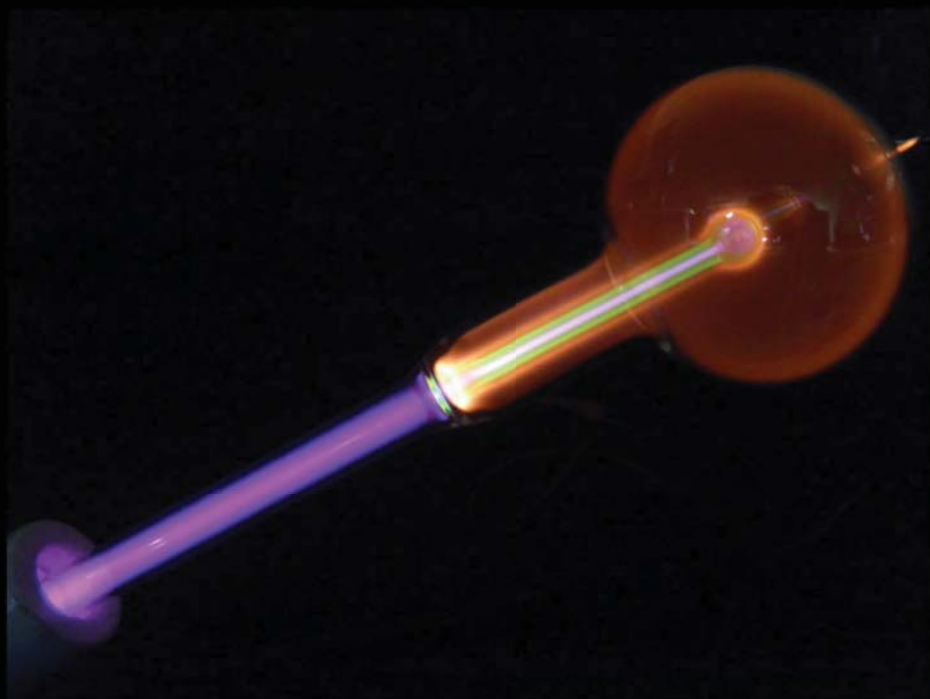


ELECTRICAL HEALING
&
THE VIOLET RAY



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BOOKS



Electrical Healing and the Violet Ray

INTRODUCTION

(short version)

“It has long been my belief, that the electric influence is the great principle by which the Almighty puts together and separates; and that it might be called, metaphorically speaking, the right arm of God.”

Andrew Cross *c.* 1835

“What are electricity, galvanism and magnetism? In these lies the great secret of nature.”

Napoleon Bonaparte *c.* 1815

About 5,000 years ago, a peasant farmer brought wild kittens home. When he petted them on dry days, there were small sparks. Maybe he wondered if there was a connection between the tiny sparks and the great lightning bolts that split the skies on stormy days.

Electricity got its name in +1600 from the Greek word for amber. Once it had a name, people began to think of ways of generating it. As soon as we were able to generate and store electricity, doctors began to try using it to cure disease.

The “electric era” began with static generators, then direct current. Batteries began around +1800. Michael Faraday’s experiments opened the door to alternating current. AC current was only a curiosity at first, and then it was adopted for the power transmission grid. High-frequency alternating currents arrived in 1892 with the suggestion that they would be valuable in medicine.

In +1836, Guy’s Hospital of London set up an “electrifying room.” Patients generally sat on an insulated stool and received an “electric bath” from a “static machine.” Doctors drew sparks from the electrified patients or shocked them with Leyden jars.

In 1872, Dr. Alphonse Rockwell asked to read a paper before the New York Medical Society, but was turned down because “electricity was the domain of crooks.” By 1890, five medical schools in New York were teaching courses in electricity. There was a great wave of interest in using electricity for medical treatment, which lasted until about 1910.

Nikola Tesla was the genius who developed the modern system of alternating current. He believed that electricity would revolutionize the world. He wanted to broadcast electrical power and use it to drive cars and airplanes with electric motors. He believed that high frequency electricity would revitalize the body.

In 1892, Tesla traveled through Europe, lecturing. He met with Paul Oudin in Paris where they discussed ways of building electrotherapeutic devices. Paul Oudin built the first “violet ray” and wrote an article on using it to cure skin disorders the next year.

The name “violet ray” occurs for the first time in 1913 in a dental journal. By 1916, inexpensive units were being sold in drugstores under this name. Medical literature uses the terms “high-frequency treatment,” “D’Arsonvalization” or “effluviation.” There is a great deal of confusion on the devices and treatments. The electric medical journals of this time period are rare, but kind librarians at the Bakken Library, University of Michigan, Philadelphia College of Physicians and the National Library of Medicine dug them out of the basement for me.

The great era of electrical healing lasted from 1890 to 1910. By the time inexpensive violet rays were being mass marketed, medical journals were doing longer covering studies on this. At least twelve companies made the devices in France, Germany, England, Canada and the United States. The depression of 1929 put the companies out of business, and the violet ray was gradually forgotten. I have only found two studies on the device in the last 70 years under the name of “D’Arsonvalization.”

The violet ray in healing would have been almost totally forgotten, except for one man. Around 1900, Edgar Cayce lost his voice for months and doctors were unable to help him. After he learned how to do self-hypnosis and diagnosed his own medical condition, he quickly regained his voice. Then he went into hypnosis and began to help a few friends with their health problems.

Floods of desperate people flocked through his door seeking help for difficult medical conditions. In his lifetime as a “psychic diagnostician,” he gave 14,000 readings in which he mentioned using the violet ray in more than 900 readings. I began this study by calling the

Cayce Association and asking about the violet ray. They knew very little about it, except for knowledge of the numerous readings.

I intended to write a short chapter on the violet ray in a book, but as I began to do research, the story gradually emerged. I wanted to tell the entire store of the evolution of medical electricity. I was surprised to learn that electricity was used to reduce weight, grow hair and remove hemorrhoids. In certain instances, it restored the sight of nearly blind persons, healed desperate cases of rheumatoid arthritis and removed skin cancer.

The best collection of electrical healing devices can be found in the Bakken Museum of Minneapolis. The man who invented the first transistorized pacemaker for hearts founded this library and museum. The Museum of Questionable Medical Devices in Minneapolis has some of the same devices, but its staff take the position that the devices were nothing more than superstition. The Indiana Medical History Museum has a wide variety of electrical gadgetry used to cure disease.

The Electropathological Museum at the University of Vienna contains paintings and objects that show the mystery traces left by lightning or power lines. One exhibit is a tattoo made by a golden chain around the neck of a woman struck by lightning. The founder of the museum, Professor Stefan Jellinek, was one of the first to show that the apparently dead from electrical shock could be restored to life by artificial respiration.

Electricity is a two-edged sword that can restore health and life or injure and kill. The benefits of simple electrical treatments far outweigh the risks involved. Hundreds of thousands of violet rays were sold and used, with few reported problems. There is no endorsement of any treatment in this book, and readers are advised to consult with a medical professional. In using any electrical device, all proper precautions should be employed.

“It has long been my belief, that the electric influence is the great principle by which the Almighty puts together and separates; and that it might be called, metaphorically speaking, the right arm of God.”

Andrew Cross *c.* 1835

Many stories of King Arthur’s court in England are about the Holy Grail. The grail was the cup used by Jesus at the Last Supper. The continental European legends speak of the grail as a stone with spirit. The *Parzifal* calls it the “lapis electris.” Angels, who were neutral in the strife between God and Satan, guarded the electric stone.

The legend of the Holy Grail is a picture of the future of electricity. The divine power can be either a healer or destroyer. Movies show the Frankenstein monster seething with electric currents. The saints and saviors are pictured with a golden electric halo.

William Gilbert (1544–1603) became the chief physician to Queen Elizabeth. She had such a good opinion of him, that he was later given a pension to continue his scientific studies. He used the money to buy many rare books and experimental equipment. One was a magnetic lodestone ground into a sphere, which used magnetic needles to show how it mirrored the earth’s field. He showed that friction on glass, sulfur and other substances would generate an attractive power, which he called “electricity.” He named it from the Greek word for amber.

In 1897, physicist Joseph Thomson completed the physical side of Gilbert’s work. He made a vacuum tube with two charged plates and a fluorescent screen. Magnetic and electric fields deflected the current, and he found a stream of charged particles. He announced the discovery of the electron.

The history of medical electricity begins with the first practical static generator in 1742 and the Leyden jar for storing electricity in 1745. Doctors electrified patients with static electricity or gave them strong shocks. This produced some promising results, but the technology was incomplete.

The first battery appeared in 1800, opening the door to low voltage direct current. Michael Faraday opened the door to alternating current in 1831 with pulsed “faradic” current. Electricity could now be generated through motion, and batteries could be charged.

In 1836, Guy’s Hospital of London set up an “electrifying room.” Patients sat on an insulated chair and received an “electric bath” from a static machine. Most patients were women. The treatment consisted of drawing sparks up and down the spine or passing shocks through the pelvis with the Leyden jars. A brass ball grounded to the earth was used to draw the sparks.

Nikola Tesla was the great genius who made alternating current the standard for transmission and use. He observed that high-frequency electricity had important effects on health. In 1892 he met with Paul Oudin in Paris where they discussed ways of building therapeutic high-frequency oscillators. Months later Oudin produced the first device that became known as the “violet ray.”

Paul Oudin began to experiment with skin disorders and found that acne, eczema and psoriasis were easily treated with the new device. After a few treatments the skin patches would begin to break up and disappear completely in two to three months. When the devices were used to spark warts or skin cancer, the anomalies often were removed within weeks.

The violet ray often took away pain, and many times it was almost considered a miracle. I experienced this after months of enduring a shooting pain in the foot. I used the violet ray around the area for a minute each night, and the pain did not return. A friend had such pain in his shoulder that he was considering quitting work. The violet ray relieved much of the pain. His girlfriend had severe pain in her knees, which resulted from gymnastics when she was younger. The device relieved most of her knee pain.

The device was valuable in dealing with arthritis and was often considered a miracle in rheumatoid arthritis. I lent my violet ray to a friend to help with his arthritis. In a few weeks his enlarged joints shrank to normal size.

The long hours of typing chapters had begun to take their toll while I was working on this book. My left hand became painful and

numb from carpal tunnel syndrome, resulting in my making many mistakes. After violet ray treatments for ten days, most of my pain and numbness was gone.

The early electrical healing devices were called by several names, but were generally known as “high-frequency oscillators.” The *Dental Brief* first used the term “violet ray” in 1913. In 1916, the first inexpensive hand-held devices appeared in drug stores. The public accepted the violet ray and hundreds of thousands of units were sold. Twelve companies made the devices in the United States, Canada, Germany, France, Spain and England. Drugstores had front window displays of violet rays.

When they became popular with the public, doctors and the FDA started to despise them. At first the *Journal of the American Medical Association* published promising therapeutic results in articles. Then it printed an article about a man who deliberately short-circuited his violet ray and electrocuted himself. This implied that the device was dangerous and should be outlawed. The Depression put the companies that made violet rays out of business and the devices became unavailable.

There is another reason why the device was forgotten. A stream of violet rays of light passes through a glass tube into the skin. Tiny sparks shoot out, and when the device is withdrawn, there are sparks causing the muscles to jerk. Using the device is very unsettling at first and slightly uncomfortable. After the initial sensation passes, the violet ray is easy to use.

Edgar Cayce was the “sleeping prophet” who gave 14,000 readings between 1920 and his death in 1945. Desperate people seeking help for medical problems consulted him, when doctors couldn’t help them. In his self-hypnotic trances, he recommended the violet ray treatments over 900 times. He kept interest in this nearly forgotten device alive.

I wanted to tell the entire story of the healers who used electricity, and emphasize the violet ray era. It was a difficult job to locate and research books and journals with information about it. I visited medical libraries at Stanford, University of Washington, University of Minnesota, University of Michigan, Philadelphia College of Physi-

cians and the National Library of Medicine. I am especially grateful to the Bakken Library and Museum in Minneapolis, which contains a collection of old violet rays and other electrical healing devices. The library has many rare books relating to all aspects of electrical healing.

In geopolitics there is a saying: “the winners write the history books.” The winners wrote the history books and textbooks of medicine. They made certain that everyone knew about the glories of surgery and wonder drugs. They made sure that electric medicine was placed in the category dominated by cranks and frauds.

Robert Becker was the leading scientist engaged in regeneration work with electricity. He discovered the ideal currents for regenerating broken bones. As his research became more interesting and promising, he found that the National Institutes of Health denied him monetary grants to continue. He was so discouraged that he wrote: “The pigeons of Zeus cover new ideas with their droppings and conduct rigged experiments to disprove them.”

The violet ray is a grandfathered device, meaning that it was produced before 1976 and is generally presumed to be safe and not subject to federal regulation. In spite of this, the FDA threatened legal action against the companies that produce them and the people who use them. The climate of official intimidation has been so strong that only one journal (*Chinese Medical Journal*) has published studies in the last 70 years.

The violet ray is not a medical miracle, but it often produced remarkable healing in a short period of time. Those who use it should take the same precautions as with any electrical device. In any healing treatment, qualified medical advice should be sought. This book does not make medical recommendations, but it does tell the history and results of those who used electricity for healing.

There is more to be told of the story of medical electricity, but this is a beginning. I am reminded of the words of Winston Churchill in 1942. “Now this is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning.” If this book results in a new beginning for forgotten technologies, then I have accomplished my purpose.

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1. THE CURE FROM THE SKIES

“From a thousand experiments, it appears that there is a fluid far more subtle than air, which is everywhere diffused through all space, which surrounds the earth and pervades every part of it. Such is the extreme fineness, velocity and expansiveness of this active principle that all other matter seems to be only the body and this is the soul of the universe. This we might term electric fire, but it is hard for us to separate the ideas of fire and burning. From this pure fire, which is properly so called, the vulgar culinary fire is kindled. For in truth there is but one kind of fire in nature, which exists in all places and in all bodies. This is subtle and active enough not only to be under the Great Cause, the second cause of motion, but to produce and sustain life throughout all nature as well in animals as in vegetables . . .”

Desideratum John Wesley.

In 1973, Chinese archeologists digging in the Hunan Province unearthed a book titled: *Prescriptions Against 52 Ailments*. It was buried about 200 years before the time of Christ. Twenty-seven prescriptions were spells chanted to cure the disorders. For one of the mystery ailments the writer remarks: “Wait for lightning in heaven and then rub both hands together. Face the lightning and chant to it: Sovereign of the Eastern Quarter, Sovereign of the Western Quarter, preside over the darkness and darken this person’s stars.”

Lightning is a mystery that was once believed to be the power of the gods. The laurel protected against it, so Roman emperors wore the laurel wreath. The oak drew the stroke, and Roman soldiers received their decorations of oak leaves as a reminder of heavenly power.

Prometheus brought lightning from the heavens, giving him the power of the gods. The prophet Zoroaster was killed by a lightning stroke in response to his own prayer. The “heavenly fire” furnished poets and writers with a sense of divine magic.

Moses saw the burning bush that was not consumed. Flames appeared upon the heads of the twelve apostles on the day of Pentecost. Renaissance artists attempted to depict the mystery fire by painting nimbuses circling the heads of the divine figures.

The town of Kulu in the Indian Himalayas has a temple on a hill dedicated to the god Shiva. A 60-foot iron rod attracts the “blessings of heaven.” Lightning flashes through the mast and shatters the statue of Shiva at the base. The shattered pieces of Shiva are reunited and used for the next blessing.

A few people seem to have a fatal attraction for lightning. Charles Brown of Kenton, Ohio, was known as the human lightning rod. On May 20, 1946, he was stunned for the tenth time when a bolt struck the public library as he was checking out a book.

Major R. Sumerford of Vancouver, British Columbia, was on army patrol during World War I. A bolt of lightning killed his horse and left him paralyzed from the waist down. He eventually recovered enough to walk with the help of two canes. In 1924, he went fishing in the mountains. His friends left for supplies while he sat under a tree. Lightning struck it and paralyzed his right side. In 1930, he was walking in a Vancouver park. As a storm came up, he hurried towards the shelter area. He was struck by lightning and confined to a wheelchair. He died two years later. On a July night in 1934, a violent electrical storm struck Vancouver. A bolt of lightning struck a single tombstone in a cemetery and shattered it. It was the grave of Major Sumerford.

The famous meteorologist Heinz von Ficker was caught in a thunderstorm on the Matterhorn Mountain in the Alps. He was struck three times in the back by bolts of lightning, and his clothes were ripped to shreds. He remained fully conscious, but the fourth lightning bolt knocked him out for a short time.

Literature contains a number of cases in which lightning provided a healing impetus. In 1776, Mrs. Wynne went to Dublin to consult with several surgeons because she had a large tumor in the left breast. The surgeons didn't want to operate, so she returned home. She was looking out of the window of her home when lightning struck it and set fire to the roof. The stroke passed through her left shoulder and down her back. She tumbled to the floor and was found later that evening. Dr. Georgius Hicks visited her two days later and found that her breast tumor was smaller and softer. In a few weeks, it was completely gone. Thereafter, he decided to try electric shock to treat breast cancer. With electrical shocks, he was able to reduce the cancerous tumors and pain in two women.

In the summer of 1806, Samuel Leffers suffered a stroke. The left side of his face was numb, and he had great difficulty speaking. He was unable to close one eye and could hardly walk. Several months later while he was in his house, lightning struck and he lay senseless for about 20 minutes. When he recovered he began to feel much better. The next day he sat down to write a letter to a friend, and he found that he didn't need glasses. Although he lost part of his hearing, he looked 30 years younger, and his face acquired a remarkable smoothness and beauty.

Susana Watts was traveling home when a severe storm struck. The carriage broke down, so she had to walk the rest of the way. The cold weather was too much and her health failed. She was unable to use her arms and was confined to bed. Three years later, a bolt of lightning struck the house and left a black large circle on the ceiling. She was unconscious, so the servants loosened her clothes and began to massage her. As she awoke, she was angry with them for touching her. Then she got up and began to walk. She stumbled and reached out for the handrail. The lightning had restored the use of her arm and cured her arthritis.

In 1822, Martin Rockwell was standing looking out of a window when lightning struck the building about ten feet away. He was briefly paralyzed and it took an hour for normal movement to return to his left leg and right arm. There was a burning sensation in his chest that continued for days. Rockwell suffered from asthma since he was a boy and was often unable to sleep. Since the lightning strike he was entirely free of asthma. He would feel it slightly when he had a cold or was fatigued.

In 1828, a ship was crossing the Atlantic with a passenger who had been paralyzed for three years. Lightning struck his quarters, and suddenly he jumped out of bed. He remained perfectly normal the rest of his life.

Another strange stroke of lightning aroused medical curiosity in 1846. Lightning struck a group of women, one of whom had been childless for years. In a few months, she was expecting. Another woman was 70 years old and had gone through menopause 20 years before. She began to menstruate, and continued for three years.

Around 1850, an English farmer developed cancer of the lower lip and chin. He agreed to have surgery, but before the scheduled date, he was out plowing his fields when he was struck by lightning. Both of his horses were killed, and his plow was shattered. A few weeks later, the cancer was distinctly less, and in months it disappeared. He enjoyed good health for the next ten years. The cancer then reappeared, and the man died.

Thomas Young was a farmer near Dukedom, Tennessee. Cancer began on his face, so the surgeon removed part of his lower jaw. The cancer continued to spread, and by June of 1932, he was nearly dead. He chose to spend his last days lying in bed or on a hammock under the trees. One day a sudden storm came and struck one of the trees to which his hammock was attached to. The bolt stunned him and ripped the soles from his shoes. In a few days, he began to feel better. The cancerous sores started to heal, and soon he was back to normal.

In 1971, Edwin Robinson jackknifed his truck in order to avoid hitting a car. As a result of the accident, he became blind and quite deaf. In June of 1980, he walked out into the backyard as a storm was brewing to call his pet chicken indoors. The next moment he felt as if "somebody cracked a whip over his head." He lay unconscious for about 20 minutes before he was able to go inside. After a good nap he went into the kitchen for a sandwich. Suddenly he realized he could see a little. His wife asked: "What time is it?" He was able to tell her that it was 5 p.m. Two days later he was able to walk about without his cane. His hearing returned and he no longer needed the hearing aid. He kept remarking about the strange feeling on the top of his head. A new crop of hair was growing over the bald area.

Two brothers in London were struck by lightning. The next day, the deaf brother recovered his hearing. A coal miner in Northern England had lost his sight after an explosion of gunpowder. After he was struck by lightning, the sight of his left eye returned. A woman with multiple sclerosis was struck by lightning. She had been slowly degenerating, but within months, she recovered most of her normal function.

Professor Stefan Jellinek was the pioneer of electropathology and founded the Electropathological Museum at the University of Vi-

enna. The museum contains more than 100 watercolor paintings and objects showing the mysterious traces left by lightning or man-made currents. One exhibit is a tattoo made by the links of a golden chain on the neck of a woman who was struck by lightning. The professor wrote several books on the effects of electrical currents and lightning.

Jellinek wrote *Dying, Apparent Death and Resuscitation*. He showed that in most cases of electrical injury, it was possible to restore consciousness with artificial respiration. Before this, most doctors believed that nothing could be done.

Few of us are willing to stand on a hill in a thunderstorm hoping that a bolt of lightning might cure our problems. Lightning is more likely to be the final solution to all of our ills! But controlled man-made lightning might just be the ticket to good health.

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2. BIOLOGICAL ELECTRICITY

"The sea torpedo is said by some to cure headache and *prolapsus ani* when applied. I tried both of these things and found neither to be true. I thought that the torpedo could be applied alive to the person who has the headaches. It could be that this remedy is anodyne and could free the patient from pain as do other remedies which numb the senses, and this I found to be so."

Claudius Galen c. +180.

"The live black torpedo when applied to the painful area relieves and permanently cures some chronic and intolerably protracted headaches, providing that the pain is localized and lacks feeling. However, there are many varieties of torpedo and it may be necessary to try two or three varieties before numbness is felt, as numbness is the sign of the cure."

Compositiones Medicamentorum Scribonius Largus c. +46.

Humans and other vertebrates have weak electric fields surrounding them. It may be that everything living has an electrical field. Certain fish have developed powerful fields and use electricity to locate food and stun it before they eat it.

The *Torpedo*, *Astroscopus*, *Malapterurus* and *Electrophorus* fish have highly developed electric organs. The organ consists of large numbers of disk-like cells called electroplaxes or electroplates arranged in orderly columns with the innervated sides all facing the same direction. The *Torpedo* has horizontal electrical plates forming thick cells. The cells discharge in parallel and generate currents of several amperes at about 50 volts. The electric fishes live in both salt and fresh water.

There are five species of the *Torpedo* in the Mediterranean. The most common is the "electric ray" *Torpedo torpedo*, which has an electric organ consisting of 800 to 1,000 cells connected with bundles of nerves. The top surface of the fish is positive and the bottom is negative.

The electric eel of South America has 70 columns of electroplates, each containing 6,000 cells in series. A large eel can produce 3 millisecond pulses of up to 600 volts. The nervous system is specially

configured so that all cells discharge in short bursts. The slowness of nerve conduction would normally be expected to produce a smaller, more spread-out pulse frequency.

The *Gymnarchus* fish responds to the presence of metals in water. When a copper wire rectangle was placed in a shallow tank, the fish appeared to be trapped within it. Every time it approached the wire, it halted, and then swam away. If a piece of wire is left in the tank for long enough, the fish will show no response. These fish do not bump into the walls of the aquarium when kept captive.

The first electric fish may have used electric pulses to locate food and navigate in muddy rivers. *Gymnarchus* discharges 300 pulses per second, but if another electric fish is nearby, shifts the frequency of the pulses, to be able to distinguish its own pulses from others. The fish hunt at night. When a microphone is put into the water, you can hear ticking, rattling, and whistling sounds. If the fish sense something around them, they raise the frequency of the impulses.

The ancient Egyptians were the first to picture the Nile catfish *Malapterurus electricus*. They probably ignored the shock and used it for food. There was a belief that the fish used its power to shock the fisherman and allowed other fish to escape.

Hippocrates recommended this fish for food, because it was soft and easily digested. He doesn't mention its shocking effects, but this might have been why he recommended it. The fish was prescribed for tuberculosis patients and for women suffering from menorrhagia.

Plato was familiar with the works of Hippocrates and talked about them in his famous dialogues. Socrates would really "electrify" his audiences, and Plato compares him to the torpedo fish. "The flat torpedo fish who torpifies those who come near him with the touch, as you now torpified me, I think. For my soul and my tongue are really torpid and I do not know how to answer you."

Theophrastus took over the school of Aristotle and wrote books on animals, fish and plants. He remarks that the torpedo could send shocks through clubs and spearing irons—numbing the hands of fishermen.

Plutarch compared the lives of famous Romans and Greeks in his well-known books. In *Moralia*, Plutarch remarks: "Swimming circu-

larly about his prey, he shoots forth the effluvia of his nature like so many darts and then infects the water. The fish around are neither able to defend themselves or escape, being held in chains and frozen.”

At the time of Christ, Tiberius Caesar ruled Rome, where slavery was common among the wealthy Romans. Tiberius freed one of his slaves, Anthero, who later walked along the shore and stepped onto a flat fish, which gave him a numbing shock. The shock relieved his “gutta,” which might have been arthritis.

Pliny wrote his *Natural History* around +70. He mentions several torpedo remedies, either eating the fish or applying parts of the dead fish. He mentions the “exhulations” of the torpedo, but getting live fish was not easy for those who needed an electric cure.

The electric fish began to attract the attention of scientists around +1700. Francesco Rida and Stephano Loranzi dissected the torpedo and found that the electric organ was essentially a modified muscle. The invention of the Leyden jar in 1745 played a decisive role in establishing the electric nature of the fish. A weak static current could now be turned into a real shock. The scientists were puzzled over the nature of the fish. It didn’t attract light bodies or electrify a Leyden jar, and there was no spark or crackling noise.

The eccentric scientist Henry Cavendish researched the electric fish. He never invited visitors to his laboratory, but on one occasion he invited a group of friends to witness his research. He constructed a model of the torpedo with electrical equipment and put it under wet sand. The visitors walked over it with bare feet and got the same sensation as the real torpedo. Cavendish estimated that one torpedo equaled 49 charged Leyden jars.

John Walsh continued the investigation of electric fish. He showed that an electrical eel would produce a visible spark in a dark room. He put two wires into the water of an aquarium in which his eel was swimming. When his friends would put their hands over the wires, the eel would sense this and give them a shock. His experiments stimulated interest in electric healing. A newspaper soon had an ad for getting healing shocks for two shillings and sixpence!

When the Europeans began to explore Brazil, they found the powerful electrical eel swimming in the rivers and ponds. Alexander

von Humboldt found that the eels were difficult to catch, because they buried themselves in the mud. The Indians drove horses into the muddy pools and the horses discharged the eels. Then the Indians speared the eels with harpoons fastened to dry wood handles.

A Jesuit missionary wrote: "In these rivers and lakes, the electric eel is found, which if any man holds in his hand, and it stir not, it doth produce no effect. If it move itself ever so little, it so tormenteth him which holds it, so his arteries, joints, sinews and all his members feel exceeding pain with a certain numbness. As soon as it is let go from the hand, all the pain and numbness are gone. The superstitious Abassines believed that it is good to expel devils out of the human body, as it did torment spirits no less than men."

The governor of Surinam, Storm Van s'Gravesander, wrote in 1754: "It has been observed that various people who had gouty pain and touched the torpedo were completely cured two or three minutes after contact. The experiment has been repeated at various times, but always with the same result."

The Dutch surgeon Frans Van der Lotte wrote in 1761: "An Indian had paralysis of the abdomen. After having used several external and internal medicines in vain, I tried an electric eel, in the presence of my friends, which had just been caught in the river and hence was in full strength, against the knees of the patient. The shock was so tremendous that two persons who were holding the patient under the arms on each side were knocked to the floor. After I had repeated this three times, the patient, who had to be carried from his plantation, walked back to the plantation without cane or crutches, completely recovered and was without need of assistance."

Abraham Van Doorn had a slave boy with crooked arms and legs. He had the boy thrown into a tub containing large black electric eels. After being shocked, the boy crawled out, but if he was unable to crawl, he was helped out. The boy completely recovered from his nerve disease, but his bones remained deformed.

Van Doorn also threw another slave with malaria into a tub with an electric eel. The slave's fever disappeared in a few minutes and didn't return. Van Doorn also tried this on an Indian boy with malaria. Once again, the electric eel cure worked.

Charles Darwin speculated about the evolution of the electric fish, because he didn't know of any transitional forms. All muscles are weakly electrical, and some people appear to be strongly electrically charged. The electric fish developed this ability and use it to locate food and stun prey.

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3. ELECTRIC PLANTS

“The physiology of plants gives a satisfactory explanation of the functions which most of their organs have to perform and good reasons for their existence and their varying forms. This is, however, not the case with the needle-like shape of the leaves in fir trees, and the beard on the ears of most cereals. Since nothing exists without purpose in all the infinite number of objects in nature, then the needle-shaped leaves and the beard must have their determined ends. In fact, they are very well fitted to be the means through which the electricity goes from the atmosphere into the earth, or vice versa; that is to say, they act in the same fashion as metallic points. To pretend that they really serve as a means of transmitting electricity because their form shows them capable of it would be to go too far. The presence of electricity in the air around them shows that they are, in fact, in a position to perform this function of transmission.”

Selim Lenström.

The story of electricity and life may have begun some four billion years ago with lightning strikes. The electrical current formed the molecules of life and linked them into chains. Lightning has a major effect on the plant world by forming nitrogen compounds, which plants use to generate proteins. Thunderstorms do more than wet the ground; they also fertilize.

In 1890, *Scientific American* announced that an electric plant had been discovered in South Africa that gave you a shock when you touched it. Nobody could find the mysterious electric plant, so it was assumed that the story was a hoax. The story may have come from someone tasting a leaf of *Spilanthes africana*. The anesthetic in the leaf gives the person a distinct feeling of a shock on the tongue.

The first electrification of growing plants began in Edinburgh, Scotland, when Mr. Maimbray electrified two myrtle trees in 1746. The trees began to leaf and bloom sooner than others nearby. Abbé Jean Nollet heard about the experiment and planted seeds in two garden pots. He electrified one pot for two weeks several hours a day. The electrified seeds grew sooner than the other seeds.

In 1747, Jean Nollet was tutoring the Dauphin. A German professor told Nollet that if water in a thin glass tube is electrified, it won't drip, but would run in a stream. He electrified mustard seeds

with charged water, and the sprouts grew 3 centimeters taller than non-electrified ones.

Abbé Pierre Berthelon was a professor of experimental physics at French and Spanish universities. He had a gardener stand on a slab of insulating material and sprinkle the vegetables from an electrified water can. He tried to collect atmospheric electricity with an antenna and pass it into plants growing in a field. He believed that the best fertilizer for plants was electricity from the sky and in 1783 wrote *De l'Electricité des Végétaux*.

In 1770, Professor Francesco Gardini stretched a number of wires above a monastery garden in Turin, Italy. Many of the plants began to wither and die. When the wires were taken down, the garden revived. He theorized that the plants had been deprived of electricity or perhaps they had received an overdose. He wanted to attach wires to the newly invented hot air balloons to conduct electricity from great heights.

L. Grandeau experimented in France by putting tobacco plants in a cage to shield them from electricity. Plants outside the cage grew 1.87 meters tall and those under the enclosed wire cage grew 1.42 meters. There were 89 flowers on the outside plants and only 45 flowers on the shielded plants. He believed that electricity increased the height and strength of the plants.

William Ross tested the power of electricity by planting cucumbers in a mixture of manganese oxide, salt and clean sand. When he applied electric current to the beds, the seeds sprouted well ahead of those exposed to a non-electrified mixture.

John Freke was a surgeon at St. Bartholomew's Hospital and a curator of its museum. In 1746 he announced that the movements of the leaves of the sensitive plants were due to electricity. He put a potted plant on a cake of wax and attached it to a static machine. When electrified, the leaves stood out. He believed that this proved electricity was the agent behind the moving leaves.

Selim Lemström took four trips to northern Norway and Spitzbergen. He noticed the tremendously rich plant development of trees, flowers and even cultivated crop plants such as rye, oats and barley. Most botanists felt that the rich summer vegetation of the northern

climates was due to light and heat. But while days are long, the sun's light is oblique, and its illuminating and heating power is greatly lessened.

Lemström noticed that the northern tree rings showed strong 11-year sunspot cycles. The harvest cycle of the north showed a strong variation with the sunspot cycle. The greater the number of sunspots caused more auroras and a more abundant harvest of seeds, roots and grass. He felt that this was due to the greater circulation of electricity in the atmosphere.

Lemström noted that northern trees had needle-shaped leaves, and cereals had bearded points. He believed these points would serve as transmitters of electricity. In order to prove his theory, he sowed barley, wheat and rye grains in cardboard boxers. The boxes attached to a static generator yielded 40% more than the other boxes.

He tried dividing a field into plots and using wires above the plants attached to a generator. This increased the rye yield by 19% and the barley by 40%. He had great difficulty doing this, because he couldn't use the static machines in damp or rainy conditions. He found that added electricity didn't help plants in poor soils. Other scientists repeated the experiments, but didn't find any difference in the yields. They felt it would take a significant difference to repay the extra work and expense involved.

Patrick Synge traveled in Africa and noted that the plants of the "Mountains of the Moon" or the Ruwenzori of Uganda had unusual vegetation. There were heathers as large as trees and impatiens with flowers two inches across. He found lobelias on Mount Elgon growing 30 feet tall, but when he brought them to England, they didn't survive. He believed that light and electric currents accounted for the luxurious growth.

There was a great deal of interest in electric crop growing in England, and many experiments were performed. Usually a wire net was placed at varying distances above the field, fastened with insulated supports. A critical review of 20 years of experiments showed no increased growth caused by electricity.

Fredrik Elfving did another type of experiment. Various plants were grown in wet soil, and an electric current was passed through the

plant roots at right angles. The roots bent to follow the lines of current flow.

William Ross got a U.S. patent on this in 1844. He buried plates of zinc or copper about 200 feet apart. The plants were connected above ground with wires, thus forming a battery. He claimed to grow very large potatoes in his electrified fields.

It is known that plant roots show galvanotrophy. A small current will cause the roots of beans to grow towards the negative pole. When roots have a high concentration of salt they will grow towards the anode. Amoebas and most protozoa drift towards the negative cathode.

In 1934, William Osterhous recorded the electrical variation across the membrane of the giant cell of *Nitella flexilis* with an electrode placed in the cell. The inside of the cell had a negative charge with respect to the outside. When the plant was stimulated, sodium ions flowed into the cell and potassium flowed out. The process reversed itself, as the plant resumed normal function.

Dr. Alexander Sinyukhin cut branches from a series of tomato plants. He took electrical measurements around the wound. A negative current or a "current of injury" flowed from the wound for several days. During the second week, a callus formed and a new branch began to grow with a positive polarity. When Sinyukhin applied 2-3 microamperes of current, branches regenerated up to three times faster.

Jagadis Bose found that radio waves produce variation in the growth of plants. Feeble waves accelerated the rate of growth, but strong radio waves retarded plants. The effect persisted for a long time after the stimulation ceased.

Oskar Korschelt was a German professor of agriculture who believed that electricity and the cosmic forces stimulated the healing of plants and people. He wrote: "It is not only the life force, but also the character of the healer that is shared with the sick person. Conversely, the character of the patient flows into the healer."

Fritz Hildebrand was a Bavarian civil engineer who believed that he discovered growth waves with a length of 10-30 centimeters. When he exposed seeds to waves for only 15 seconds, larger plants with greater yields were produced. This is far higher than the violet

ray frequency. He used a complicated apparatus, but Surgeon General Alexander Heermann produced them with a simple circuit.

Bindo Riccioni devised a simple apparatus for treating large numbers of seeds electrically. He treated up to five tons of seeds a day by allowing them to flow between parallel capacitors hooked up to a resonating circuit. He reported harvest yields up to 37% above average. A seed processing plant was built in the Soviet Union using this technology. Corn yields went up by 15–20% and oat and barley yields increased from 10–15%.

In 1922, Alberto Pirovano published *La Mutazione Elettrica*. He invented the process of “ionolozation” in which pollen was subjected to high voltage electricity of 500–600 hertz. When used to fertilize flowers, it produced a wide variety of changes in plants. Plants were giants or dwarfs, and their seeds and fruit were changed. Flowers were markedly altered. He produced several new varieties of tomatoes, which became popular with gardeners. It is possible that the violet ray might be used to produce the same changes.

In 1964, Charles R. Keller received patent 3,120,722 for the treatment of sick trees. He used a current of 800 hertz and 6,500 volts placed about three-quarters out on the main branches. He claimed the electrical stimulus revives the immune system of the tree and overcomes the infection.

He would attach wires to the main branches and turn on the equipment. The higher the voltage, the shorter the treatment time. Sometimes he would treat the roots by pounding in metal stakes and attaching the wires to the tree branches. He treated avocado trees for canker and orange trees for scale and dieback. The terminal parts of the branches were apparently dead, and the whole tree had few or no new sprouts in the spring. The following spring, the trees would show new growth and the apparently dead limbs would return to life. Often they would bear a heavy crop of fruit.

In 1968, Dr. H. Len Cox read an article in the magazine *Aviation Week and Space Technology*. Satellite photos showed which field attacked by pests had a different “electromagnetic signature” from good fields. He decided to try changing the electromagnetic signature by adding particles of magnetite to the soil. He brought back a truckload

of ore from Wyoming and charged the particles with a strong magnet.

His garden didn't look much different until harvest. The radishes, carrots and turnips were large. He began selling ten-pound containers of magnetite to gardeners who reported that irises doubled the number of blossoms on a single stem and that their gardens were much more fruitful. It didn't seem to work in flowerpots; the magnetite had to go into the earth.

There is an ancient Pueblo prayer chant, expressing the effect of nature's electricity:

My corn is green with red tassels,
 I am praying to the lightning to ripen my corn.
 I am praying to the thunder, which carries the lightning
 Corn is sweet where lightning has fallen. I pray to the colored clouds.

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4. ELECTRIC ATMOSPHERE

"The electric condition of the atmosphere is, I believe, not the least important of its properties with respect to its influence on health, though the mode of its operations is but very imperfectly understood as yet. The development of electricity in the air is the result of almost all the chemical and vital actions going on in the world around us. It is called into existence by the growth and decay of every form of animal and vegetable existence."

On Change of Climate Thomas More Madden 1864.

"It is clear that [the sun's] radiation produces the electrical current which operates adaptively on the organism as a whole, producing memory, reason, imagination, emotion, the special senses, secretions, muscular action, normal growth and the growth of benign tumors and cancers. They are all governed adaptively by the electric charges that are generated by the short wave or ionizing radiation in protoplasm."

The Phenomena of Life Dr. George Crile 1936.

During thunderstorms, we observe the powerful transfer of electrical energy generally from the sky to the earth. We don't realize that there is just as much electrical activity on clear days, only this time it is from the earth to the sky. Pierre Lemonnier discovered that the electrical activity on clear days balanced the electrical transfer of storms.

Another form of electrical activity apart from lightning is St. Elmo's fire. Pliny wrote: "Stars make their appearance both at land and sea. I have seen a light that forms on the spears of soldiers, keeping watch by night upon the ramparts. They are seen also on the sail-yards and other parts of ships, making an audible sound and frequently changing their places. Two of these lights forebode good weather and a prosperous voyage."

Julius Caesar described his military campaigns in *De Bello Africano*: "About that time there was a very extraordinary appearance in the army of Caesar. In the month of February, about the second watch of the night, there suddenly arose a thick cloud, followed by a shower of stone, and the same night the points of the spears belonging to the fifth legion seemed to take fire."

Robert Fox noted that the aurora borealis was at right angles to the magnetic meridian. "The aurora may therefore, I think, be considered an exhibition of electric currents at a great height, which are connected with others nearly parallel to them in the interior of the earth. Whether we regard terrestrial magnetism as the effect or cause of the direction of electric currents, it cannot be doubted that these phenomena are in harmony with each other."

Georg Bose (1710–1761) tried to increase the strength of his static generator. His modified apparatus produced a discharge that flowed, wandered and flashed. This gave him the idea that the northern lights were an electrical current wandering across the sky.

Other philosophers turned their attention to the cause of lightning and electrical phenomena in the atmosphere. In 1758, the Swedish physicist Johan Wilcke noted that he had seen clouds crashing into each other. He believed the friction between the clouds produced lightning and this brought the pouring rain.

The electrician Martinus van Marum had the idea that rain deposited electric fluid onto the ground. Electrified clouds affected the electrical balance of all objects over which they floated.

Signier Giambatista Beccaria found that high winds produced no electrification. In clear skies with calm weather, he always perceived signs of electricity. His apparatus was always electrified before the rain fell. When the rain ended, there was little sign of electricity.

The higher his rods reached or his kites flew, the stronger the sign of electrification. He found that clouds bringing rain carry moderate electricity. He noted several instances where rain without lightning had signs of electricity. He found that the large thunderclouds passing directly over his apparatus were positively charged. When the cloud passed, the apparatus indicated negative electricity.

Beccaria formed the theory that electrical matter escaped from the earth and ascended to the higher regions of the air, collecting vapors as it rose. The more electricity collected, the greater the amount of rain in the clouds.

He also believed that hail formed when electrical matter ascended to the cold upper atmosphere. He believed that snow was made by the action of electricity. Snow as well as rain electrified his apparatus.

In the 1880s, Julius Elster and Hans Geitel began the modern study of atmospheric electricity. They found that the soil emits electric ions into the air. In good weather, the earth has a negative electrical charge, while the atmosphere is positive. Electrons stream skyward from the soil and plants. During storms, the polarity is reversed: the earth is positive and the base of the cloud layer is negative. At any given day, there are some 4,000 storms recharging the lost electricity of the earth.

Elster and Geitel believed that the ions carrying the current were due to radioactivity. They shielded a sample of air with lead but it still carried a current. In 1911, Victor Franz Hess of Vienna University took measuring equipment up to 16,000 feet in a balloon. To his surprise, the ionization increased as he went higher, which he later found was due to cosmic rays. He was awarded the Nobel Prize in 1936.

In 1920, Scottish physicist C.T.R. Wilson linked the pieces of the puzzle together. In fair weather the negative current of the earth was being neutralized by positive ions. During thunderstorms, lightning regenerated the earth's supply of electricity. The thunderstorms were like the cells of a battery.

Thunderstorms become most active during the afternoon hours of 3 to 8 p.m. The earth has the strongest electric charge at 7 p.m. at Greenwich, England. This is just after the peak of thunderstorms in Europe and Africa, but numerous thunderstorms are happening in North and South America.

Physicists tested the theory by having specially equipped B29 bombers fly over thunderstorms to measure the positive current. They calculated that the total current flow between the earth and the sky was 1800 amperes. To maintain this current, the earth had to have 3,600 thunderstorms over the whole earth.

A normal person has a difference of about 200 volts of static electricity between the head and the feet. The top of a high skyscraper might be 40,000 volts. From the soil to the ionosphere is a whopping 360,000 volts. There is tremendous electrical energy here, but harnessing it is difficult and uncertain.

On a high mountain peak, this becomes apparent. The U.S. Army Signal Service kept an observing station on Pikes Peak, Colorado. They published their observations in 1889. During storms, blinding flashes of fire often entered both rooms of the station from the lightning arrestors. On several occasions, the hair and whiskers of observers were electrified. On June 7, 1882, a bolt charged the telegraphy wire, and it could be seen in brilliant light with rose-white scintillations. When observers got near the wire, there were violet flames the size of lead pencils streaming out from the wire.

During one storm, the cups of the wind-measuring anemometer discharged vivid violet flames accompanied by a sound like a carriage wheel rolling through hard packed snow. When the observer put his hands near the cups, the fingers became tipped with painful flames.

We know that sunspots are great electrically charged plumes of particles smashing into the earth. They create the Northern and Southern lights. During times of active sunspots, tree rings are larger, wines are better, and plant growth is greater. Is this due to greater atmospheric electricity?

In 1843, Heinrich Schwabe plotted an average number of spots seen per year and came up with a cycle of about ten years. Other observers refined the data and came up with a period of 11.2 years. It was widely assumed that this cycle continued on throughout history.

E. Walter Maunder was the superintendent of the solar division of the Royal Greenwich Observatory in London. In 1894, he published a paper with the title: "A prolonged Sunspot Minimum." He researched the old records and found that during a 70-year period from 1645 to 1715, there were virtually no sunspots.

In China, sunspots were observed for centuries with the naked eye, because the skies were so dusty. The western world didn't know anything about them until Galileo observed them with his telescope. There were good observers after the time of Galileo, but they didn't see sunspots. César Cassini discovered the dark division of Saturn's rings, and Saturn was found to have five satellites. Isaac Newton made his first reflecting telescope, but hardly anyone was seeing sunspots.

The sun's speed of rotation is known by studying its spots. Johannes Hevelius charted the spots on the sun from 1642 to 1644 and

found a remarkable change. The equator speeded up and completed one rotation a day faster than in 1625. Was this the reason for the lack of spots beginning in 1645?

During a period of 37 years, not a single aurora was recorded anywhere on earth. When one was seen in England in 1716, the astronomer Edmund Halley wrote a paper on the phenomenon.

As sunspots became normal, scientists didn't know what to make of the missing sunspot years. Perhaps people didn't bother to record them, they thought. When the effects of sunspots on tree rings was known, a search of tree rings showed that there had been a real change in solar activity. When the sun is active, the extended magnetic field protects the earth from cosmic rays, and less carbon 14 is formed. When there are few spots, more cosmic rays enter the lower atmosphere and more carbon 14 is formed.

During the period of time when the sun had few spots, the temperatures fell by about 1° C. Glaciers advanced and the Norse colony in southwestern Greenland died out. They were locked in with pack ice that didn't thaw. Scientists studying records of the past have found at least 12 times that the sun stopped its electrically charged flares, and each time, the temperature on earth fell. These times lasted from 50 to several hundred years, and substantial amounts of ice may build up at the pole.

One of the great effects on health is caused by negative electrical ions in the earth's atmosphere. Hills contain more negative ions than valleys, and the bases of clouds generally have a strong negative charge. Waterfalls have a great density of negative charges, which falls off rapidly with distance. Air brushing up against a metal surface becomes positively charged.

The dry desert winds brush against the sand to produce large amounts of positive ions. These reduce human breathing capacity by about 30%. The strong desert winds like the Sharav of Israel have large numbers of positive ions which produce headaches and nausea in many people

Negative ionization produces feelings of calmness and peace in people. They sleep better and feel better. It is good to have a negative ion generator where two different groups such as labor and management meet to discuss grievances. Rats perform better on tests and resist disease better when breathing more negative ions.

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5. THE ELECTRIC EARTH

“The earth and all the bodies we are acquainted with are without exception supposed to contain a certain quantity of an exceedingly elastic and subtle fluid which philosophers have agreed to term electric. The moment any body becomes possessed of more or less than its natural quality, very remarkable effects arise from it. The body is said to be electrified and is capable of exhibiting appearances which are ascribed to the power of electricity.”

History and Present State of Electricity Joseph Priestly 1767

“Electricity is a quality universally expanded in the matter we know and which influences the mechanism of the universe far more than we think.”

Charles Dufay 1737

When William Gilbert wrote his famous book on magnetism, *De Magnete* (1600), he coined the word “electric” from the Greek word for amber. Magnetism attracted small particles, and so did an electrified body. They didn’t attract the same substances which puzzled the philosophers. Michael Faraday finally provided the missing pieces of the puzzle by showing that electricity creates magnetism, and magnetism can create electricity.

Gilbert had carefully constructed a globe of magnetic material to show that it represented the earth on a small scale. If our earth is a spinning magnetic field, then it must generate electrical currents. Is the great current known as the “northern lights” a product of the spinning magnetic field? This is partly true.

Nature had magnetic stones, but there were “electric stones” known as amber. The world’s best deposits of amber were found on the shores of the Baltic Sea and carried to the Mediterranean across the great river route of Europe. Amber had the radiance of gold; it was part of the bracelet of Penelope and the shield of Hercules.

Spinners knew the electrical qualities of amber in ancient time. Syrian woman called amber “harpega,” meaning “clincher” because it grasped light threads. In the dry climate the spinners found that they could harness its electrical qualities for practical use.

The holy priesthood of the Jewish people began with Aaron, the brother of Moses. The official clothing of his office was a breastplate

consisting of 12 stones worn during sacred duty. The seventh stone was the ligurian stone. The meaning has long been debated, for this is the word for Lynx. The sacred stone was probably amber.

Three hundred years before the time of Christ, Theophrastus wrote a book on the minerals of Greece. *De Lapid* notes that the property of amber is possessed by the mineral tourmaline.

The old lore of tourmaline was forgotten until the mineralogist Johann Lehmann noticed that a small crystal of tourmaline drew ashes to itself when placed on a burning coal. This curious behavior was known to Dutch and German jewel traders when they imported the stones from Ceylon.

Linnaeus mentions this stone in his 1737 *Flora Zeylanica* under the name of "lapis electricus." When it is dropped into hot water, one end turns positive and the other end turns negative. It could also be rubbed to generate an electric charge. Dr. William Heberden introduced tourmaline to English scientists.

Franz Aepinus (1724–1802) found if he immersed a tourmaline in hot water, it changed the electric field. The crystal acquires a positive electrical charge on one face and a negative one on the opposite face. If a crystal were heated on a hot surface or by focused sunlight, the natural charges of the crystal were reversed. Aepinus viewed tourmaline and magnetized iron in the same way. He was able to show that each magnetic phenomenon had a parallel in the electric realm.

Johann Schweigger was another curious figure in the early history of electricity. He believed that the ancients knew of two kinds of electricity in antiquity, designated by the names of Castor and Pollux. The inner nature of electricity was contained in the hieroglyphic pictures of the Dioscurae. The two stars represented the two electricities. He gave lectures at Erlanger, Germany, on his theory that the smallest particles possess opposite charged poles. Electronegative substances have more negative electricity in their negative poles.

William Gilbert found that diamonds, sapphires, amethysts, opals, Bristol stones and beryl crystals would attract light bodies when rubbed. Robert Boyle (1627–1691) began to work on electrical minerals. He found that minerals produced more electricity if they were warmed before being rubbed. He found that his electrical minerals

would attract smoke very easily. He believed that the electrical bodies emitted a glutinous effluvium, which grabbed small bodies and carried them back to the crystal.

Andrew Crosse believed that electricity formed minerals. He claimed that he produced crystals of quartz, aragonite and malachite. He displayed samples of the crystals at meetings of the London Electrical Society. In 1836, Cross announced that he had produced artificial life by passing electricity through a silicate solution. Little bugs came crawling from the solution as a result of the current. Nobody else was able to replicate the experiment.

William Stukeley had the curious theory that earthquakes were probably caused by electricity. He noticed that during the London earthquake of 1749, there were small fireballs in the air with a sulfurous smell. The weather had been dry and warm which got the earth ready. The dryness of the earth didn't allow the electricity to drain off. Before the earthquake, all fruits, flowers and trees were blooming early. Electricity had quickened the vegetation!

Stukeley noticed that in the days after the earthquake, many people had pain in the back, arthritis and nervous headaches. The same things happened after electrification. Earthquakes were electric quakes!

There is a curious theory that the earth is crossed with electromagnetic fields generated with running water. In 1931, Hartmann, Schneider and Schweitzer developed ideas about the relations between electromagnetic fields emitted by running water in underground faults. The best device to detect these electromagnetic fields is the lecher antenna, a metal loop of about 20 centimeters, open at one end, with handles.

Many people in Europe believe that health problems are due to sleeping or living above electromagnetic faults. If you can locate them and shift position, you can improve your health. Dowzers are able to locate such faults.

In 1958, Dr. Hans Hansche gave a lecture: "Research carried out quite a number of years ago has shown that earth is checkered with electric poles, and that there is a continuous energy exchange between heaven and earth. Many trees have been discovered that try to avoid

negative radiation fields and therefore grow elsewhere, or if they cannot do so, fail to thrive, or become completely deformed. If space has an electric field, it must follow that humans have one too. The eternal dream has been to make this aura visible.”

The normal electric field of the earth may keep the direct current system of the body in bounds. After a cosmic ray decrease, more people come to psychiatric hospitals. There are disruptions in behavior with a change in the earth's electric field.

In 1844, the first commercial telegraph system was put into operation between New York and Washington D.C. The telegraph operators quickly discovered that other signals were traveling along the telegraph lines. The currents were strongest during displays of the northern lights and when compasses became erratic. During a big storm in 1859, it was impossible to send telegrams for seven days. At other times, operators could send messages without using batteries.

In 1922, the Carnegie Institute of Washington began systematically measuring the earth's currents. It was found that earth currents of all of the continents varied together. Electrical storms generally had a 27-day period, which is related to the rotation of the sun. When there were more sunspots, there were greater earth currents.

A study at Tucson, Arizona, showed that the weakest earth currents were about an hour before midnight. The electric flow was towards the southeast at midnight, but it veered eastward at 2 a.m. By 5 a.m. the flow was going northward, and the electrical current was strongest at 8 p.m.

Rutger Wever experimented boldly: he isolated people in underground caves from all clues to the passage of time, with constant temperature, light and sound. His subjects developed irregular body rhythms. Wever found that an electrical field of 0.025 volts per centimeter pulsing at 10 hertz dramatically restored persons to normal biological measurements. Ten hertz is close to the dominant alpha frequency of the brain in all animals. The weak electric field restored normal circadian rhythms. It may have been the frequency in Precambrian times when life evolved in the shallow seas.

In 1851, the German chemist Christian Friedrich Schönbein read a paper before the Royal Medical and Chirurgical Society. He showed

that a stroke of lightning forms nitric acid and also provides the deodorizing and oxidizing agent ozone. An engineer who was struck by lightning while camping on a mountain identified the smell of ozone as the same as Schönbein's artificially produced smell. We know that nitrous acid is the building block of proteins and is necessary to the nutrition of plants.

Life on earth may have started as a result of electricity. In 1953, Dr. Harold Urey and his graduate student Stanley Miller placed ammonia, methane, hydrogen and water in a jar without oxygen. Sparks went through the strange atmosphere, and amino acids were formed. A lightning flash might have been the beginning of earth's spark of life.

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6. ELECTRIC PEOPLE

“O Socrates, I used to be told, before I knew you, that you were always doubting yourself and making others doubt. Now you are casting your spells over me, and I am simply being bewitched and enchanted, and am at my wits end. If I venture to make a jest upon you, you seem both in your appearance and in your power over others to be like a torpedo fish, who torpifies those who come near him and touch him—as you have now torpified me.”

Meno Plato

“Disease is a deviation from the state of health, implying some alteration in the functions, properties or structure of some organ or tissue and may be generally described as an abnormal performance of the processes constituting life. That being so, it would be illogical to imagine that one of the most delicate and most necessary of those processes, *i.e.*, the maintenance and regulation of the neuro-electrical system, could proceed without deviation in any disease area.”

Studies in Electro-Physiology Arthur E. Baines 1918

A number of people have exhibited unusual electrical properties. Theodore Beza could be seen at night by the light from his eyebrows. Sparks would flash from the body of Charles Gonzago. In the early days of Jamestown, Virginia, sparks could be seen coming from the clothing of Mrs. Susanna Sewall.

Robert Boyle, one of the greatest early English scientists, investigated a woman whose hair locks persisted in sticking to her cheeks. He suspected a trick, but it was apparently static electricity. Another woman had the same problem when the weather was cold and frosty.

In 1846, a 14-year old French peasant girl displayed remarkable electrical phenomena for ten weeks. Her bewildered parents brought her to Paris where many scientists observed her powers. Pith balls or feathers hung from silk threads would be attracted or repelled by her electrical fields. At times the force was so great a 60-pound table would move if her apron merely touched it. The girl was afraid of the strange manifestations of her power.

An infant born in 1869 at St. Urbain, France, was charged like a Leyden jar. Nobody could touch him without receiving a shock. When he died after nine months, a luminous radiance appeared around his body, remaining visible for some time.

In 1895, a 14-year-old Missouri girl seemed to turn into an electrical generator. When she touched metal objects, her fingers gave off powerful sparks. When a doctor attempted to examine her, he was knocked unconscious for several seconds. Her electrical abilities eventually diminished and vanished by the time she was 20.

In 1920, a group of 34 convicts at Clinton Prison in New York were stricken with botulinum poisoning after eating canned salmon. Most of these men developed peculiar electrical powers. One man tried to crumple up a piece of paper and throw it into a basket, but it wouldn't leave his hand. A compass needle would rotate when it was near the convicts. As they got better, they lost their power.

During fair weather, natural electric current passes from the feet to the head. This minute current might be necessary to our health, but there are no studies on it. In 1922, George Quarrie published his ideas on the importance of this current. (Later, this topic is discussed related to the treatment of depression.)

There were mansions in Scotland with large lawns kept mown by horses, but the horses couldn't work more than several days in a row. They were always shod with leather or rubber shoes to prevent damage to the lawn. Quarrie believed that the insulation over the feet damaged the eyes more than a week of work.

He showed with a galvanometer that when the soles of the feet are connected to the earth, a current flows. He believed that we damage our health by wearing insulating shoes, and the feet get sore very quickly from wearing these shoes. If a metallic connection were added to the shoes, the feet would quickly feel normal.

Quarrie asked his readers to put 3-4 thickness of paper in their shoes, because that was a good insulator. In about four days, the feet would become painful and the eyes would be inflamed and sore. If your shoes are properly grounded, your eyes won't get sore, your feet will be healthy, and you won't get pain in your teeth!

The galvanometer is used to measure electric currents. In 1904, Erich Konrad Muller reported to the Swiss Society of Natural Sciences that he was able to discover the emotional content of words with a galvanometer. The report eventually got to the Swiss psychoanalyst Carl Jung who began to work with it. A list of words was read to a patient who reacted strongly to the words burn and pay. It happened

that his stove had overheated and ruined the floor. His paycheck wasn't enough to cover the damage, and he was concerned.

When we blush with emotion, the blood vessels dilate and skin flushes mildly red. Emotions are always influencing our electrical conductivity. The electrical resistance of the skin changes with slight changes in emotion.

Psychologists worked with this tool in the first decades of the 20th century. It was of real interest, but it did not seem to be of great use in treating disturbed persons. A simple type of galvanometer known as the "E meter" became a part of the teachings of Scientology. Founder L. Ron Hubbard believed that by focusing on words and situations with electrical disturbances, he would "clear" the mind. This became a kind of electrical scientific confession of "sins."

Arthur Baines made the most interesting studies of the body's current. He had patients hold silver electrodes in each hand. The patient was grounded first, then the deflection was measured from hand-to-hand. A strong hand-to-hand deflection indicated good health. With the old type of equipment he was using, he obtained a good hand-to-hand reading of 250 mm. in health. A weak deflection corresponded with mental depression.

A 59-year-old man had a hand-to-hand deflection of 70 mm. He had many financial worries and was suing to try to get his money back. A cell with the negative current was connected to his spine and a one-millivolt current was run to his abdomen. After ten minutes, the hand-to-hand deflection was 189 negative. Then the connections were reversed, and the hand-to-hand deflection became 260 positive. The patient felt better and was much more cheerful.

A woman used a large ear trumpet in order to hear. Her hand-to-hand deflection was only 25 mm. After using a weak continuous current to raise her hand-to-hand deflection, her hearing was immediately restored. The hearing continued to be normal.

Baines found that strong healthy active people have a positive deflection, and that people with a negative deflection are inclined to be lacking in determination. Most cases could be improved by means of a low continuous current applied by a belt around the middle.

Baines found that epileptic attacks were due to excessive electrical pressure in the brain. If hot salt water was applied to the head during

the beginning, it would prevent the attack by allowing the electricity to escape. If a small silver plate was fastened to the area and connected to the midbody, it would allow the electricity to escape and there would be no further attacks.

One patient had fairly frequent epileptic attacks, which gradually got worse. He seemed dazed with his twisted right hand, and left hand clutching the breast. The bromides were stopped and a wire attached to drain off the nerve current. In the next five days, there were only two fits and his general intelligence improved.

Baines experimented with a carbon rod, which was the central part of a battery. He found that when people held the carbon rod in the right hand it produced an off-scale positive deflection; this was reversed when held in the left hand. He found that a rod magnet had exactly opposite effects. When it was held in the left hand, it produced strong positive deflections. By using these tools, he could restore the healthy positive electrical deflections.

Baines was measuring the microamperes between the right and left hands with an old style galvanometer, which used a mirror and light beam for extreme sensitivity.

I got a circular magnet and a hard carbon rod and gave them to an electrical engineer. He found that the silver electrodes holding either the magnet or the carbon rod generated a weak electrical current. Neither the magnet nor the carbon rods have a mystery effect—they are generating a weak electric current across the body. When people ceased to hold the magnet or the rod, there was no increased force. He did find a difference between people in the microamperage across the body. The experiments raise a question: would a weak electrical current across the upper chest increase the vitality and health of people?

Dr. Harold Saxton Burr (1889–1973) believed that electric fields were the organizers of life. He made a new type of voltmeter, which drew no current. He found that the precise moment of a woman's ovulation could be measured by the changes in her electric fields. He found that cancers could be detected in organs before any clinical signs were observed. He could locate the position of a chick's head in the egg during the first day of its incubation. He found that strong electric fields around seeds predicted good strong plants.

Leonard J. Ravitz Jr. measured the depth of hypnosis with the technique. He concluded that all humans are in hypnotic states most of the time. He found that the electrical organizing fields anticipate physical events around us and affect the mind.

Amphibians contain a sort of skin battery. Their skin is negative by 40-80 millivolts in relationship to their insides. This forms a regenerating current in salamanders. Frogs don't regenerate lost limbs, but when a negative electrode was hooked up to one, the limb began to regenerate. If the current was reversed, the stump was damaged and there was no regeneration.

The regenerating limbs depend on the sodium ion channels of the skin, and if the animals receive a sodium channel blocker drug, the limbs don't regenerate. Pure water means little electrical conductivity, but a little salt added to the water increases the rate of conductivity. The electrical pattern creates the pattern of the lost limb and determines the migration of the healing cells.

When the limb of a frog is removed, there is a positive electrical potential for the first three days and the stump doesn't regenerate. When a salamander has an injured limb, it develops a positive potential for the first three days, and then it develops a strong negative potential in the limb. The leg regenerates, which is of great scientific interest.

How does a clam get a shell or how does a coral organism surround itself with a rocky home? It appears that calcium deposition is electrochemical in nature. A weak electric current generated by the living cells deposits the calcium from the seawater.

The process has attracted a fair amount of commercial interest in building undersea structures. A wire mesh outline of the structure is made. Then a weak electric current is applied. Calcium carbonate begins to build up, and as long as the weak current continues, the structure keeps getting thicker.

If you suck on a lemon and then examine your teeth under a microscope you will find tiny pits. If you wait a few days and then re-examine them, the pits are gone. Several researchers worked on remineralizing solutions for the teeth. If cavities started to form in the early stages, prolonged use of remineralizing solutions and electrical current could fill them in without help from the dentist.

A measurement of eight human subjects showed that the surfaces of the teeth were 10-37 millivolts positive in comparison to the lip. The potentials were higher in the upper incisors and less in the lower incisors, and lower in the premolars and molars. Teeth that were badly decayed or dead had small or even zero potentials.

Rat incisors grow very rapidly with a well-developed capillary bed. Human teeth are supplied with blood vessels on the inside. If the teeth are not growing, what is the purpose of a good blood supply? Perhaps the blood is charging the teeth to become positive in relationship to the structures around them. By being weakly positive, electricity is acting as an electroplating mechanism. The surface is slightly alkaline. The calcium in the saliva is being electrically deposited on the damaged area of the teeth!

The implications of electrical calcium deposits are also apparent in arteriosclerosis. Calcium salts and cholesterol deposits on the artery walls. This is a real puzzle. Is diet affecting the electro-deposition? Could we use electricity to remove the arteriosclerosis? We do not have an answer to these mysteries at present.

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7. MAGNETIC PEOPLE

“Tomorrow we shall arrive at a mountain of black stone called lodestone. The current is now bearing us towards it and the ships will fall into pieces and every nail in them will fly to the mountain and adhere to it. God has given to the lodestone a secret property by virtue of which everything of iron is attracted towards it. On that mountain is such a quantity of iron, as no one knows but God, whose name be exalted. Great numbers of ships have been destroyed by the influence of that mountain.”

Arabian Nights

“As I was saying, this is not an art in you, whereby you speak well on Homer, but a divine power. This moves you like the stone which Euripides named Magnetis, but most people call Heraclea. This stone not only attracts iron rings but also imparts to them a power whereby they are able to do the very same thing as the stone and attract other rings. Sometimes there is formed quite a long chain of bits of iron rings, suspended one from another. They all depend for this power on that one stone.”

Ion Plato

The word magnet comes from the city of Magnesia in Asia Minor. There is an old story of a shepherd who found that the iron nails of his shoes were pulled out. This story became legendary; it was said that ships passing near iron-rich mountains found their nails pulled, so they were wrecked.

The Chinese may have had the first magnetic compass, but their descriptions of it are poor. In +1242, Bailak Kibdjaki wrote about the first Arab compass, “The captains navigate the Syrian sea, when the night is so obscure that they cannot perceive any star to direct them according to the determination of the four cardinal points. So they take a vessel of water, which they place sheltered from the wind within the ship. They then enclose a needle in a piece of wood or a reed in the shape of a cross. They put it in water contained in the vase, so it floats.”

Magnets were the subject of great mystery in medieval times. Sailors believed that garlic would destroy their power, so they didn't eat garlic. They also believed a magnet had no power in the presence of a diamond. Burglars carried magnets to help them pull in the treasure. Magnets carried in clothing were believed to cure cramps and gout.

They were supposed to draw the poison from wounds, prevent baldness, cure headache and facilitate childbirth.

The magnetic properties of iron led to great speculation in medicine. Pliny believed that iron stopped bleeding. It was an effective healer in shingles and St. Anthony's fire. Ætius, a physician of emperor Justinian I (527–565) wrote: "We are assured that those who are troubled with the gout in their hands or feet find relief when they hold a magnet in their hand."

D.S. Parasnis wrote: "Many strange and curious properties have been attributed throughout ancient times and the Middle Ages to the magnet. It was supposed to give comfort and grace, to be of value in disputes and to cure dropsy, hemorrhage, toothache and many other disorders and diseases. The magnet was also supposed to reconcile husbands to their wives. The belief in the supernatural properties of the magnet continued, in fact, down to the end of the last century."

William Gilbert made the mystery of the earth's magnetism seem simple with his scientific demonstration in *De Magnete* (1600). His work was one of the first real works of science. He also made an electroscope that pointed towards a charged source.

Several people have exhibited some strange magnetic properties. In 1879, a 19-year-old girl in Ontario was recovering from an unknown illness. She developed electrical discharges and also became an electromagnet since any metal objects she picked up would adhere to her open hand.

In 1888, a 16-year-old boy came to the attention of scientists in Maryland. He could suspend iron rods from his finger tips. He could lift a container filled with iron filings merely by pressing three fingers against the side of the container.

The Spanish priest Eusebius Nieremberg (1595–1658) believed that man was magnetic. If a person were placed in a boat on a still pond, the person would finally come to rest with his or her head facing north. Nieremberg noted that Jews buried the dead with the head placed to the north, while Christians buried the dead unnaturally.

Jacques-Arsène d'Arsonval (1851–1940) was one of the first people to observe magnetically stimulated phosphores in 1896. He

put his head into a coil carrying 30 amperes of current at 110 volts and 42 hertz. It gave him such vertigo that he nearly fainted. With a smaller coil he saw phosphenes and experienced muscular contractions as well.

In 1910, Sylvanus Thompson headed the British Institution of Electrical Engineers. He independently discovered this same phenomenon and coined the word magnetophosphenes. He had a coil of 32 turns of thick copper wire wound around an eight-inch diameter circle. When he stuck his head into the high magnetic field, the flickering phosphenes were visible even in daylight. Several subjects noticed a strange taste after being in the field for 2-3 minutes.

Phosphene flickers were best perceived when the eyes were closed or the room darkened. When 480 amperes of current flowed through the coil nearly everyone could see a 25-hertz flicker. Below 15 hertz, flickers were seen as a series of flashes. At 20-35 hertz, light had a quivering flickering effect. Above 40 hertz, the light is more uniform and the flicker is rapid.

Two blind subjects were tested in the changing magnetic field. One was able to see phosphenes without persistent after-images. This had no benefit for lost vision.

Knight Dunlap believed that the phosphenes reported by Thompson might be due to suggestion caused by the loud hum. He eliminated the hum, but all his subjects still reported flickering. When the frequency was reduced to 25 hertz, the whole visual field appeared illuminated. The flickering could still be perceived with the head below the coil.

There was an early attempt to cure blindness with electrically generated phosphenes. Charles LeRoy was a distinguished French chemist and doctor who in 1755 discharged a Leyden jar through the head of a blind man and discovered phosphenes. He had a 21-year-old patient who became blind after a high fever. His parents took him to Doctor Leroy and implored him to shock their son. They had read an article about a 7-year-old boy cured of blindness by electric shock. A brass wire was attached to the patient's head and feet, 12 shocks were given from a charged Leyden jar. The young man could see flames descending rapidly before his eyes, but he remained blind.

Until 1820, magnetism and electricity were regarded as separate things. Hans Christian Oersted proved they were related, when he observed that a wire carrying an electric current deflected a suspended magnetic needle.

A strong magnetic pulse would produce an electrical pulse in the body. Since the pulse is not passing through metal coils as in a generator, the effect is weak. In 1964, Reginald G. Bickford and Bertil Frenning were able to produce a twitch in the muscles of frogs and rabbits by stimulating the sciatic nerve with a pulsed magnetic field. When they used the same techniques in volunteers, they obtained a twitch in muscles.

Magnetic stimulation produces the same effect as electrical stimulation. It begins a current resulting in depolarization and initiation of a nerve potential. The work goes back to Michael Faraday's experiments in 1831, when he found an induced current flowing in a secondary circuit.

A group of scientists in Sheffield, England, began to work on a magnetic stimulator. They made a unit, which had from 400 to 3,000 volts with a pulse lasting for a few milliseconds. A small magnetic coil would only stimulate the surface of the body, but a large coil would send a pulse deep inside the body.

The magnetic stimulator consisted of a pulse generator producing a discharge current of 5,000 amperes with a magnetic field strength of 1 tesla or more. The power output for a fraction of a second was five million watts. The great surge of power lasts only a thousandth of a second.

The pulsing magnetic field can be used on bruising that follows some types of surgery. It gives relief in peptic ulcers and there is marked relief in sprained shoulders and swollen joints. The treatment is useful in neuralgia, headache, muscular rheumatism, gout, angina pectoris and hyperesthesia of the gastrointestinal tract. There is no mechanical contact, and the patient doesn't have to undress.

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8. STATIC ELECTRICITY

"Moreover a few weeks of static treatment scatters many of the little troubles of life that are not definite diseases. It is so comforting to mental and physical ills that have no medical name; it can tide us over so many emergencies that would otherwise leave the marks of age upon us. It can so marvelously conquer pain; it can bring such instant strength and rest to weary feet and aching backs that faint under burdens, it will quickly make light. It is so competent, so practical and so decisive when it is indicated that its effects must inspire the admiration of every beholder even as they command the grateful admiration of every beholder. They command the grateful affection of all who have rejoiced in the blessed benefits of this matchless handmaid of the physician."

Samuel Howard Monell (1857–1918)

The first unrecorded displays of static electricity resulted from petting a cat or stroking a wool garment. Thales of Miletus was one of the seven wise men of ancient Greece. Around -560, he discovered that amber, rubbed with a dry cloth, attracts light bodies to it. He believed that amber possessed a soul and was nourished by substances which it attracted to itself.

Otto von Guericke developed the first static generator in 1672. He was trying to disprove William Gilbert's ideas about the earth as a magnet, and he didn't care about the generation of static electricity. The discovery was not of practical value and was little known.

In 1675 Sir Isaac Newton found that when he rubbed a telescope lens with cloth, it would attract bits of paper which would stick after the rubbing ceased. The best results were obtained with a scrub brush of short hog's bristles.

Stephen Gray found that he could convey an electric current over a distance with a wet hemp string in 1729. Then he hung a 700-foot line on loops of silk and found that the electricity would pass the whole distance. This was the first experiment to introduce the idea of conductors and nonconductors. In 1747 William Watson extended the distance of a Leyden jar shock four miles in order to prove the velocity of its transmission.

In 1742, a static machine was made from a glass cylinder, and it generated enough electricity to produce visible sparks. This was followed by the glass plate machine of Jesse Ramsden in 1768, which became the model for medical static generators. In 1784, John Cuthbertson constructed the first powerful static generator.

Around 1745, two men independently invented the electric condenser in Leyden, Holland. Petrus van Musschenbroeck was trying to electrify water. Ewald von Kleist knew that frictional machines generated electricity, and thought that he could store it in a glass bottle full of water. He took a bottle with a cork and pounded a nail through it, penetrating into the water. He turned on the static machine for a few minutes, then touched the nail and received a terrific shock. The water was then replaced by tin foil surfaces on the inside and outside of the jar.

The Holtz static machine of 1865 had 16 revolving plates and 16 stationary ones but no direct connection between the revolving and stationary plates. The machine has. It produced a static current of extremely high voltage and low amperage. The Toepler-Holtz model would charge and hold a charge under conditions where the Holtz model would go dead.

The static machines were fickle and would occasionally change polarity in the terminals. A round piece of dry pinewood was used to test for polarity by holding it at right angles to the output terminal balls. Positive current would follow the wood, but negative current wouldn't.

The positive pole of static electricity was soothing and quieting. The negative pole was stimulating or irritating. Static sparks were used on chronic conditions where strong stimulation was desired. They were used for only a short time, because patients didn't enjoy the sensation. The static director was a brass rod with a vulcanite handle. The end was applied directly to the patient's skin and caused red spots to appear, which lasted for hours.

Static electrical treatments were usually given as a brush discharge. The best discharge applicator was shaped like a pencil and tipped with sharp brass points. When the static generator was turned on high, the electrical current felt like a spray of hot sand.

The static baths charged the patient and caused a peculiar sensation all over the body. The treatment was sedative, but it had no specific effects. A strong static charge could make the patient's hair stand on end. People often fell asleep after a static bath.

The static wave current exercised the cells. It decongested the tissues rapidly and thoroughly. Flabby muscles became firm and active under its use. The currents gave remarkable help for underdeveloped youngsters. Tired workers became more active under static treatment.

A static current applied to the liver and gallbladder causes a flow of bile into the intestinal tract and stimulates it. When the static current energizes the liver, the brain becomes more active. The brain is the negative terminal of the body and the liver is the positive terminal, according to the theory of George Crile.

A seven-week-old baby suffered from acute diarrhea; medical help didn't work. The mother held her child on the static platform and received ten minutes of positive static spray. When she returned home, the child slept three hours, and the diarrhea ceased. The baby took more treatments and continued to get better.

An 18-month-old child was very sickly and thin, and the mother believed that her child would soon die. She gave it three static treatments a week, with cod liver oil. Soon the child became active and healthy.

The static wave current would often give prompt relief from pain when heroin or morphine wouldn't give relief. Normal Titus studied the treatment of 662 cases of sciatica with the static current. He found that the current almost always relieved pain.

A man smoked a dozen cigars a day and got cancer of the tongue. His brother had his tongue removed, and he died in misery, unable to speak. This man refused an operation, but the pain got worse, and cocaine no longer gave him relief. He suffered greatly for six months.

The static spray was tried without any promises. The first treatment removed most of the pain and soreness of his neck. The second treatment gave him some power of speech, and he was able to sleep three hours without whiskey or cocaine. The tumor shrank but was not cured and he had no pain. He felt so much better that he continued to take treatments several times a week until his death.

The static current was very useful in treating a hoarse voice. A man had acute laryngitis and could hardly talk above a whisper. He was treated with interrupted static current which restored his normal voice. Two weeks later he lost his voice, but it was restored after a static treatment.

Tuberculosis patients often have to struggle for breath and breathe very rapidly. When the static wave current was applied over the chest, the breath rate dropped markedly. A 30-minute treatment enables the patient to heal and absorb more oxygen.

A 36-year-old woman had a cough and bronchitis for five years and was gradually getting worse. Her health failed, and she could hardly walk across the room. She had to sleep in an upright position. She was constantly coughing and her throat was always irritated. Many doctors tried to treat her, without results.

Sparks were administered up and down her spine, and the static spray given to her back, leg and chest. She was treated every other day for four weeks. There was a remarkable improvement in all symptoms and the soreness of her chest nearly disappeared. She was able to sleep nearly all night and do general housework.

Another woman suffered from bronchitis; when she got up she had intense diffused pain over a large area of her side. She was placed on the static platform and connected to the positive pole with the negative pole grounded. Her spine was given needle sparks. After the first treatment, she was able to draw a full breath without pain. It took a week of static treatments to reduce her cough.

A large static machine could produce strong contractions. The patient begins the treatment when an electrode is placed on the abdomen and another on the back. When the voltage is raised, there is a feeling of terrific compression.

Fluid in the joints and tissues is easily removed with the static current. Static brush discharges keep down the swelling from injuries. When bursitis is combined with diathermy, it yields quickly to static brush discharge.

Myosis [excessive contraction of the pupils] is an eye condition that yields to the static current. Infrared or visible light was shone on the area, and then the static current was used to heal it.

David Yates treated some cases of deafness with static electricity. He would put the patient on an insulated platform and hold the negative pole against the deaf ear. The positive pole was held in the hand. If possible, he gave the patient two 30-minute treatments a day at first. In order to prevent sparking in the ears, cotton soaked in salt water was inserted into the ear. Some catarrheal cases showed remarkable improvement after a few weeks of treatment, while others had only slight improvement.

William Snow treated a 15-year-old boy with symptoms of fever, vomiting and pain in the back and legs. He was unable to walk in the morning and became completely paralyzed during the next 48 hours. Polio had caused his paralysis, and the boy was nearly helpless.

A Morton wave static current was applied to his spine, and sparks were applied to the entire surface of his body. Each day he was given a 40-minute treatment all over the spine. For the first two weeks, the treatments were daily, and then every other day. After the sixth treatment, he was able to walk about 30 feet. He continued to improve steadily, but his left hand and arm didn't fully respond.

When Bell's palsy paralyzed the face, Snow used diathermy on the patient for a day or two. Then he treated the paralysis of the face with the static wave current. In most cases palsy would cease.

Static treatments could stop a cold in its early stages. A woman began to catch cold and lay awake with nausea, headache and chills. She was put on a static platform with the negative pole grounded. After five minutes of treatment with the positive pole, her symptoms began to disappear.

The Morton wave current was a static pulsed current. It was used for sciatica, lumbago, nephritis, chronic arthritis and prostatitis. The current directed to the patient is always positive. The spark gap was adjusted to give the desired voltage.

Static currents were used in all pains and injuries. A woman had enlarged joints in her hands and ankles and walked with difficulty. She took three static treatments a week, her pain was relieved and nearly all her joints were reduced.

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9. THE FIRST ELECTRIC DOCTORS

“First let not the shock be too violent; rather let several small shocks be given. Secondly, do not give a shock to the whole body when only a particular part is affected. If it be given to the part affected only, little harm can follow even from a violent shock. For instance, in a palsy of the tongue, the shock may be given to the tongue only by applying one wire to the hinder part of the neck, and another to the tongue. And if in any case there be danger of too great a shock, it may easily be prevented.”

The Desiratum John Wesley

“The master of technique secures his results with ease, while the unskilled owner of even the finest apparatus labors in vain to secure them. He does not know how, and he soon doubts their possibility. Like the blindfolded traveler taken to a hill top in a strange country and told to delight himself with the beauties of the landscape around him, so the average physician stares at the terra-incognita of scientific electro-therapeutics with the bandages of ignorance upon his eyes and sees nothing of all that research has made plain. To him electricity is electricity and nothing more.”

Elements of Correct Technique Samuel Monell 1900

The first good static generator was invented in 1742, and the Leyden jar followed it in 1745. It is no surprise that the first case of electrical healing came along in 1748. Jean Jallabert was a professor of physics at Geneva, Switzerland. A locksmith had a stroke, leaving him with a paralyzed hand and only able to walk with a cane. Jallabert connected the paralyzed foot to a Leyden jar and drew sparks from the motionless hand. The sparks made his body tingle. The locksmith could flex his thumb a few days later, and in about ten weeks was able to return to work.

This case came to the attention of Jean-Antoine Nollet who got permission from the chief doctor at the Hotel des Invalides to electrify three paralyzed patients for weeks—but none improved. Nollet electrified cats and pigeons and found that they lost weight as a result. He was unable to find an increase in their pulse rates.

Abbé Pierre Bertholon believed that he could use electric shocks to cure malaria. The shocks had to be administered immediately before the expected return of the malaria attack. Several doctors found they could cure malaria with carefully timed electrical shocks.

Dr. Maddock wrote in the late 1800s: "In my experience I know of no more valuable feature of static electricity than its power to help eliminate malarious conditions from the system. Scientists have universally admitted that in malarial districts, the air is electrified negatively. Following this out, I reasoned that owing to the greater conductivity of the air, due to moisture, people residing in paludal districts were deprived of an adequate supply of positive electricity. Acting upon this, I have for years employed the static machine by positive insulation in every case of suspected malarial origin and the results have surprised myself."

When a person has a malaria attack, millions of parasites in the blood all divide and change forms in minutes. The patient develops a high fever and is severely ill. These attacks are so regular that the person knows within minutes when the next attack will come. Several southern planters found they could cure malaria by bathing in cold water immediately before the next attacks were due. The attack didn't happen, and they repeated the cold bath two days later and permanently disrupted the cycle of the parasites.

I conclude that malarial parasites have some sensitivity to the external environment of their host. The parasites reacted to the changes in the body brought on by electrical shocks by not dividing. When this was carried out for the next few expected attacks, the cycle of the parasites was broken, and the body disposed of them.

Other early reports exist. Dr. Friske directed shocks through the abdomen to kill tapeworms. In 1798, Dr. T. Gale used static electricity on convalescent yellow fever patients. Electricity was also used for impotence in men, and soon they appeared young and lusty.

John Wesley was born into a large family in Epworth, England. When he was three, his father was imprisoned for debt. At the age of six, he narrowly escaped being burned to death and was rescued a few minutes before the roof fell in. He became a missionary to America and then returned to England. He found that the Church of England didn't meet his spiritual needs, so he founded the Methodist Church. The people who came to his meetings were often poor and in need of medical help.

Wesley started a fund to provide the poor with clothing, and in 1746, opened a dispensary in London to practice medicine. The clinic was very successful and soon was crowded with patients. He wrote a book on medicine, *Primitive Physic* (1747), and in 1758 he published *Advice With Respect to Health*.

He developed an intense interest in electricity, which he regarded as the source of life. He tried applying sparks from a generator to a dark spot on the eye caused by a blow three days before. The spot disappeared in about 15 minutes. He applied sparks to the toe of a man who experienced chronic pain for some eight years, and the pain left.

In 1765 Wesley had a bad accident when his horse reared and fell on his leg. He was badly bruised in the right arm, breast, knee and ankle, which swelled greatly. He was electrified morning and night, and the lameness slowly healed.

Wesley recorded in his journal in 1773 that he had pains in his left side and shoulder. He had fibrosis with an inflamed throat six days earlier. He wrote: "I could scarcely lift my hand to my head, but after being electrified, I was so much better that I preached with tolerable ease in the evening."

Wesley was stricken with bronchitis, which didn't clear up. In 1783 he tried electricity on himself at the age of 80. "Finding still some remains of the fever with a load and tightness across my breast and a continual tendency to the cramp, I procured a friend to electrify me thoroughly, both through the legs and the breast several times in the day. God so blessed this that I had no more fever or cramp and no more load or tightness across my breast. In the evening, I ventured to preach three quarters of an hour and found no ill effect at all."

He published a book on healing with electricity and described many cases. Mr. Greenfield was reported to be dying of gout of the stomach, which was probably angina pectoris. After he was electrified through the breast and the violent symptoms immediately ceased, he fell into deep sleep. A man affected for weeks with constant headache was twice electrified with a few light shocks and was entirely cured.

Wesley mentions a long list of disorders which he cured by electricity. It cured St. Anthony's fire, blindness, burns, coldness in the feet, *etc.* At the end of the list he remarked: "The best method is to

give 50 or even 100 small shocks each time, but let them be so gentle as not to terrify the patient in the least. Drawing sparks removes the furrows on the eyelids called barley-corns by exciting local inflammation and promoting suppuration.”

Pierre-Jean-Claude Mauduyt turned to Benjamin Franklin as the starting point of his electricity treatments. He studied the weather and found that the north wind increased atmospheric electricity, and the south wind destroyed it. Northern winds are more likely to be dryer, and static sparks are easier to produce at this time. Southern winds are apt to be damp, and static machines were of little use at the time.

He had three electrical treatments. The first type of treatment was putting the patient on an insulated wooden platform to keep the fluid from running off. Then a static generator was used to give the patient an electric bath. In one case, a 17-year-old girl had not experienced menstruation, but after a few baths, it came.

The second treatment was using electricity to remove blockages. The doctor drew sparks from the charged patients with a grounded rod. This was used to treat nervous conditions and epilepsy.

The third type of treatment was the “commotion.” This was sending sparks through the affected area with the discharge of the Leyden jar. It was used when drawing sparks didn’t work.

Jean-Paul Marat was a scientist, philosopher and revolutionar born in Neuchatal, Switzerland, in 1743. He studied medicine in Bordeaux, Paris, Dublin, Edinburgh and Amsterdam before practicing medicine in Soho in 1765.

He was a strange man with a large head who stood about five feet tall. He made one of the most detailed and objective accounts of electrotherapeutic practice in the 18th century.

Marat selected three patients with different disorders. He electrified the room in which they were seated. In order to keep the patients around, he hired someone to tell them stories. He tried to ask them objective questions, without influencing their answers. He had the air so heavily charged with electricity that cork balls suspended on a ten-inch string spread apart by two inches. The first experiment with air ionization didn’t appear to help the patients that much.

He thought that a young man with gravel and dysuria was suffering from too much electricity. He decided to try electrifying the air every two minutes in the bedroom for five hours a night for 2.5 weeks. To his surprise, the man got better.

He tried using electricity by “commotion.” This was the jerking of muscles by shock. He wanted to find out if their body temperatures rose, so he had subjects hold a thermometer. After 15 minutes of shocks, the temperature rose by half a degree.

Marat found that cancer patients didn’t get help, and he believed that electricity might even stimulate the tumors. Electricity usually didn’t help kidney disorders. Electricity did help arthritis, cramps and paralysis. He published *New Discoveries on Fire*, then *New Discoveries on Light* and finally *Discoveries on Electricity*.

When Jean-Paul Marat worked in London he was poor, so he robbed the Ashmolean Museum of Oxford of some medals. He was captured in Dublin and returned to Oxford for trial. He was sentenced to hard labor rather than being hanged.

At the beginning of the French revolution of 1789, when the Bastille fell, Marat joined the radical Jacobeans. His health failed and he became sensitive to sunlight and developed an unquenchable thirst and itching skin. He became a radical revolutionary and contributed to the French terror. When Charlette Corday stabbed him to death, there was hysterical grief among his followers which became a rallying point for the Jacobeans.

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10. BENJAMIN FRANKLIN CLEARS THE AIR

"I say, if these things are so, may not the knowledge of this Power of Points be of use to mankind; in preserving houses, churches, ships, etc, from the stroke of lightning? This directs us to fix on the highest parts of those edifices upright rods of iron, made sharp as a needle and gilt to prevent rusting. From the foot of those rods a wire is put down the outside of the building into the ground, or down around one of the shrouds of a ship and down her side until it reaches the water. Would not these pointed rods probably draw the electrical fire silently out of a cloud before it came nigh enough to strike, and thereby secure us from that most sudden and terrible mischief?"

Benjamin Franklin

In 1773, Charles Dufay found that wax rubbed with cat's fur was electrified, but it differed from a glass rod electrified by rubbing with silk. It attracted an electrified body, which was repelled by glass, while it repelled an electrified body that was attracted by the glass. Dufay discovered the "insulator" and called the two kinds of electricity "vitreous" and "resinous." Benjamin Franklin would solve this mystery by designating the "two electricities" as positive and negative electricity.

Although Franklin established the modern science of electricity, Robert Symmer published articles about the two electricities in a convincing manner. By 1790, most continental electricians were dualists, and they regarded Symmer as the restorer of the two-fluid theory of electricity. He based his theories on silk stockings. One cold winter night, he threw his socks against the wall and found they stuck. He believed that the electrical properties of his socks arose from two distinct fluids that counterbalanced each other.

There was a second mystery that remained to be solved about electricity. Abbé Jean Nollet had wondered if there was a way to prove the identity of lightning and electricity. Several early electricians suspected that lightning was the same thing as their static sparks, but they didn't know how to prove it.

Benjamin Franklin was a successful printer of almanacs and newspapers in Philadelphia. He gained his success from good writing coupled with wonderful bits of wisdom. We still remember “A stitch in time saves nine” and “There is nothing certain in life, except death and taxes.”

Franklin became interested in electricity after hearing a lecture by Dr. Archibald Spencer. He obtained some electrical apparatus through Peter Collinson in England and began to repeat Spencer’s experiments. He sent letters to the Royal Society describing his experiments, and Peter Collinson read them to the society.

In 1747, there were big troubles between England and Spain over the right to gather salt at Tortuga, an island in the West Indies near Haiti, and to cut logwood at Campechy, a Mexican state on the Yucatan Peninsula. Volunteers were recruited in Pennsylvania for an invasion of Cuba, but the city of Philadelphia was Quaker and the people didn’t believe in fighting or in providing the means for others to fight. A French privateer sailed up the Delaware River and raided outlying settlements, and Spanish privateers followed. Philadelphia was stricken with terror, and nobody would defend themselves.

Franklin stopped his electrical experiments and wrote *Plain Truth*, a pamphlet depicting the horrors of war in such a way that triggered the people of Philadelphia to raise money and organize a regiment to defend themselves. The war between England and Spain ended in 1748 with the treaty of Aix-la-Chapelle.

Now that Benjamin Franklin had done his civic duty, he devoted himself to the study of electricity. He sold his newspaper, almanac and printing house to David Hall, which gave him enough money to live the life he desired, with leisure to read, study and make experiments.

Franklin began his experiments by assuming that “electrical fire” exists as a constituent of all matter in an unelectrified state. Charles Dufay had assumed that matter was made of equal amounts of two weightless fluids. Franklin decided to call any body positively electrified if a glass rod rubbed with silk repelled it. Rubbing cat’s fur with sealing wax electrified it negatively. His work became the basis of the work of the French physicist Charles Coulomb. Coulomb’s law states that like poles repel and unlike poles attract one another.

Franklin explained the phenomenon of the Leyden jar and showed how points attracted electricity. He declared that lightning was the same as static electricity. The Royal Society wouldn't publish his letters, but Peter Collinson did publish them.

In 1748, Benjamin Franklin wrote to Peter Collinson, reasoning that if lightning was electricity, then pointed conductors could channel it and thus avoid damage to buildings. In 1850, he recommended that houses, churches and ships have pointed rods on top and a wire to conduct lightning to the ground. He found that a single lightning rod had a limited area of protection and recommended multiple rods for large buildings.

He noted that it was dangerous to take shelter under a tree during lighting. "It has been fatal to many both man and beasts. It is safer to be in the open field for another reason. When the clothes are wet, if a flash on its way to the ground should strike your head, it may run in the water over the surface of your body. Whereas if your clothes were dry, it would go through the body, because the blood and other humors containing so much water are more ready conductors. Hence a wet rat cannot be killed by the exploding electrical bottle, but a dry rat may."

Thomas Dalibard tested Franklin's idea about lightning rods in France. He used a sharp pointed iron rod 40 feet high, insulated at the base and resting on a table. When a thunderhead passed over, sparks flew from the rod. Dalibard was so alarmed that he sent for a priest! Then he reported to the French Academy of Science: "Franklin's idea is not just a conjecture, here it has become a reality."

There was speculation that the Temple of Solomon in Jerusalem might have had lightning rods. The Jewish historian Josephus records that there were many points and pipes on the roof running to caverns in the hills, but there is no suggestion that the temple was struck by lightning or that King Solomon knew about lightning rods. The only function of the pipes was to drain off and save the scarce rainwater.

New England had many more electrical storms, and the lightning rods worked wonders in tall buildings. Churches had been especially hard hit, because of their tall towers. It eventually became law that all tall buildings had to be protected from lightning.

In June of 1752, Franklin made a kite with two crossed sticks and a silk handkerchief. He put an iron point on the upper part by the string. Rain began to fall as he stood under a shed and raised his kite. A cloud passed over and still there was no trace of electricity. The falling rain made the string a conductor, and the fibers began to fluff out. He put a key next to the string and drew sparks from the skies. This dangerous experiment attracted the attention of scientists in Europe.

Professor Richman of St. Petersburg, Russia, erected an iron rod in his observatory for the purpose of repeating Franklin's experiments, but unfortunately a lightning flash struck him on the head and killed him. Signor de la Garde of Florence, Italy, was struck by an unexpected stroke, but recovered.

In 1752 Benjamin Franklin treated a 14-year-old girl stricken with epileptic fits. She had such violent fits that three strong people could hardly keep her in bed. She had cramps throughout her body with general convulsions and choking. She had suffered this way for ten years.

The girl wrote: "At length, my spirits were quite broke and subdued with so many years affliction and indeed I was almost grown desperate, being left without hope of relief. About this time there was great talk of the wonderful power of electricity, and I happened to think it might be useful to me. Accordingly I went to Philadelphia in the beginning of September 1752 and applied to B. Franklin, who I thought understood it best of any person here. I received four shocks morning and evening, they were what they call 200 strokes of the wheel, which fills an eight gallon bottle and indeed they were very severe."

"When I went home, B. Franklin was so good as to supply me with a globe and bottle, to electrify myself every day for three months. The fits were soon carried off, but the cramp continued somewhat longer, although it was scarcely troublesome and very seldom returned. I now enjoy such a state of health as I would have given all the world, for this time two years before and I have great reason to hope it will continue."

In 1757, Franklin wrote to Benjamin Cowell: "People were brought to me from different parts of Pennsylvania and neighboring

provinces to be electrified, which I did for them at their request. My method was to place the patient first in a chair, or on an electric stool and draw a number of large sparks from all parts of the affected limb or side. Then I fully charged six two-gallon jars, each of which had about three square feet of surface coated; and I sent the united shock through the affected limb or limbs, repeating the stroke commonly three times each day."

The patients usually had some improvement at first, but often there was no improvement after the 50th day. The patients generally returned home and didn't apply for further treatment. He admitted that he had doubts whether the exercise provided by the walk to his house or the electric treatments provided the temporary improvement. He wished that he had the help of a skilled physician to help him work with patients.

Benjamin Franklin used a static generator and a Leyden jar to give spark and shock treatments; the therapy became known as Franklinism. The static generator that he used may still be seen at the Franklin Institute in Philadelphia.

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11. GALVANI'S ELECTRICITY

"Many distinguished scholars published the same theory long ago. We were amazed at our good fortune in being the first to hold in our hands this electricity, which is concealed in the nerves and to draw it forth from the nerves and to set it practically before our eyes."

Luigi Galvani

"When Galvani touched the muscles of a frog with different metals, and noticed their contraction, who could have dreamt that all Europe would be traversed with wires, flashing intelligence from Madrid to St. Petersburg with the speed of lightning? In the hands of Galvani, and at first even in Volta's, electrical currents were phenomena capable of exerting only the feeblest forces. Only the most delicate apparatus could detect them. Had they been neglected, on the ground that the investigation of them promised no immediate practical result, we should now be ignorant of the most important and most interesting of the links between the various forces of nature."

Hermann von Helmholtz 1873

In 1678, the entomologist Johanniss Swammerdam covered the muscle of an animal with a small silver wire. When the nerve touched a copper wire, the muscle contracted. He showed his experiment to the Grand Duke of Tuscany, but it was just a curiosity and the experiment was forgotten.

Frans van der Lott studied the "fluid emitted by the electric eel." It passed through iron, tin, silver and gold, but was stopped by sealing wax. He concluded that it was electricity. The early physiologists did not believe in animal electricity. They *knew* that electricity couldn't pass from the nerves to the muscles without spreading to all neighboring muscles.

Luigi Galvani became a professor of obstetrics at Bologna, Italy, and exhibited a growing interest in physiology. He published papers in 1773 and 1774 on the muscles and the effects of opiates on frogs. In the next two years he published papers on the structure of the ear and physiology of hearing. In 1783 he published a paper on the structure of a bird's ear with drawings.

He began to work with electricity in 1780 using a static machine and a Leyden jar. He dissected a frog and placed it on the table with

the electric machine. He induced violent contractions in the muscles of the frog. He noted that muscular contractions occurred even when a spark passed a short distance from the static machine. He enclosed a frog in a glass jar and covered the bottom with a conducting material. The frog jumped just as quickly as if it was in direct contact with the static machine.

Abraham Bennet invented the electroscope, a glass cylinder covered by a brass cap with an enclosed tube with two strips of gold leaf. Galvani used the electroscope and found that silver and zinc excited the strongest contractions. He thought that these were the best metals for discharging the animal electricity.

Galvani found that increasing the power of the spark didn't result in a stronger contraction. As he reduced it, there was a sudden complete disappearance of the contraction.

He began to wonder about atmospheric electricity. One stormy evening he connected the frog nerve to a long metallic wire pointing towards the sky. He obtained strong muscular jerks during the storm. He tried the same experiment on a clear day, hanging his frogs on the iron railing of his house and waiting. When he pushed the metallic brass hooks into the frogs attached to the iron bars of the railing, the legs began to contract.

The contractions of the frog legs didn't seem to have any relationship to the electricity in the sky. He got the idea that muscular contractions accumulate in the air and then are discharged when the hook came into contact with the iron railing.

He brought the frogs inside, placed them on the iron plate, pressed the brass hook against the frog and got the same muscular contractions. He repeated the experiments with various metals and obtained both stronger and weaker effects. He even tried glass, stones and dry wood, but nothing happened. He held the idea that electric fluid exists within the tissue, and the right metals are a stimulus for it to be discharged.

He developed a theory that atmospheric electricity, static electricity generators and Leyden jars were various aspects of the whole. In 1791, he published his famous paper: *Commentary on the Effects of Electricity on Muscular Motion*. All of the electrophysiology of the next two centuries sprang from the frogs of Galvani.

Alessandro Volta initially accepted Galvani's view that animal electricity was conducted with a metallic arc and began to experiment with metals without the frogs. In 1792, Volta published a letter stating that electricity didn't come from the frogs. "Animal electricity" was "metallic electricity."

Volta was wrong in almost all of his conclusions about animal electricity. There is real animal electricity, and it is involved in all fundamental processes. Animal electricity is a complex system of ion pumps and ion channels. They create concentrations of sodium and potassium and convert concentration gradients into an electrical potential. Current is a movement of ions originating from cellular activity.

A nerve fiber a few feet long has as much electrical resistance as several million miles of copper wire. The body solves the problem of poor conductivity by a chain battery reaction in which the difference between the electrical potentials of sodium and potassium provides the current. The speed of electricity in wire is the same as the speed of light—which is 300,000,000 meters per second. In 1850 Hermann von Helmholtz showed that the nerve conduction speeds are less than 30 meters per second.

Galvani seems to have realized that he was wrong and ceased to publish in the electrical area. However, he still sought ways to demonstrate animal electricity and his notebook for 1795 contains a series of experiments on the electrical properties of the torpedo fish.

Galvani continued to try proving that there was animal electricity. He found contractions could be elicited by using a nonmetallic arc and connecting nerve and muscle tissue through a tissue cut. When the surface section of the nerve touched the muscle, the leg contracted. In 1797 he proved that a section of the right sciatic nerve touching the surface of the left sciatic nerve would contract both muscles. The secret of this turned out to be contact between injured and noninjured tissues.

A slight injury to living cells causes the injured area to become negatively charged with respect to healthy cells. The injury voltage can amount to 50 millivolts. An injury potentially can become large enough to stimulate the nerves. C.L. Nobile constructed a galvanometer and detected the injury current of the frog.

There is real animal electricity, and it is linked with life. The greatest manifestations of it in nature are the torpedo, the electric catfish and the electric eel. At the time that Luigi Galvani was working, there was no way to understand or detect the weak electrical currents of animals or humans.

In 1850, Du Bois Raymond showed experimentally that a current of electricity was generated by the muscular excitement of a living human being. Reymond had to wind 3.2 miles of wire onto his galvanometer coils in order to get enough sensitivity to detect animal electricity.

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12. VOLTA'S ELECTRICITY

"The apparatus to which I allude and which will no doubt astonish you, is only the assemblage of a number of good conductors of different kinds arranged in a certain manner. Thirty, forty, sixty or more pieces of copper, or rather silver, applied each to a piece of tin, or zinc, which is much better, and as many layers of water, or any other liquid which may be a better conductor, such as salt water. Lay pieces of pasteboard, well soaked in these liquids and interposed between every pair or combination of two different metals in an alternate series and always in the same order of these three kinds of conductors. This is all that is necessary for constituting my new instrument, which, as I have said, imitates the effects of the Leyden flask."

Alessandro Volta 1800

There were only two ways of detecting weak electric currents when early scientists did their experiments. In 1753, Sulzer found that two dissimilar metals in contact with the tongue gave a bitter taste. The metals by themselves produced no sensation. Scientists could feel the current with the tongue or they could make frog legs contract. In 1788, William Nicholson described a "doubler" of electricity. Alessandro Volta saw the article in *Philosophical Transactions* and he made one. Using the doubler, he was able to detect weak electric currents resulting from two different metals.

Volta believed that the soul controlled the body through the nerves by means of the electric fluid. He thought the organs controlled by the will are easily excited by electricity, while organs like the heart, whose activity didn't depend on the will, reacted less to electricity. In 1792, Felice Fontana showed that the heart also reacted to electricity.

In 1795, Volta published a table of metals arranged according to their ability to "push" the electrical fluid into conductors. The series began with zinc as the most active; charcoal was the least active. He used contact with different metals between a wet interface to measure the amount of "electric fluid."

Volta wasn't thinking about the idea of a battery, until the spring of 1799; he was just experimenting and developing his own ideas about electricity. Then he read an article by William Nicholson who taught the anatomy of the electric fish. The nerve plates that generated a pulse of electricity gave him the idea of the battery.

The new way of generating electricity completely eclipsed Galvani's ideas. Anyone could take a series of dissimilar metal plates and place cloth or papers soaked in salt water and wire them together. The more plates were wired together, the more electricity was generated.

The first doctor to use the Volta pile was Carl Grapengiesser (1764–1846). He was the first to use the term “battery” instead of “pile.” He applied a battery made of silver and zinc plates to a young girl who lost her voice. The doctor recommended trying the battery on patients suffering from deficiencies of vision, hearing and also for sciatica and rheumatism. It was even tried for dissolving gallstones, when surgery was extremely risky.

Volta became friends with Gabriel Lavernine, the surgeon-general of the French army in Italy. He built some electrical devices for him in 1802, and they were used on the troops at the hospital in Como, Italy. Lavernine applied a metallic belt consisting of 90 cells around the midsection of his patients.

Lavernine was the first to treat epilepsy with 400 strong shocks. This delayed the convulsions for 12 hours. Lavernine wrote: “To be certain that the delay was due to voltaism, I did no electricity to the patient. I waited several days, during which the same periodic attacks recurred. Seeing that this approach was effective, I persisted in the voltaism and gained a diminution of epileptic attacks, the second time for 14 hours, the third for 28 hours, another for two whole days and on one occasion for eight days. When I left Como, the man had rejoined his regiment.”

Stefano Marianini was Volta's favorite pupil and began working with the battery. In 1827, Countess Sandi went to a party in good health. She was walking across a room when she fell to the floor. She was unable to use her legs and doctors failed to help her. Marianini used a battery of 58 pairs of copper and zinc discs. He gave her 150 shocks to each leg per treatment. Then he increased the battery to 75 pairs of discs and gradually increased the number of shocks to 800. In three weeks, the Countess was able to stand, and in two months able to walk.

The early batteries didn't last long and the amount of current quickly declined, so doctors couldn't use them for long without a sig-

nificant loss of voltage. John Daniell made the first good battery with a fairly constant current for a long period of time. His “gravity cell” made the telegraph a commercial possibility. The Grove battery was invented in 1839 and the Bunsen battery in 1842. The new batteries enabled doctors to use them for some time before they had to be replaced.

The idea of the battery spawned some interesting healing ideas. First to be patented were “magnetic tractors.” These were rods of dissimilar metals that were drawn over the skin. They were very popular for a time, but they did absolutely nothing.

In 1853, Dr. Victor Burq wrote *Metallotherapie*. He developed a system of therapeutics in nervous diseases based on the action of metals on the body. He applied different metals to mental patients and did have some results. Most doctors believed that the effects were due to imagination.

A woman had no feeling on one side of her body. Zinc, copper and gold applications proved worthless. When iron was applied for 20 minutes, there was a feeling of sensation again. The patient continued to progress until feeling was restored to her whole side.

In 1878, Burq tested a woman suffering from hysterical symptoms. All treatments failed, including surgery. The left leg was sensitive to gold and copper. The application of gold relieved the sensitivity, but when it was removed, the patient returned to her previous condition. When she was given subcutaneous injections of gold chloride, her symptoms subsided.

Another woman complained of eye problems with swollen eyelids. When copper was put on her body, the puffiness of her eyes went down. After 11 days, she was able to read for an hour. She felt she was cured after a month of treatment, but her trouble returned. This time copper alone didn’t work, but copper and zinc quickly relieved the eye problems.

Most doctors believed that Dr. Burq was simply deceiving himself. Jean-Martin Charcot was willing to study unpopular ideas. He found that the effects usually didn’t last more than a few hours, and patients showed no signs of permanent improvement.

In 1878, Herbert Tibbits founded the “West End Hospital for Diseases of the Nervous System.” He translated G.B. Duchenne’s 1856 book on medical electricity and added notes of his own. Then he began to make high-priced electropathic belts. They were lined with different buttons of metals with the idea of creating a tiny electric current when worn. His fellow doctors criticized him for promoting worthless healing devices. He sued his critics in 1893. The witnesses for the defense were numerous electrical engineers and even the president of the Royal Society, Lord Kelvin, testified. Tibbits lost badly, and his electrical healing career ended.

Cautery is a brief burn to areas of the body that need healing. It was very common to use a controlled burn especially with arthritis and gout. In 1850, John Marshall began to use “galvano-cautery.” This was the use of electricity to heat a wire or a piece of metal to burn the patient. His patient had a chronic fistula in the cheek, which resisted treatment for a year. Several operations had failed, so he decided to cauterize it. A platinum wire was passed through the opening. After nine seconds of heating, the fistula was essentially cured, although it took 11 days to heal together.

Archaeologists and historians have discovered at least two post-scripts to Volta’s battery. During the years of 1938 and 1939, Wilhelm König found a number of earthenware jars in Iraq. They were lined on the inside with copper cylinders. They had an iron rod extending through the lid. He thought they might be batteries and he described his find in *Neun Jahre Irak* (1940).

In 1946, Willard Gray made a duplicate of the 2,000-year-old batteries, filling the inside with copper sulfate instead of the unknown electrolyte which might have been vinegar or lemon juice. The battery worked. It might have been used for electroplating.

In India, an ancient manuscript 3,800 years old, known as the *Agastya Samhita*, describes putting a copper plate into an earthenware vessel. Next copper sulfate and moist sawdust are added. Then a zinc sheet with amalgamated mercury is put over it. The two metals produce “mitra-varuna.” This energy will split water into pranavayu and udanavayu. These are obviously oxygen and hydrogen.

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13. DIRECT CURRENT THERAPY

“Polarity is the secret of success. You must know your poles —their quality; what each one does. You will then see the indication for each in actual use. If you get this firmly founded in your understanding, if you remember to be doctors first, always, and never consent to be anything else. If you use your medical knowledge to show your patient’s need and then your knowledge of the galvanic current to supply that which is the indicated remedial measure, then I can promise you, from a long and successful demonstration in my own employment of it, that both you and your patient will be pleased. The proof of the pudding is in the eating. It is the END RESULT that counts.”

John U. Giesy 1933

Galvani touched the new world of electricity with his frogs, but failed to understand what he was doing. Volta understood what Galvani missed and drew on the model of the electric fish to create the first battery. Battery electricity is best known as “direct current.” When applied to medicine it is known as “galvanism.”

The *volt* became a unit of pressure created by a copper-zinc battery cell. The *ohm* became the measure of resistance, while the volume of electrical flow was the *ampere*. Voltage divided by resistance determines the amperage. The ampere was a large unit, and a thousandth of this, the *milliampere*, was the unit of therapeutic use.

The galvanists used several rules. Any rapid change of current made patients uncomfortable. If current were suddenly decreased to the ear, the patient would get dizzy. Overweight patients took more voltage to produce a reaction; thin patients took less. Unless electric shock was used, the current was always slowly increased at the beginning.

Every battery has two poles. The positive pole contracts blood vessels and reduces circulation. It inhibits bleeding and reduces inflammation. It produces an acid reaction that can destroy tissue when there is high current density. The negative pole increases blood flow and widens blood vessels. It sets up an alkaline tissue reaction and can destroy tissue by becoming too alkaline in high current density.

The galvanists used the positive pole to stop bleeding and shrink tumors. When they needed to widen something, they used the negative pole. The pole used was generally applied to a narrow area to focus the electric current. The other pole was called the dispersive electrode. It was generally a large pad applied to the back or abdomen. The treatments were usually less than 15 minutes to avoid tissue damage from direct current action.

In treating hemorrhoids, an electric doctor might insert a needle and then connect it to the positive pole. The hemorrhoid would begin to shrink, as the blood supply was reduced from the current.

In 1870, George Vivian Poore showed that a galvanic current passing through a fatigued muscle gave it relief from fatigue. Chronic fatigue was treated by putting a cathode (negative) over the forehead and the anode over the lower neck. The current begins at 2-3 milliamperes and is increased until it reaches 12-15 milliamperes at the end of the treatment. After several treatments, fatigued patients began to feel exhilarated. This was used to treat fatigued soldiers during WWI.

A busy doctor suffered from loss of physical and mental energy. The cathode was applied to the back of the neck and the anode to the front. Then the electrodes were reversed. He found great relief after the first sitting and had better sleep with progressive improvement.

In one form of migraine, the person had a cool face with dilated pupils. The anode was applied to the face and the cathode was held in the hand or attached to the neck. The current was gradually increased and then gradually diminished.

A railroad engineer dislocated his right elbow 20 years before. Then he developed numbness in the little finger, and the ulnar nerve was swollen at the elbow joint. The positive pole was placed on the swelling, while the negative pole was placed over the fingers. After 15 treatments, there was a great deal of improvement.

Russian doctors treated 45 cases of deficient gastric secretion with galvanism. A large cathode of 8 × 9 inches was placed on the back and an anode of 6 × 7 inches was put on the stomach. The anode increased the secretion; the cathode reduced it. The doctors claimed that pyloric spasm, pain, discomfort and flatulence disappeared. The treatment used 80-100 milliamperes over a 30-minute period.

Moritz Meyer put an anode of about 15 volts to the thoracic part of the spinal cord and the cathode to the prostatic part of the urethra. In about half a minute the face and surface of the body assume a death-like pallor from the contractions of all the small arteries. This was tried in a seven-year-old boy who had constant epileptic attacks. The parents consulted several famous doctors and even took the boy to Charles Brown-Sequard, but the epileptic attacks continued. After a few treatments the attacks stopped, and the doctor reversed the poles to increase the blood flow in the arteries.

A 40-year-old man suffered for three years with epileptic attacks with complete loss of consciousness and intense headaches. His intellect steadily gave way, and he had a hard time at work. He couldn't read at all during this time, it was impossible for him to express ideas, and his memory was gone. His brain was treated with galvanic current, without result. Then the sympathetic (the nerves in the lumbar and thoracic of the back) were galvanized, and after no trace of the disorder remained, the treatment ended. The patient recovered his mental functions after treatment.

A 60-year-old man had paralysis on the left side of the face and tongue. Galvanization of the brain produced only a slight improvement, but galvanization of the sympathetic was followed by a beneficial effect. After a few applications, the facial paralysis had considerably diminished. He was able to speak, dress himself and walk without crutches, although with some difficulty.

A woman suffered from headache, sleeplessness, indigestion, agonizing pain in the back and severe dysmenorrhea. Many noted gynecologists treated her without benefit. A few days before menstruation, she was galvanized in the splanchnic nerves, followed by an immediate beneficial effect. The headaches and pains in the back disappeared, and she was able to sleep through the night. Another galvanization of splanchnic nerve three days later resulted in painless menstruation. She previously spent days in bed; now she was able to work normally.

The first attempt to treat asthma was by Dr. Alexander Wilson Philip in 1817. He used about 8-16 volts and applied one metal plate to the back of the neck and the other to the epigastrium (abdominal area). He allowed the current to pass until the patient said that his breathing was easier. This might be up to 20 minutes.

The anode (positive) was applied to the vagus nerve on the neck in asthmatics, and the cathode was applied to the stomach or lower back. Mrs. C. was affected with severe asthma. Galvanization of the vagus 15 times completely cured her.

Mr. P. developed asthma when he was nine. Each year the asthma attacks increased in severity and frequency. The least cold or sexual intercourse was followed by an asthma attack. Galvanization of the vagus nerve was followed by a beneficial effect. After the first treatment, he didn't have a single attack during the remainder of the winter.

Mr. J suffered from severe asthma and was treated by many doctors. Then he had a severe attack, which lasted for two weeks. He wasn't able to sleep during the long attack. After the first application of galvanic currents, he slept comfortably for the night and his problem disappeared.

Mr. N. suffered from severe hay fever in August and spent whole days sneezing and dripping with tears. He had a fever at night and struggled for breath. After the current was used for a week, all his symptoms disappeared.

Dr. Charles Russ found that nearly all germs were carried towards the positive pole of an electric current. The weak current was usually lethal to the bacteria, and there was no need for zinc or copper ionization. His discovery was applied to wounded men during WWI.

A soldier had a perforated gunshot wound of the leg, which was badly infected. It looked like the leg would have to be amputated. The leg was put in a bath, and an electrode was connected with the positive pole. The negative pole was connected to an indifferent electrode made of salt-water soaked cotton on the back. The current was slowly turned up to a reading of 25 milliamperes. He was given daily half-hour treatments, and in five days there was healthy granulation of the wound.

A doctor in India experimentally treated rabies in mice by passing a direct current through them. He put the negative electrode on the forehead and the positive clip to the tail. After 15 minutes of passing 200 microamperes through the body, the virus was displaced from its cellular attachment and swept from the brain. This discovery has implications for treating viral infections.

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Additional material in one version:

Professor Rossbach believed that the anode soothed pain. He applied the anode to the severe sciatic pain he suffered and it helped, but he was surprised to find that the cathode was much more effective. In 1878, a gentleman suffered from pain around the right eye. He took quinine and injections of morphine without any benefit. After the first application of current to the eye, the pain disappeared.

A man suffered from pain on the right side of his face, which came in spells lasting about an hour several times a day. The anode was applied over the painful spots, and the cathode was applied to the neck. He had immediate relief without pain.

Edgar Cayce gave several psychic readings for people suffering from multiple sclerosis. He recommended the wet cell, which was a low voltage battery. He recommended that gold, silver or camphor be put into the battery. I believe that he picked up this procedure from the "universal mind." Some practitioner was successfully treating people in this way. I believe that these substances in the battery did nothing.

In effect, Cayce recommended low voltage positive current applied to four points on the back. These points were the 1-2 cervical vertebrae, the 1-2 dorsal vertebrae, the 9th dorsal and the 4th lumbar vertebrae. The negative electrode was applied over the area of the solar plexus and the navel. A weak current applied from the back to the front of the body stimulated the nerve centers. There are several cases in which desperate multiple sclerosis patients used the readings to heal themselves over a period of months.

14. ELECTROPUNCTURE

"Electropuncture is in my opinion the most proper method of treating rheumatism, nervous afflictions and attacks of gout, when the inflammatory symptoms that sometimes accompany them have been sufficiently subdued, which calls for a well-understood medical approach. One attacks the illness directly at its root; one changes the mode of being of the very nerves that make the pain felt. You force pain to disappear by the power of the electrical vibrations and administer shocks gradually and in reasonably intensity. In this operation, one is making use of an agent whose strength always surpasses that of the nervous activity, and overcomes it, no matter how tenacious it may be. One can always be sure of attaining the goal desired; namely of changing the defective mode of sensibility and the defective mode of action of the affected part."

Mémoires sur l'Electropuncture Jean-Baptiste Sarlandiere 1825

Acupuncture in China was developed thousands of years before the time of Christ. At first, sharp stones were pressed against body points to bleed the patient. Then the idea developed that the special bleeding points could be influenced by moxibustion, which is burning little cones of dry plant material.

Writers combined the mythology of the Yellow Emperor into a series of books. The *Nei Ching* describes the Yellow Emperor and 160 points used for moxibustion and acupuncture. As more doctors adopted acupuncture, more points were added.

When the Dutch began trading with Japan and China, they brought the art back to Europe. The first medical writer to discuss acupuncture in Europe was Wilhelm ten Rhyne in 1683. Louis Berlitz revived it in 1816 for the relief of pain. In 1821, James Morss Churchill wrote a tract on it, which created considerable interest.

The mysterious points were believed to be channels for the chi, which was the life energy. By needling the points, you were regulating the energy flow. After President Richard Nixon's visit to China, there was a great deal of interest in acupuncture. Dr. Felix Mann used acupuncture anesthesia in 100 cases and found it worked well in about 10% of the patients. There was some analgesia in 65% and no help in the remaining 25%. He had tried acupuncture anesthesia on himself, but it failed on all three occasions, so he had to use regular anesthesia.

Dr. Robert Becker received a grant to study acupuncture after Nixon's visit. His group of researchers found that the acupuncture

points were surrounded by electric fields. He believed that the lines marked by acupuncture points might be the body's natural electrical system. They carried messages to the brain, which changed the amount of current necessary to stimulate healing in the troubled area. The poking of metal needles might be a way of regulating the body's natural electrical current lines. Just when he began making progress towards this end, his grants were cut off. The National Institutes of Health told him that acupuncture was no longer of interest.

There is a theory that blood is a fixed electrical reference point and tissues are fluctuating positively or negatively in relation to the blood. Water moves towards areas of negativity and moves away from positive potentials. The idea here is that acupuncture readjusts the electrical currents towards normal through needle conduction. A puncture made by a hypodermic needle instantly reduces the body's resistance from a level as high as a million ohms to nearly zero. When the doctor gives you a "shot," perhaps the acupuncture effect is doing more good than the medication.

There is another theory that the benefits of acupuncture are due to releasing morphine-like substances, which reduce the pain. An electrical stimulus increases the pain threshold by two to three times. In 1844, Edmond Hermel employed electroacupuncture for the treatment of sciatic and lower back pain. He used two needles and put the positive needle over the site of pain.

The pain clinic at the Osaka Medical College treated 30 patients for pain who hadn't had help from nerve block or acupuncture. They were able to obtain 42% long-term pain relief. They found that a current produced by 12 volts was the most effective for pain relief.

The electrical current may also increase the activity of the cells. An experiment was done using needles placed 4 mm. below the skin of rats. Using four pulses of direct current per second at 0.75 volts, the liver microsomal activity increased greatly.

When a direct current passes into the body, it forms alkaline ions at the positive pole and acids at the negative pole. If the current is too intense, the body can be damaged at the electrodes. In 1800, William Nicholson and Anthony Carlisle were the first people to do electrolysis of water. This liberated hydrogen at the negative pole and oxygen

at the positive pole. Sir Humphrey Davy used this reaction to produce sodium and potassium in 1807.

Louis Berlitz was the first to write about electricity in acupuncture, in 1816. He used needles made of different metals to produce an electric current without the need for a battery. He found that this heightened the effect of the acupuncture.

The first person to write about the idea of “electrolysis treatment” was Gustav Crussel (1810–1858). He submitted a number of papers to the French Academy of Science beginning in 1841. Since electrolysis decomposed water, he felt that he could use it to decompose undesirable tissue. He later abandoned the treatment in favor of galvanocautery. A resistance wire was put into the tissue and a current passed. Heat destroyed the unwanted tissue.

Dr. William B. Neftel of New York was the first person to treat cancer with electropuncture. His patient healed slowly after an operation, but then another growth the size of a fist developed. He didn’t want another operation, so in 1856, Neftel put a positive needle into the tumor and several negative needles at a distance from the tumor. He began by applying electricity for two minutes from ten cells. He increased this daily until it was ten minutes at 30 cells. The tumor increased after the first treatment; then it began to shrink. The patient had been very feeble, but became stronger day by day. In three months, there was no sign of the tumor. The patient died three days later of a different cause.

Dr. Julius Althaus carried out the first systematic work on the therapeutic possibilities of acupuncture electrolysis in 1867. He inserted needles connected to the terminals of a battery. The negative electrode formed alkaline materials and released bubbles of hydrogen. His first experiment on electrolysis was to destroy a pea-sized naevus of the eyelid in 1866. The lady was so nervous that she was put under chloroform. A needle was inserted into the right half of the growth and connected to the negative pole of a ten-volt battery. The positive pole was connected to a moistened electrode applied to the skin of the neck. The current was passed for two minutes, then the needle was withdrawn. It was repeated with the left half of the tumor and the result was satisfactory. He treated other growths this way, too.

Althaus treated a woman with cancer of the breast. It was surgically removed, but five weeks later, a new growth formed and many

smaller nodules sprang up. She steadily got worse until she was thin, weak and in great pain. He inserted a cathode needle into the cancerous nodules on the right side of the chest and placed the anode on the left shoulder. The current was gradually raised for ten minutes. The woman was relieved of her pain and the cancerous nodules disappeared. She looked well, but she got pneumonia after a winter cold spell and died.

Althaus treated a man with a growth on the left side of his neck. The man had lost his voice and couldn't swallow. After the needles were inserted in a growth and attached to a 15-volt battery his pulse went down and he was able to eat. The tumor nearly disappeared in a month.

Bjorn Nordenstrom developed an electrochemical theory of cancer. He used electropuncture to alter the ionic composition of fluids around the cancer. He treated a group of 26 lung cancers that had been rejected for surgery and didn't respond to chemotherapy. He put two platinum needles under local anesthesia through the chest wall. One electrode was put into the cancer and used as the anode. The other was placed two to three neoplasm diameters from the anode. Then he applied 5 to 20 volts to the electrodes for one to two hours. Usually one treatment was enough to destroy the cancer.

A woman had a large malignant lump in her left breast. She refused both surgical and nonsurgical treatments and asked for electropuncture. A platinum needle was inserted into the growth and connected to the anode while the other needle was placed 10 centimeters away and connected to the cathode. Ten volts were applied resulting in a 15 ma. current. This was gradually increased over a two-hour period. Two days later the tumor was shrinking, and then it disappeared. She had regular medical checks every six months, and there were no signs of the cancer.

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15. ELECTRICITY IN GYNECOLOGY

"Electricity in any form, when applied to the cure of disease, is set down as pure quackery by many medical men, simply because they know nothing about it, and won't take the trouble to learn for themselves what, to many, is a hard study. My confidence in its powers and in its capabilities in relieving the disturbing symptoms of uterine fibroids, as well as in curing many chronic inflammatory conditions in the pelvis, continues to increase. I venture to predict that the gynecological bag, as at present filled, will have soon to be reconstructed and that most of its present contents will be thrown out. I have no fear for the future of electricity."

Thomas Keith 1889

"Electricity is a powerful constitutional tonic according to the method of its application and can be used as a sedative or a stimulus to the nervous system. It is therefore beneficial in cases of nervous exhaustion. It is also used very largely in the dispersion of tumors in diseases of women and is especially valuable because we can bring the central nervous system under its influence."

New York Times 1892

The era of electrical gynecology began in 1755, when Anton de Haën began treating amenorrhea (lack of menstruation) with electricity. In 1764, Christianus Ludovicus Alberti published *De Vi Electrica in Amenorrhœam*. Only static electricity was available at this time.

In 1837, Thomas Addison published a study of treatment with electricity of women's problems. The patient was placed on an insulated chair and connected to a static generator. A grounded brass ball was passed about an inch over the spine at a distance of about an inch for five to ten minutes, which resulted in a red eruption. The treatment was used for all forms of uterine disease.

Uterine fibroids and irritation of the uterus known as salpingitis have long been known to cause problems for many women. The cause of these conditions is not known. The areas are subjected to alternating waves of estrogen, which proliferates the tissue, and progesterone, which maintains the pregnancy. Uterine tissue reacts with small growths, which result in a painful condition. When the condition is relatively severe, it is usually treated by hysterectomy, which involves surgically removing the uterus.

The first application of electrotherapy to gynecology occurred in 1859 when Auguste Tripier used faradic current to treat lesions of the uterus. He did not have great success, but there was no satisfactory medical treatment at the time.

In 1889, Willis E. Ford experimented on electrical treatment for uterine fibroids. He put electrodes into eggs. He found that the albumin coagulated around each electrode with fine filaments extending between them. Homeopathic physicians closely followed his experiments, because they did not believe in surgical operations.

George Apostoli got interested and he began to experiment in alternating current, faradism, intrauterine direct current and "galvanopuncture." This is acupuncture with a needle in the inflamed area and a dispersive electrode.

Fibroids, uterine irritation or childbirth may cause unstoppable bleeding. A 40-year-old mother had severe uterine bleeding. Her husband used tampons soaked in vinegar, but the bleeding wouldn't stop. The woman was taken to the nearest hospital in an ambulance. Positive current was applied at a level of 2 milliamperes for an hour. A large negative electrode was applied to the abdomen. After an hour, the bleeding stopped and fresh tampons were inserted. By the third electrical treatment, the bleeding was entirely stopped. She begged to go home for Christmas with the family and was released from the hospital.

A woman suffered from backache and bleeding for seven years. A fibroid the size of an orange was causing the problem. Positive current was applied to the cervix at a level of 5 milliamperes for 30 minutes three times a week. A dispersing electrode was placed on the abdomen. After the second treatment the hemorrhage ceased and the backache was gone. Eight months later the patient remained free of backache and bleeding.

George Apostoli used a carbon electrode in the uterus and a negative belly pad of potter's clay. He claimed that he always arrested hemorrhages after one to three treatments. He would put a needle into the area above the fibroid and apply positive current. He used large dispersive electrodes made of clay on the abdomen or back. This enabled him to pass a fairly high current level into the fibroid. He

began the treatments at 20-40 milliamperes and then increased this to 100-150 millamperes if the person could stand it. The treatments were normally given twice a week.

Apostoli believed that hysterectomy was morally wrong and an incurable sexual mutilation. He expressed himself so strongly that a flood of women flocked to take his treatment. He remarked that surgeons know only how to do hysterectomies for fibroids, and this is what they would recommend. His treatment was slow and required patience. During this period of time, every fifth woman died from this surgery, for there were no antibiotics or good sanitation.

A 34-year-old woman came to Apostoli's clinic. She had long periods every two to three months. Menstruation was marked with severe pain and vomiting. She spent days in bed, often crying involuntarily. He treated her with a negative intrauterine electrode with a large dispersive pad. She was able to take 100 ma. of current for five minutes. The condition could still be felt under deep touch, but her painful menstruation was gone.

A woman suffered from endometriosis. She was given negative galvanopuncture for five minutes at a treatment. After six treatments, the pain was almost entirely gone. Instead of a hysterectomy, she had three more children.

Franklin Henry Martin wrote the story of his life in *Fifty Years of Medicine and Surgery*. He once attended a meeting of the Chicago Medical Society in which George Apostoli demonstrated his work on uterine fibroids. Most of the doctors there were complete skeptics, but Martin got the equipment and tried it out on a woman. She had great relief of discomfort to his surprise. After treating several patients, he wrote: "One of the most astounding features of this treatment in the case of an old fibroid, was the almost invariable immediate relief from pressure and so-called neuralgic pain, nervousness and distress."

A 34-year-old woman had PMS, which made working difficult, and she had severe vomiting. She was treated with six negative puncture treatments at a depth of one centimeter. This rapidly reduced pain, and a year later all symptoms disappeared.

Painful menstruation was treated by putting a negative electrode in the uterus with a 12-inch dispersive pad on the lower abdomen as the positive pole. There was usually marked relief from pain in three to four treatments and long-term relief from pain. This was used as a treatment for sterility. One woman had been married for five years and was anxious to have a family. She was given four treatments and conceived two months later.

A woman suffered from irregular menstruation. When menstruation stopped, she became depressed and suffered severe headaches. Negative galvanism was applied to the vagina and the positive pole was placed over the lumbar spine. This brought the cycle back to normal. This therapy was also used to treat dysmenorrhea.

A 22-year-old woman had a swollen right breast that was a deep purple color. Several doctors advised a mastectomy. Negative galvanism was applied to the entire surface of the affected breast with a salt-water pad with iodine. A large indifferent pad was applied to the abdomen. Three treatments a week with 10-15 ma. of currents were applied for 30 minutes a day. The breast softened and in five weeks, became a normal color with several small nodules. Dr. Massey felt that this treatment could distinguish benign from malignant nodules in the breast.

A woman suffered a severe blow to the right breast. Two months later, it had a small lump, which became as large as an orange; she had severe pain in the breast after arm movement. An anode was moistened with 10-15 drops of iodine and applied to the breast over the tumor, and the cathode was put over the opposite side of the breast. A current of 15-20 ma. was applied for five minutes. The treatments were given twice a month until the tumor was reduced to half its size.

A 43-year-old woman had a tumor about the size of a hen's egg causing her darting pains. The current could not be stronger than 10-15 ma. without causing her too much discomfort. It didn't completely remove the tumor, but the pain disappeared, and a soft swelling remained. Another swelling began in the right breast, but the same treatment caused her relief and its disappearance.

It is now known that free iodine has a strong effect on breast cancer when taken internally. It seems probable that this could be a

valuable treatment of breast cancer, but no further studies were done.

Electrical treatment was found to relieve vomiting during pregnancy. A large cathode was placed on the stomach area. Two smaller anodes were applied to the vagus nerve on each side of the neck. Henri Bordier applied up to 15 ma. of current. Any time there was a sign of vomiting, the current was turned on. It was only applied for a few seconds and then gradually reduced to zero.

A 22-year-old woman had long suffered from urinary incontinence, and all measures proved useless. The patient was greatly inconvenienced by the affliction during the day. A short wire electrode was put into the entrance of her urethra and connected to the cathode. A sponge electrode was connected to the anode and put over the area. After the eighth treatment the patient was completely cured.

Dr. Francis Katona of Budapest, devised a urination reflex stimulator. This was a special catheter with a silver tip connected with wires to a special direct current stimulator. The repeated stimulation through this catheter for 90 minutes a day is said to have developed normal micturition reflex. This method requires no surgery and appears to have no complications.

Dr. Henri Bordier used this method of treating urinary incontinence. He used a short sound [sic] to touch the urinary sphincter muscle. A series of weak shocks were applied for five minutes a day. He continued treatment until the patient was cured, which normally wasn't very long.

The era of electric gynecology ended just as quickly as it had begun. In 1897, Dr. Hiram Vineberg tabulated the literature of 372 cases of fibroids. He found that only nine were completely cured. Five deaths occurred during from the treatment, but 242 women were cured or much improved. This started a real debate on the efficacy of the treatment.

At the 1898 meeting of the American Gynecological Society, the delegates argued the question: "Has electricity ceased to be a useful therapeutic agent in gynecology?" Egbert H. Grandin testified that he abandoned this method of treatment after a decade of exploring it. Another doctor testified that after keeping careful records for years, and reviewing them, he was convinced that he was wasting his time.

Another electrotherapist offered his equipment to anyone who promised him "not to use it on a human being." These people had been greatly discouraged by the long period of treatment and the frequent failures. They used clumsy electrical equipment, because electricity had not yet been wired to homes and hospitals. By 1900, surgery was considered to be the only way of dealing with uterine fibroids. Despite the abandonment of nearly a century of work, several of the techniques may prove to be of interest to doctors of the future.

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Additional material in one version:

George Apostoli knew that the positive pole shrank the tissue and stopped bleeding.

A 36-year-old woman suffered from a prolapsed uterus and could scarcely walk more than a few steps. A current was applied to the lumbar region and the solar plexus. She was now able to stand steadily with her eyes closed. Her uterus returned to its normal position.

16. ELECTRICITY AND MENTAL CONDITIONS

"It is a great recommendation of the study of electricity, that it now appears to be, by no means, a small object. The electric fluid is no local or occasional agent in the theater of the world. Late discoveries show that its presence and effects are everywhere and that it acts as a principal part in the grandest and most interesting scenes of nature. It is not, like magnetism, confined to one kind of body, but everything we know is a conductor or non-conductor of electricity. There are properties as essential and important as any they are possessed of, and can hardly fail to show themselves wherever the bodies are concerned."

History and Present State of Electricity Joseph Priestly 1767

Arthur E. Baines was a submarine cable engineer. He used sensitive galvanometers to measure the signals from the long cables. While testing, he found that the electricity of his own body threw off the readings. He found that his fellow workers changed the readings. He began testing his friends and found variations, which he linked to health and energy.

He used the galvanometer to study plants and found that they have a negative and positive end. He believed that the waxy bloom on peaches and apples was part of the dielectric insulation of the plant to alter the current flow. He felt that cholesterol was part of the dielectric system of the body. He found that wounds would heal rapidly when coated with wax to alter their electrical properties.

Using a sensitive galvanometer, he began to measure the deflection between the index fingers of the right and left hands. A normal healthy person had a deflection of 1.5 microamperes. He reasoned that people with lower electrical deflection were often unhealthy. He attributed the lower voltage difference to a lack of nerve energy. Country air, moderate exercise and good food increased the electrical deflection. He found a big change in electrical deflection when people were near power lines.

He found that he could greatly increase the electrical deflection by holding a hardened carbon rod in the right hand or by holding a magnet in the left hand. Baines traveled in Egypt and noted a number

of statues of the Pharaoh holding a short rod in the right hand. He believed that they were increasing their electrical deflection and thus their personal power.

Baines and his medical friends tried treating people by having them hold hard carbon rods in their right hands. The galvanometer quickly went off scale. He found that nerve deafness, severe fatigue and many cases of paralysis were due to inadequate body electricity. One case of paralysis recovered after 13 years by this simple technique.

I doubt that the magnet or the carbon rod had anything to do with the treatment. Rather, a weak electrical current was being passed from one side of the body to the other. The experiment should be redone and perhaps could indicate a major help for problems that are now difficult to treat.

A number of early attempts were made to treat mental states with electrical currents. Dr. Julius Althaus (1833–1900) believed that electrical currents would retard old age and improve the mental state. He wrote a number of books on electrical treatment around 1860. He once treated a judge for facial paralysis, but the man kept coming back for more treatments because they made him feel so much better. “I feel lighter; my ideas are more clear. I can concentrate my attention much better, and I can better resist the somniferous effect of lawsuits. I can retain more easily the arguments to compare and weigh them up. In short, my intelligence is more acute, and work is easier.”

A 26-year-old woman was insane, and many remedies were tried on her without success. A positive electrode was applied to her head, and the negative electrode was applied to her feet. The treatment gave her a headache, but she became more rational and was able to do needlework. A study on 11 patients claimed cures for three, benefits for another three, with five receiving no help.

Dr. Alford Newth began to treat the mentally ill with electricity at the Sussex Asylum. He put their hands and feet in a basin of water with a little acid for conductivity. Electrodes were applied to the top of the head or the top of the spine. He found that nine of the 15 cases he treated benefited.

A woman suffered from depression with a propensity to commit suicide. She was electrified 26 times with the positive pole applied to the head and the negative to her feet. After treatment the woman appeared to be much brighter, conversed rationally and was now able to do needlework. She was discharged as cured.

In 1884, Christian Engelksjon reported on the case of a 50-year-old man suffering from depression for three months. He had a single treatment of faradic current applied through electrodes to his head, when he smiled and said: "Now it is gone." He was depressed the next morning, but another treatment relieved him. After a third treatment he returned to work.

In 1887, Joseph Wigglesworth treated 11 women in the Rainhill Asylum with electricity. He claimed to cure three and improve three. A 23-year-old woman suffered from dementia. The cathode was applied to her forehead and the anode to the nape of her neck during 60 treatments over a three-month period. The current began at 3 ma. and increased to 25 ma. as the patient slowly got better.

Static electricity was tried on the insane, especially after the powerful Holtz machine was introduced in 1865. Robert Chase treated a woman suffering from incurable melancholia. She was so timid and nervous that he had to use the static breeze at a distance for 20 minutes. She slowly improved, and her depression left.

Another woman was confined to a hospital bed after suffering from delusional melancholia. She was treated with static sparks over the stomach, liver and abdomen three times a week. She complained a lot, but her weight began to increase as she was able to take solid food. After six weeks, she was discharged as near normal.

Depression is one of the major problems of modern society, although we cannot say that there is more depression now than in previous centuries. In early centuries the problem was called *melancholy*. The doctors of the 19th century wrote articles and books on "neurasthenia," and many people claimed to be suffering from it. This catch-all word was not only depression, but also bad nutrition and the lack of opportunity that prevailed at the time. In modern society, we have increased demands in the workplace, little job security, insecurity in marriage, and our lives are so filled with tasks that we can't get ourselves centered.

Physiologists experimented with passing a weak current over the forehead and then studying the apparent brightness of a light while current was being passed. The subjects being tested noticed something else. When the electrodes over the eyebrows were positive with respect to the legs, there was an increase in alertness, an elevation of mood and sometimes a tendency to giggle. If the electrodes over the eyebrows were negative, the subjects became silent and withdrawn.

The physiologists recruited 32 volunteers to see if observers could figure out if positive or negative current was being applied over the eyebrows. The observers were able to score this correctly in 26 cases. These remarkable findings resulted in a study of 29 patients with long-standing cases of depression. The current improved 13 and gave 11 temporary improvement. Most patients had some relief of depression while the current was passing. The treatment involved a current of 150-300 microamperes for four to six hours a day. They could not feel the feeble current. Most patients had a reduction in depression that lasted for hours or days.

A 54-year-old woman had to nurse her mother-in-law during a terminal illness. It affected the woman, who developed ulcers, lethargy and severe depression. She was given 50 microamperes on each side of her head for ten hours. By bedtime, she felt relieved; the improvement lasted two or three days. The electrical treatment was given twice a week, steadily improving her mental health. When it was discontinued for two weeks, she lapsed back into depression.

A 49-year-old woman had nine years of continuous depression resulting in five admissions to the hospital. She would talk in whispers and continually wring a handkerchief. After two and a half hours of weak current, she felt lighter and more relaxed. When the current was turned off, she felt weak and tired. After another treatment, she felt nearly normal.

A woman suffered from depression and claustrophobia, necessitating many periods off work and frequent changes of occupation. Shock treatment and drugs failed to help her. She couldn't get a job and felt very depressed. After a six-hour treatment of 40 microamps above each eyebrow, she began to feel better. She took two treatments a week, in which the current was increased to 200 microamperes on each side of the eyebrows. Soon she no longer needed treatment and was able to hold a regular job.

If the positive electrode produces an elevated mood above the eyebrows, then could a negative electrode in the same place calm down those who needed it? This was studied in four persons with manic states. They were given 250 microampere currents for two to three hours. After ten days of treatment, three patients had their excited behavior and elevated mood restored to controllable levels.

A 55-year-old housewife began exhibiting aggressive behavior. She took off her clothes on the street and wept bitterly, and therefore she was admitted to the hospital. Shock treatment and drugs gave her little help. A treatment with negative current brought her mood to normal, but she relapsed after stopping the treatment.

The demon theory of mental illness passed away with the coming of the medical revolution of the 19th century. According to the theory, people hearing voices in their heads and people with multiple personalities had valid reason for believing that they were possessed by demons. The Bible said that true believers could cast out the voices. The theory faded after priests and preachers failed in their attempts to exorcise the “bad spirits.”

Reverend Joseph Priestley, the leader of a Presbyterian Church in Leeds, England, in 1770, experimented with electricity. It was rumored that he could perform miracles. A woman who believed that an evil spirit possessed her came to him and begged for help. He didn't want to treat her, but he finally sat her on an insulated stool and charged her with static electricity. He ended the session by giving her a good shock. The woman explained: “There, the devil's gone. I saw him go off in that blue flame, and he gave me such a jerk as he went.”

Carl Wickland (1861–1945) used electricity to drive out demons. He and his wife—a spirit medium—worked together. The patient would sit on an insulated chair next to a large static generator. The demon or spirit would be frightened by the static shock and enter his wife's body, where it would converse with him. He would then try convincing the bad spirit to leave the patient.

The scene went something this: After the initial shower of sparks, the controlling spirit stamped furiously and spoke angrily in an excited childish voice. “No, no! I do not like you. You have so much

fire. I am afraid of that fire.” So, the patient became free of the voices within, thanks to electricity!

Electricity has been used to treat addiction and mental conditions. If you really want to quit something, but you just can't break the cycle, you can treat yourself, but it is best to have professional help. An apparatus can be made from a nine-volt battery stepped up to produce a 70-volt AC shock. The first treatment is done with professional help.

A schoolteacher smoked for 20 years, and just couldn't quit despite encouragement and help from her doctors. In consultation, she was given a shock as soon as she inhaled. The treatment continued this way for two weeks. She was able to quit and had no problems resisting the temptation to smoke.

A teacher kept having negative thoughts about his wife's character. These thoughts happened after a joking remark, but there was no reason for him to be suspicious. In treatment he was asked to imagine the remark, and then give himself a shock. After ten days of imagining it and shocking himself, the negative thoughts vanished from his mind.

A graduate student was troubled with strange sexual fantasies, which disturbed him. He was told to imagine them and signal by hand when he had a clear image in his mind. When he did so, a shock was administered. He found it more and more difficult to conjure up the fantasy. By the tenth treatment, he reported that he had no more interest in fetish and masochistic practices.

Researchers have been experimenting with cranial electrostimulation. The CES units are very similar to electrosleep units. They are set at 100 hertz with a pulse width of two milliseconds. The electrodes are placed just below the ears and a pulse is applied for 40 minutes a day for several weeks.

The initial results are very promising. In certain head injury accidents and alcoholism cases, memory and reasoning are gone, and there is no good way to restore them. The people in the test lost their ability to learn new associations and were confused and bewildered. The pulsed current gradually increased their memory and ability to function.

The violet ray was often used to treat fatigue and depression, usually by passing it over the spinal cord. It was also used to give short stimulating sparks by passing it over clothing. The sparks strongly stimulated the nervous system and raised the blood pressure.

A testimonial of the Marvel Violet Ray Company read: "I am glad to inform you that I got a Super Marvel Violet Ray and it has done me more good than weeks and weeks of taking medicine. I had a nervous breakdown, and it seemed I could not get my strength. At one time a nervous weakness came over me, including stomach trouble. I was in the home of a friend, and she gave me a treatment with the violet ray, and I felt such a change that I went and got one for myself."

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17. ELECTRICAL MUSCLES

"It must be conceded that we are passing into the dawn of a day of physical methods in medicine. Not only does the physician of 1904 give fewer and less drugs than his brother of 1804, but the patient is, I believe, less inclined than formerly to take large and frequent doses of physic. Whether or not this is altogether as it should be, will probably be better known to the practitioner of 2004. Being neither an electrician nor an electrotherapist, still as a dermatologist I have found myself drawn into the employment of a variety of physical methods during the past few years, several of which have to do largely with electrical currents."

Charles W. Allen, M.D. 1904

Static machines were used for the first electrical treatments of the muscles. The first reports of dramatic cures in paralysis aroused a great deal of interest. Most people had no benefit from the static currents and shocks then used.

In 1762, Sir William Watson reported on a seven-year-old girl with tetanus. Her jaw was locked and muscles rigid. Her right wrist and hand remained pliant and the muscles controlling speech were unaffected. She could only be fed through a gap created by the extraction of two teeth. No treatments worked, so Watson decided to try electricity. At first it didn't seem to work, but he continued. After six weeks, she was back to normal.

Guillaume-Benjamin-Amand Duchenne began practicing electrotherapy and found that the faradic current was better than direct current for testing muscles. Every morning he went around the Paris hospitals looking at cases which interested him and performing electrical tests on them. Duchenne was the first to stimulate individual muscles for general diagnosis. He wrote a book in 1855 about his muscle tests: *De l'électrisation localisée*.

In 1857, Hugo von Ziemssen carefully mapped out the entire surface of the body showing the location of the motor points. He marked these with silver nitrate and proved by dissection immediately after death that his clinical charts corresponded with the entrance of the nerves into the muscles. He published anatomical charts showing where to stimulate the motor points, and the facial expressions resulting from the stimulation of the individual facial muscles.

Hugo von Ziemssen found that these points vary slightly between people and that they are the junctions between the nerves and the muscles. When an interrupted galvanic current is applied to a point on the body, there will be a minimum voltage where the muscle contracts. This is called the "cathode closure contraction." If the polarity of the electrodes is reversed, a higher voltage at the anode is required to contract the muscles.

Faradic current is a pulsed uneven alternating current. It produces a mild prickly sensation when the stimulation is of fairly short duration. If the muscle reacts to a pulse of faradic current, the motor neurones are intact. When the pulses are repeated more than 20 times per second, there was no time for muscle relaxation and the contractions became tetanic. When the current is interrupted, the muscle contractions begin and end suddenly.

The negative pole of electrical current produces muscle contractions most easily. Sine wave current produces a marked prickling stimulation, because the stimuli are of longer duration. The marked stimulation produces vasodilation and the skull reddens with the increased flow of blood to the tissues. The sine waves are not as comfortable as the faradic currents.

Muscle contractions increase the demand for oxygen and food. This dilates the capillaries, and there is an increased blood supply to the muscle. As the muscles contract and relax they exert a pumping action on the veins and lymphatic vessels.

The French doctor Henry Bordier was the first to try using electrical currents to develop the muscles. He used a metronome to interrupt a direct current. The pulsed current was applied to the arm muscles for one second and then interrupted for one second. The treatments were done for six minutes three times a week at an intensity of 10-15 ma. After two months, the circumference of the upper arm rose from 26.5 cm. to 29.2 cm. The muscles of the entire arm increased by about 2 cm., and the subject was much stronger.

These experiments were redone in the 1980's by sports trainers eager to increase muscular strength. The Russians used a pulsed 2500-hertz current for athletic training. Russian sources reported a muscle strength gain of 20-40% after 20 days of maximal muscle constrict-

tion. The muscle has to be overloaded to obtain an optimal increase in strength.

In 1872, Dr. George Vivian Poore treated a man who had a severe case of writer's cramp and spasms of his right arm. The patient was a writing clerk in the days before the typewriter, and because his handwriting was so good, he had long hours of work. His handwriting suddenly began to degenerate and in a few days he couldn't use his right hand. He was able to do some writing with his left hand; then it degenerated. He had to quit work and live on his savings, which were nearly gone. He had taken five different medical treatments without results. Dr. Poore tried strychnine, and then potassium bromide, which helped his sleep, but didn't improve his hand. Then Dr. Poore got a battery of 23 cells and attached them to salt water sponges on either side of the deltoid muscle. He counted "one, two," like a drill sergeant, and the spasms subsided. All of the muscles of the arm were exercised in the same way.

The next day the man noted that his arm had very few spasms; within two days he was able to use the arm for dressing himself. Every day the muscles were exercised with the direct current, and there was marked improvement. When Dr. Poore started, the patient's handwritten name was an unreadable blur. In a week it appeared more legible. In six weeks it had returned to a beautiful handwriting again.

Dr. Poore gave a friend a pound weight and had him stretch his right hand out straight and hold the weight until he could no longer hold it out. After about four minutes, the man had muscle pain and had to lower the weight. Then Dr. Poore put a positive pole in the axilla [armpit] and a negative pole further down the arm. The patient remarked "All the fatigue is gone, and I feel as strong as when I began." Other friends had the same reaction; when the current was flowing, muscle fatigue was apparently gone.

Most people could hold the weight at right angles to the body for about three minutes. A strong friend was able to manage six minutes with great effort. The next day Dr. Poore had him hold the weight out and passed the current for the whole time. The friend was able to last more than 13 minutes.

Dr. Poore had friends squeeze a dynamometer eight times, resulting in a combined effort of 388 pounds. When a current was applied through the muscles, the next eight squeezes registered 477 pounds. The next day he reversed the sequence. Six squeezes with a current yielded 431 pounds of effort, and the next six squeezes without current yielded 279 pounds. He tried alternating the squeezes with and without current. A normal squeeze was about 60 pounds and a squeeze with current flowing was about 80 pounds.

Physical therapists used electrical stimulation to increase local blood flow. Increased blood flow would aid athletes and it could help injuries heal, and restore the area. The theory was evaluated in 12 healthy subjects who received pulses of the maximum tolerable voltage that they could stand for ten minutes. Their blood flow was measured and graphed in relation to the duration and voltage of the pulses. The study found that a voltage lower than the maximum and 32 or 128 pulses [sic] per second had the best effect on increasing blood flow. A negative polarity had the greatest effect, but broader evaluation was needed to establish the clinical effect.

Before polio vaccination, thousands of people found themselves paralyzed every summer. They often thought they were coming down with flu. When they woke up the next day, they found they could no longer walk or use their arms. The polio virus is carried by flies and is still around, although most children are now immune.

Dr. Poore treated an 11-year-old girl whose left leg was powerless. He attached the positive pole to her spine and used a wet sponge electrode over the entire surface of the leg as the negative pole. It took four months of treatment before the muscles began to react. With a little more treatment, the girl was able to walk without problems.

Jean Bergonié found that successful paralysis treatment depended on the degree of stimulation. He treated a child with a paralyzed arm with a pad electrode at the shoulder level. The arm jerked, but the child played and slept during the treatment. He used a faradic current varying from 24 to 36 volts interrupted and reversed 40 times a second. The first treatments were for 30 minutes and then were increased to 90 minutes. He believed that the most serious case of polio paralysis could be cured if the electrical treatment was intensive.

Stephane Leduc used intermittent currents to treat muscle paralysis. His direct current pulses caused 12 muscular contractions a minute for about five minutes. The treatment was given twice a day.

Franz Nagelschmidt used surged sinusoidal current. In one instance, a brother and sister were taken ill with polio. The boy died; the girl had paralysis of the legs and back. After a few months of electrical stimulation, she was able to walk without limping, and dance.

A 21-year-old man suffered from polio at the age of 19. His legs gave him no support, and he could only walk on crutches. With the surged sinusoidal current, he gradually improved over a two-year period so that he could walk without crutches.

Paul Oudin used the violet ray to treat atrophied muscles. He used sparks to make the muscles contract. When it was used for treatment this way, it was passed over clothing instead of skin, so the distance produced a spark.

Oudin treated a 30-year old engineer with muscle atrophy of the Charcot Marie type. Walking was difficult and the use of his hands was nearly impossible. After every treatment, walking was easier for him. After six weeks of treatment, his walking became near normal, and he was able to resume his occupation. Then his hands became relatively paralyzed, and he couldn't extend his fingers. After five treatments, his fingers could be extended.

A 19-year-old woman suffered from Duchenne paralysis, and her arms, hands and fingers were nearly useless. After five weeks of treatment, she was able to put her hands on her head. The strength returned to her arms day by day. When her father had to leave Paris, the treatment stopped, so it was not known if the improvement lasted.

A medical student suffered from a locked left knee and the upper leg muscles atrophied. He was hardly able to walk, and he couldn't walk upstairs. After a month of treatment, he was able to resume medical studies, and after two months, he was nearly back to normal.

Athletes are constantly trying to get the winner's edge. Doctors tested TENS electrical stimulation on 21 well-trained competitive athletes. The stimulation of muscles was done 30 to 45 minutes before competitive exercise. When athletes were subjected to an increased workload on a bicycle ergometer, it increased the maximum capacity by 9%.

A long-distance woman runner was tested ten times over four weeks. Five tests were made following electrical stimulation and five with placebo stimulation. The woman gained a mean time of 5.5 seconds. Two runners had a reduction of 2 seconds in 800-meter races. Competitive swimmers shaved nearly a second off their times. Electricity may be the athlete's best friend!

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18. ELECTRICAL BONE HEALING

“It is useless to argue whether electricity is harmful or useful, for it is both since these are attributes which are not mutually exclusive. Every therapeutic agent will be harmful if used improperly. What physician would refuse to use vomitives or purgatives because some ill-advised physicians have take the heart or even the lives of patients by their use? Let us assume that my prophecy comes true, that we shall be able to administer electricity with such strength that it will break an arm or leg. The break would result only from an overdose of electricity, but this would not exclude the use of small amounts of electricity for medicinal ends. I have said for the first time in the present work that eventually we shall be able to attack diseases by electrification.”

Thoughts About Electricity Johann Gottlob Krüger

When a bone is broken, we immobilize it for several months and expect the arm or leg to be as good as new. On many occasions, the bone simply refuses to heal, and the person can be crippled for years. Often it is a problem of advanced age, where the body has lost its regenerative capacity. This is a major medical problem; it is estimated that nearly 100,000 fractures a year fall into that category.

Bone is about as strong as cast iron in resisting compression. Bone is the mineral apatite, which is a mineral mixture of calcium phosphate. About 20% of the bone is live bone cells. Bone doesn't heal as such, but new bones are formed from other tissues to fill the gap where the fracture is.

When a crab generates a new shell or a seashell grows, it uses a weak electrical current to form a calcium skeleton. Our bodies form bone in the same way a crustacean forms a shell. The mitochondria are the powerhouses of the cells. Their ATP sequesters adenosine calcium phosphate and deposits it into to bones.

The first mention of using electricity to heal bones is contained in Alexis Boyer's book on surgical disease, *Traité des maladies chirurgicales et des opérations qui leur conviennent*. In 1812, he described a case in which a fracture didn't unite after 13 months. The leg below the fracture could be moved easily in any direction without causing much

pain. A current was applied and after two weeks, the limb became less flexible. After six weeks of electrical current, the man was able to walk.

In 1850, Frederick D. Lente wrote an article on using electricity to cure three people whose bones didn't unite. He noted that many doctors used a seton to irritate the area, in hopes that the bone would begin to unite. Mary Waters made a false step on the street and broke both bones of her left leg. No healing had taken place two months later. Lente gave her ten-minute treatments with electricity. A month later, the union was quite firm, and the patient was discharged.

Lente wrote: "Electricity is easy of application, not very painful and in no way dangerous. But to be effective, it must be applied in connection with acupuncture. It appears to have little or no effect when the poles of the battery are applied merely to the soft parts on either side of the fracture as the current does not appear to reach the bone at all."

In 1853, Dr. Marlz Holl had a man with a leg fracture which didn't unite. A year had passed, and there was no sign of healing. Dr. Holl put a needle into the interspace and passed a direct current into the break for the next two weeks. The leg began to heal, and he felt that he had made an important discovery.

In 1860, Dr. Alfred Garrett treated a ship captain who fell and broke his thigh while building a ship. The fracture didn't heal for months. Garrett put the leg in a splint and inserted long electropuncture needles. A needle was put into the upper inner edge of the femur muscle so the point would touch the bone near the fracture. The needles were insulated, except at the tip, so the electricity wouldn't escape into the flesh.

A ten-cell Daniell battery was connected to the needles for five minutes a day. This was repeated every third day for three treatments. Then the current was applied daily from large sponge electrodes applied to the legs. Three weeks later the patient was freed from the splint, and the thighbone was knit together and the leg was stiff. Three months after he was released, the old captain was on a ship heading towards the East Indies.

Large numbers of fractured limbs occurred during WWI. Dr. Alfred E. Barclay reported on a number of men with ununited fractures, which were treated with electricity.

Old literature records one instance in which the violet ray was used to stimulate bone healing. A railroad worker broke the bones in his forearm. They were set in a hospital, but three years later, they still didn't unite. He went to specialists who couldn't help, but after using high-frequency electricity, the bones united.

Robert Becker and his research team did studies on the amount of current necessary to start bone formation. When Frederick Brown dropped the current applied to test batches of frog blood to 700 picoamps, the cells began to change, first at the negative electrode, then at the positive electrode. This is far less current than humans can feel.

Bone breaks did not respond to high currents. They did respond to a current in the range of 5 to 20 microamperes. This is little more than the current that it takes to run a watch. The bone cells did not multiply to bridge the gap. The red blood cells dedifferentiated and became primitive cells, which began to generate bone!

An infection in the bone area is the most difficult to heal. Often it will remain for years, draining pus and stubbornly refusing to heal. Robert Becker made a small electrode of silver, which released ions into the fracture area. The silver ions killed off the infection and stimulated healing.

In experiments the fibula bone of rabbits was cut with a fine saw. A current of ten microamperes was applied to half of the bones. Accelerated healing occurred only when the cathode was situated within the fracture gap. After 18 days, the healing was advanced enough to permit mechanical stressing of the fracture.

Several experiments suggest that healing is accelerated with pulses. A 15-hertz field generated 20% more bone. Another study involved pulsed electromagnetic fields. All but two of the delayed healing fractures healed within ten months using a field of pulses of 300 microseconds separated by 1500 microseconds.

A two-year-old boy had surgery on the tibia, the leg bone. Eleven years passed and the tibia still hadn't healed properly, leaving him a virtual cripple. The surgeons inserted two 10-microampere electrodes

at the site of the pseudarthrosis site and left them in place for 14 weeks. Nine months later, X-rays showed that the fracture had united.

A 50-year-old woman fractured her collarbone in a car accident. Two weeks later pins were inserted to hold the bone in place. The fracture didn't heal, so the pins were removed and an electrode was inserted into the break. A weak current was applied for seven weeks and the bone united.

In 1979, the FDA approved clinical use of electrical treatment for nonunion of bones. The treatment can be invasive by inserting needles into the fracture area. A second way is by using a powerful magnetic field, which stimulates an electric field. The magnetic treatment induces a current and can last as long as necessary. The success rate for inducing rapid healing by the electrical modalities is generally from 70-90%.

One of the major problems of aging is osteoporosis. The bones become thin and brittle, and when broken, take a long time to heal. The hind legs of young rats were immobilized, which resulted in bone loss. An hour of pulsed square-wave current resulted in marked formation of new spongy bone. This has promise for the treatment of osteoporosis.

In 1917, Cornelius Kappers elaborated the theory of neuro-bio-taxis growth. He found that the cells and nerves reacted to an electric current in the growing embryo. In 1920, Dr. Sven Ingvar published a brief report showing that growing nerve fibers reacted to electricity.

It would be wonderful if, when we lost a finger or a foot, we could regrow it. If children under age ten lose the end of a finger, and it isn't stitched up, the entire finger will regenerate. As a boy, I cut off the end of a finger with a corn knife. I have to look very closely to tell which finger it is.

The newts, salamanders and axolotls naturally regenerate their lost limbs. They are unable to regenerate their limbs in pure water with poor electrical conductivity. An electrical current begins flowing through the missing area. The cellular debris is transported away; the uninjured cells begin to lose their specific characteristics, which they used to identify themselves as muscle or bone. They begin to divide and become the parts of the tissue needed to produce the new limb.

Scientists have been studying electrical regeneration in the legs of frogs. Frogs can't regenerate limbs, but they are related to the creatures that do. When a microcurrent is applied to the lost frog limb, stumps are produced which have large amounts of nerve tissue. The anode destroys the muscles, but the cathode stimulates regeneration. However, complete regeneration is not obtained.

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19. ELECTRICAL WEIGHT REDUCTION

“It [electricity] induces an acceleration of the pulse, it is singularly *calmant*, eases the respiration, develops animal heat, augments cutaneous transpiration, makes more active the urinary secretion, disperses nervous irritation, and gives tone to the whole organism. It is the great disperser of equilibrium to the disturbed balance of the system, it increases the vital forces, and augments the energy of absorption. In a word, it excites and facilitates the play of all the functions. It is regarded by those who use it as the greatest regulator of menstruation. The well-being which it instantaneously produces causes those who have once experienced it to wish for a repetition of its beneficent effects.”

A. Arthuis *Traitement dei Maladies Nerveuses* 1871

In 1892, **Theodore Guillez** treated obesity with a high intensity direct current. He used large flat sponges applied to the buttocks, thighs and abdomen. The current was gradually raised to 150 milliamps and maintained for about 30 minutes. Each treatment was terminated with a series of current interruptions designed to provoke energetic muscular contractions. Patients were said to lose from 8 to 15 kilograms in a month.

In the same year, Jules Larat and Georges Gautier of Paris tried treating overweight patients with a sinusoidal electric bath. All of the muscles were tetanized [continuous muscle contraction] for 35 to 40 minutes. These alternating currents tended to accelerate the heart, and the patients felt anguish.

In 1903, Henry Head studied the sensory nervous system. He found that a direct current pulse with a duration of 5 milliseconds gave a painful electrical sting. He decreased the pulse length and found that there was no sensation at all at 2.5 milliseconds. He worked with H. Lewis Jones to produce induction coils, which produced no sensory effects.

In 1903, Stephane Leduc showed that an intermittent direct current could replace the faradic current for medical purposes and was particularly valuable in diagnosis. He designed a mechanical interrupter driven by an electric motor that varied the duration and

frequency of the resulting pulses. He found that the voltage necessary to give a minimal muscle contraction was lowest when the length of the pulse was $\frac{1}{10}$ th of the stimulation cycle.

Dr. S.C. Damoglou tried treating abdominal obesity with Leduc's currents using electrode cushions. A current intensity of 40-60 ma. contracted the abdominal muscles without any unpleasant symptoms. The treatments were done three times a week and lasted 15 minutes. By the 12th treatment, the abdominal girth of a 45-year-old man had diminished nearly three inches and the patient lost 9 pounds. Another patient measured almost four feet around the abdomen. He was treated three times a week, and by the 20th application, he had reduced more than five inches.

Over half of all Americans are overweight, and many are seriously overweight. Our remote ancestors were once peasant farmers, who dug roots and gathered berries. Life was hard and their bodies learned to conserve every calorie for lean times. Now we are city dwellers who sit behind office desks and peck away at computers. We don't walk to work; we ride in comfortable cars. Every street corner has a fast-food restaurant with pictures of large, affordable, calorie-ridden meals.

Ultraviolet light causes some stimulation of the metabolism, and many people lose weight after being exposed to the summer sunshine. Ultraviolet light treatments were given to a man who weighed 238 pounds. He complained of heart palpitations and difficult breathing. He did a lot of walking, but it didn't lower his weight. He took two ultraviolet treatments a week without undertaking a special diet. This reduced his weight to 212 pounds.

Jean Bergonié studied physics and science before becoming a doctor of medicine at Bordeaux in 1883. He studied electrical medicine in Germany and Austro-Hungary from 1885-7. He was a champion bicyclist who held records on several tracks and a member of many scientific societies. In 1895, he founded *Archives d'Electricite Medicale* and his wife edited the journal. When World War I broke out, he became an army doctor in field hospitals. After the war, he began working on cancer treatment.

In 1909, Professor Bergonié read a paper before the French Academy of Sciences on the electrical stimulation of muscles for weight

loss. He used a mechanical interrupter, giving about 30 to 50 pulses of direct current per second which produced muscular contractions without pain or fatigue. During the first quarter of a second, the muscles were rested, then they were excited by anode current for a quarter of a second, then a quarter second rest and finally a quarter second of cathode current. Since direct current forces ions through the body, the current was periodically reversed every quarter second so this would not happen.

The people treated were asked to avoid fatty foods and not eat for four hours before treatment. A medical history of the people was obtained. (Many obese persons have sugar in the urine and enlargement of the liver and intestinal autointoxication.)

Bergonié was struck by the large proportion of patients who had made pilgrimages to the great American and European spas. Often they lost 20-30 pounds during their trips, but they gained it right back after they returned home.

Professor Bergonié found that most people could tolerate a half-hour of electrical treatment, and this could be gradually increased to last an hour. Some patients could take two treatments a day, but generally one treatment a day was enough.

The subject would take off nearly all clothes except shorts, bra and socks and lie down on the chair. A wet salt-water towel was applied over the back, arms, buttocks, thighs and the legs. At first the electrical shocks were feeble and the first treatment was generally kept to 20 minutes. After ten minutes, the shocks were gradually increased to a comfortable tolerance and eventually to cause vigorous muscular contractions.

The first sensation was that of mild tingling, which disappeared as the strength of the current grew and induced muscular contractions. In general, five parts of the body were treated at one time. Each group of muscles was made to rhythmically contract with increasing intensity. The current retuned the muscles, and as the treatments continued, it took less current to restore good muscle tone.

The equipment was a reclining chair with an adjustable footrest, constructed of wood for insulating purposes. A series of ten electrode plates cover the body, and cotton towels soaked in salty water were

wrung out and put over the plates. The top electrodes were held in place with rubber bracelets. Sandbags were often put over the patient to make the contracting muscles work against extra weight. This developed the muscular system, and most patients found that they had much less fatigue.

The Bergonié device was connected to a rheostat, which controlled the level of voltage to each area being stimulated. Since he had no modern electrical equipment, the result was a very complex device. The apparatus had a series of dials that varied the current to the different areas of the body. The amount of current varied with the patient. A muscular patient might require about 25-30 milliamps, while a fat patient might need 70-80 milliamps to excite efficient contractions. Some areas of the body might require higher voltage in order to get normal muscle contractions. It took more current to contract the abdominal muscles than the muscles of the extremities.

The contractions of the muscles could be timed, and doctors were advised to set them 10 beats per minute below the pulse rate in cases of rapid pulse. The intermittent pressure on the veins stimulates the blood flow towards normal, and the heart beat falls after the treatments. The breathlessness, which was frequently present in these cases, was relieved. The blood pressure often came back to normal.

The first treatments might last 20 minutes in a seriously overweight person, given every other day. The first month, the treatments might be daily and then every other day. Bergonié asked his patients to drink plenty of salty water before and after the treatment to help the body get rid of the toxic waste products released by the muscle treatment.

The treatment was not only for weight loss. During WWI, it was used to treat men who had lain in hospital beds for months. Their muscles and bones had atrophied during the long period of time it took to heal their wounds. Treatments in the Bergonie chair restored their muscle tone and will to live.

Professor Bergonié used a faradic coil set at 24 volts with a rate of interruption of about 100 pulses per second, and reversed every 30 seconds. The current density was only 0.01 milliamperes per square centimeter. It was not necessary to use diets or any special preparation while doing electric weight loss.

A typical treatment would take off about half a pound, and a long treatment could take off as much as two pounds, although this was not considered desirable. Adolph Veith modified the equipment and used it to treat German patients. He used a surged sinusoidal current, which didn't affect the muscles quite as much.

Another interesting aspect of the treatment was that it caused weight loss in specific areas of the body. If the thighs or stomach were unusually fat, the weight could be reduced in that area alone. It was not necessary to connect the electrodes to the other parts of the body.

Patients with high blood pressure found that the peripheral vessels dilated and their blood pressure fell. Patients with low blood pressure found it rose towards normal during the treatment. Many patients who complained of insomnia commented that they had a return of normal restful refreshing sleep. People became more active with the course of the electrical treatment, and felt energetic.

A 28-year-old woman who was 5 feet 4 inches and weighed 219 pounds had followed many diets with only temporary results. With six weeks of electrical treatment, her weight fell to 193 pounds. She discontinued the treatment and then took occasional treatment. Her hips and thighs were reduced eight inches and her stomach was reduced seven inches.

A doctor's wife went from 175 pounds to 160 pounds after four weeks of treatment. She felt more energetic and continued to lose weight without treatments. Her asthma was better, and she had regular bowel movements.

A 40-year-old woman took electrical treatment for four weeks and lost 15 pounds. Her low blood pressure had been 106/78, which went to 126/78. She lost six inches on the abdomen and five inches on the hips. Her poor health began to improve.

There has always been a demand for weight loss equipment, but there was less demand in the early years of the 1900s. When World War I came along, Professor Bergonié's equipment was forgotten. The Sanax Company of New York City sold it in the U.S. At the time of the war, the concern was getting enough to eat, and weight loss was not a concern. Electrical weight loss was buried in the pages of the old medical journals. Some would be of interest to revive now.

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20. ELECTRICAL NARCOSIS or SLEEP

“You know yourself the property of the torpedo or cramp fish, which not only benumbs all those that touch it, but also strikes the numbness through the very net into the hands of them that go about to take it. And some that have had greater experience of this fish report that, if it happen to fall alive upon the land, they that pour water upon it shall presently perceive a numbness seizing upon their hands and stupefying their feeling, through the water affected with the quality of the fish. And therefore, having an innate sense of this faculty, it never makes any resistance against any thing, nor ever is it in danger. Only swimming circularly about his prey, he shoots forth the effluvia of his nature like so many darts, and first infects the water, then the fish through the water, which is neither able to defend itself nor to escape, being (as it were) held in chains and frozen up.”

Morals Plutarch

In 1858, Benjamin W. Richardson tried to prove that constant current could possess anesthetic properties. Morphine is not absorbed through the skin, but Richardson dipped a sponge in a morphine solution and backed it with a copper plate connected to the positive pole of a battery. The negative pole was placed on a wet sponge placed a little lower on the arm. After several minutes passed, there was no sensation when the arm was pricked with a needle.

The next year he shaved the hind leg of a dog and wrapped a copper band around it with a sponge soaked in aconite and chloroform. He wrapped another sponge covered with a copper plate around the lower part of the leg. After 11 minutes, it was insensitive to pain and Richardson proceeded to amputate the leg. The animal gave a minor indication of pain.

In 1902, Stephane Leduc produced brief pulses of low voltage direct current with 100 interruptions per second. He found that a 12-volt current interrupted 200 times per second would produce local and general anesthesia. The pulsed DC current became known as the Leduc current.

Leduc placed the cathode on the forehead and the anode over the spine in the region of the lower back. The first trial was carried out

on small dogs with a current of three volts. After three minutes, the dog was completely anesthetized. In order to produce narcosis, it was necessary to start with a relatively high current, which knocked out the animals, and then reduce the current. A minute after the current was turned off, the dog was apparently normal.

During the next experiment, the dog woke up under the current, so it was necessary to increase the current. There was a stage of excitement, but the experiment was completed without any further reaction. When the current was turned off, the dog staggered a little, but walked normally.

Experiments with dogs showed that the best way to put them under was a relatively strong current of 300 milliamps for 30 seconds. Then the current was reduced to 50 milliamps. After the shock of the current, the legs flexed and the standing animals fell. There were spasms in the legs after 5-10 seconds. Then the breathing stopped. Sometimes there was urination or a bowel movement. The heart stopped for a few seconds and then began to beat at a slower rate.

When the current decreased, there was twitching which receded spontaneously. In the state of electronarcosis, dogs could stand if placed on their feet. Their eyes were closed, and there were no righting reflexes. Pinching or pricking the skin produced no reaction. If the current was high, respiration was difficult.

Two doctors helped Stephane Leduc try electronarcosis on himself. He felt unpleasant sensations as the current was increased. He couldn't speak, and then he was unable to move, although still conscious. His perception was dreamlike.

Leduc described his experiences: "When the current was at its maximum we could still hear as if in a dream what was said around; we were conscious of our inability to move or to communicate with our colleagues. We did feel contacts, pinching and pinprick in the forearm, but the sensation was blunted as if the extremity was numbed. The most unpleasant feeling is to be aware of the disassociation and progressive disappearance of the faculties."

If the electrodes were placed on the frontal part of the skull, the pupils become constricted and didn't respond to light. If they were placed in a low position, there was profuse secretion of saliva and tears.

When Leduc announced that he had produced electrical sleep, Nicola Tesla remarked that he passed a current 5,000 times stronger through his head and didn't lose consciousness. He did fall into a deep sleep when he lay down. Tesla remarked that it might be dangerous to apply strong currents to the brain.

The first medical experiment was done with a man who suffered for years with congestive headache, although he took many medicines to relieve it. The negative electrode was placed on the top of the neck and the positive was placed over the lower back. The experiment started at 4.5 volts and 1.5 milliamps of current. There was a fluttering or palpitating sensation. The headache was not relieved, but it shifted to the left side of the head.

Then the electrode on the upper neck was placed on the forehead. The patient experienced a dull heavy pressure extending across the entire frontal region. As the current increased, there was a fluttering or palpitating sensation. There were sensations of pressure, palpitating and rushing currents. There was a soothing feeling that seemed to underlie the other sensations, which seemed to be internal. The headache was reduced. When the current was shut off, he felt confused and then exhausted. He slept for a few hours, and when he awoke, the headache was as bad as ever.

Electrodes were placed in the same position on a woman. The current was set at 6,000 interruptions per minute. When the voltage was increased to six volts, the woman went to sleep. Her pulse was regular, but her breathing was irregular. When the current was shut off, the woman felt like she was waking from a refreshing nap. She felt rested and energetic for the rest of the day.

Leduc felt that the only really useful current was a frequency of about 100 hertz. The pulse width of one millisecond was useful in electronarcosis. German researchers found that a 50-hertz alternating current pulse would work nearly as well. It slowly became apparent that any current capable of stimulating the central nervous system could produce electronarcosis.

Researchers attempted to use electronarcosis in mentally ill patients. Nine schizophrenics who had been ill for more than four years were given more than 100 treatments. The initial current strength was

maintained for 30 seconds and then decreased to the level supporting normal breathing.

The electrode's position on the head altered its reactions.

When the switch was thrown, the arms jerked forward and outward, while the legs flexed. The current stopped the heart for a few seconds, then it began to beat initially at 20 beats per minute. The respiration stopped briefly, then shaking and twitches began, and breathing returned to normal. Some patients became restless after about seven minutes, and the experiment was terminated. If the current was slowly increased, the patients remained in the electronarcosis state.

The first experiments didn't go well, but later experiments with Russian electrosleep equipment produced better results. If the illness was less than two years in duration, it could cure the patient. Electronarcosis was applied to 47 schizophrenic patients with short-term illness. In this series, there were 19 recoveries, and 16 social [sic] recoveries.

A 17-year-old boy developed delusions two weeks before admission into the Navy. He was given seven electrosleep treatments and adjusted so well he was able to enlist in the Navy. The 28-year-old wife of a naval officer developed delusions and began hallucinating. She was given 29 treatments and recovered.

A group of 12 patients with depression and insomnia were treated for five to ten times for 30 minutes. The current was set at 100 hertz with a pulse duration of 1 millisecond. The voltage ranged from 12 to 20. The effect was marked in 9 of 12 patients with immediate improvements in sleep and improved feelings.

The use of electrosleep units produced mixed results. The first results might be difficulty sleeping and waking up frequently! With continued use, the sleep usually became deeper and more regular. Patients often felt an increase in energy while awake with mild euphoria.

Sedac units using weak currents proved to be quite useful in treating phobias. The electrodes were placed over the bridge of the nose and the current was switched on. The forehead electrode was positive and the negative pole was attached to the wrist.

An 18-year-old college student became increasingly fearful and obsessive. She had episodes of acute panic and delusion about the end of the world and flying saucers. She took Sedac treatments three times a week and then twice a week for three weeks. The phobias declined and she was able to resume college.

A woman with three children suffered from attacks of sudden fearfulness with trembling and she made several visits to the hospital emergency room. She was given Sedac treatments for three weeks, which brought about dramatic improvement.

Electrosleep proved to be useful for getting people off of methadone addiction. Two groups of 14 persons were studied. The 14 receiving electrotherapy had marked reductions in anxiety. Half had normal anxiety function. After eight treatments, nine patients were able to get along without methadone.

A hospital at Bordeaux did an experiment with detoxifying heroin addicts. The Sedac unit was attached to the patient for 48 hours. The patients could detach the unit to take a bath or walk about. It proved to be quite helpful in detox treatment. The psychiatric team tried placebo stimulation, but this produced no results.

In 1951, an Italian doctor made an attempt to do surgery on a patient under electrosleep. This didn't work well, and higher currents made it necessary to give injections of a muscle relaxant drug beforehand. Minor surgery could be done under electrosleep. The French dental surgeon Aimé Limoge used a special unit to do surgery on patients. He put the cathode between the eyebrows and the cathode behind the ears. The 77 hertz current passed through the sides of the brain.

Modern electrosleep units produce a relaxed state with a low intensity electrical current. Batteries power the device making it independent. The patient lies on his or her back with an electrode over the upper face. The cathode [negative] is applied over the eye and the anode is applied over the mastoid process, the bone behind the ear. The treatment starts at 100 pulses per second with a pulse duration of 1 millisecond. The voltage is raised until a mild tingling sensation starts.

The treatment lasts 30 minutes and may be repeated for up to three weeks. The patients may not fall asleep, but may experience blurred vision and a mild headache. Others report being extra alert, with improved sleep afterwards. There seems to be a curative effect in a variety of clinical conditions.

A Somniatron unit was tested on 32 neuropsychiatric patients. The pulse rate of this experiment was synchronized with the 11 cycles per second of the brain's alpha rhythm. Attainment of sleep during treatment was not pursued directly, but there was emphasis placed on getting a good night's sleep afterward. It generally took 3.3 sessions to reach a restful sleep.

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21. ELECTRICAL RESUSCITATION

“When the several measures recommended above, have been steadily pursued for an hour or more, without any appearance of returning life, electricity should be tried—experience having shown it to be one of the most powerful stimulants yet known, and capable of exciting contraction in the heart and other muscles of the body, after every other stimulus has ceased to produce the least effect. Moderate shocks are found to answer best, and these should, at intervals, be passed though the chest in different directions, in order, if possible, to rouse the heart to act. Shocks may likewise be sent through the limbs, and along the spine; but I am doubtful how far it is useful or safe, to pass them through the brain, as some have recommended.”

Observations on Apparent Death From Drowning James Curry 1815

The first person to study the possibility of using an electrical shock for resuscitation was Peder Christian Abildgaard (1740–1801), a Danish physician and veterinarian. He was one of three Danish students sent to France to study veterinary medicine, because there was a cattle plague in 1762, and nothing could cure it. Veterinarians advocated quarantine and slaughter as the only successful method of control. He taught at the veterinary school at Copenhagen, which was established in 1771.

Abildgaard published a summary of his electrical experiments in 1775. He began by studying the deaths of animals killed by lightning and found that the body wasn’t usually damaged enough to kill it. He rigged up ten Leyden jars and couldn’t get enough of a shock to kill a young horse.

Then he got a hen and shocked its head. It lay as if completely dead and could not be aroused by any stimulation. He gave the hen repeated shocks to the head, but it remained still. Then he tried an electric shock directed through the chest to the spine of the back. Suddenly the hen rose up and walked about quietly on its feet. He tried the same experiment with a rooster, and it apparently died from the shock to the head. But with a powerful shock through the chest it briskly flew off, knocking his Leyden jar on the ground and breaking it.

In 1774, Sophia Greenhill fell out of her window onto the ground and was apparently dead. The surgeons at Middlesex Hospital declared that nothing more could be done. Then Mr. Squires arrived and tried electricity 20 minutes later. He gave several shocks through the thorax and perceived a small pulsation. After a few minutes, the girl began to breathe with difficulty and then vomited. She was in a stupor for a few days, but she slowly returned to normal.

Electrical resuscitation was tried in a case of lightning in 1782. Lightning struck a house at Gravelines and an elderly man was taken up for dead. A doctor from Guy's Hospital electrified him, and the man was restored to life.

Giovanni Aldini, the nephew of Luigi Galvani, wanted to try electrical revival on the human body. A criminal was hung for murder and the body was rushed to a house in 1803. Professor Aldini gave the deceased criminal a shock to the jaw. The man then began to quiver, one eye opened and it appeared as if the man might be restored to life.

Three weeks later Professor Giovanni Aldini experimented with the head of a decapitated ox. When he applied electricity the tongue retracted and it bellowed. The head and eyes began to move, but it was dead.

There was little understanding of artificial resuscitation before the middle of the twentieth century, and the techniques we use were completely unknown. In 1753, Christoph Hufeland proposed the idea of applying electricity to the phrenic nerve to revive newly born infants. The first attempt to stimulate the breathing muscles came in 1756. Leopoldo Caldani excited the phrenic nerve of a dog with a static discharge. He noticed the jerking motions of the chest wall and theorized about the utility of the phenomenon.

In 1818, Andrew Ure purchased the body of a condemned criminal after he hung on the gallows for an hour. He made an incision in the neck and below the fifth rib. After applying a battery to these points, there were respiratory movements. He believed that if the rope didn't injure the neck and it had been less than an hour, electricity could have revived him.

William Halse experimented on electrical revival in the 1840's. He drowned newborn puppies in water, then shocked them until they began breathing normally. Electricity enabled the body to regain control of itself. A woman heard of his work and brought her daughter, who couldn't close her eyes, and the right side of whose mouth was contracted. A month of shocks restored her face to normal.

Electricity was able to revive an inebriated man in 1840 who fell into water and was under for six minutes. A stomach pump and ordinary means of respiration were exhausted. The diaphragm below the seventh rib was exposed. Electricity stimulated the diaphragm and saved James Rock.

In 1856, Hugo von Ziemssen treated a 27-year-old domestic woman who was asphyxiated by charcoal fumes. He faradized the phrenic nerves, the chest expanded and the woman began to cough. This was continued for two hours until respiration was fairly reestablished. Eleven hours afterward, respiration was normal, and she was well the next day.

In 1871, **Ferdinand Steiner** of Vienna, wrote a lengthy account of research made in connection with accidents from anesthesia. He used cats, dogs, rabbits, horses, and one donkey. He found that a faradic current applied within fifteen minutes could usually restore heart contractions in most instances.

One of the greatest advances in medicine was anesthesia to eliminate pain. Chloroform was wonderful, but quite a few patients didn't wake up after the operation was over. A large battery with hand-held electrodes was applied over the neck and the left side of the body. This revived 5 of 7 people in 1872.

In 1948, a new type of artificial respiration was devised that used 40 pulses per second of direct current lasting two milliseconds. The voltage is raised and lowered to maintain normal respiration, producing smooth diaphragmatic contractions that mimic normal breathing.

The first known electrical accident was in France in 1879. A lineman contacted a 250-volt alternating current line and was killed. The next year another accident happened in Scotland. The first death in the United States was Samuel Smith of Buffalo, New York. He was drunk when he put his hands across the terminals of one of Buffalo's new DC generators. Thomas Edison argued strongly against alternat-

ing current on the grounds that it was dangerous. A number of his men were killed with direct current, so he should have known better.

The State of New York held hearings on the electrical deaths. Officials reviewed all hopeful medical treatments. One man was placed in a hole to “draw out the electricity.” He began moving six hours later. Alfred West was struck by lighting. Rescuers placed his feet in warm water and pulled on his toes. Other schemes were the injection of brandy and producing reflex actions on the lungs.

The great turning point was an 1899 paper by Jean Louis Prevost and Frederic Battelli titled: “Death by Discharges of Electricity.” They found that an electric shock did not usually kill the body. It disordered the orderly pumping of the heart, so that it vibrated irregularly. Ventricular fibrillation of the heart was the cause of death. If a strong counter shock was applied, regular heart motion could be restored.

They began by studying ventricular fibrillation. High voltage shocks applied between the head and feet didn’t usually cause ventricular fibrillation, but low voltage shocks did. The ventricles would begin to beat rapidly, the heart weakened, and arterial blood pressure fell to zero.

They tried using alternating current shocks of 45 hertz and 4,800 volts to revive dogs. One electrode was placed in the dog’s mouth and the other electrode was placed on the legs or rectum. The longer they waited, the poorer the results were.

The electric power companies at first ignored the deaths of their linemen; it was just part of the new technology. However, they couldn’t ignore the growing number of deaths, so a team was appointed in 1926 to study the problem. In 1930, William Kouwenhoven was shown the paper of Prevost and Battelli. The team began to try using counter shocks in the laboratory.

Monkeys weren’t good laboratory subjects, because their fibrillating hearts would spontaneously return to normal. Dogs reacted to shocks like humans. When 19 dogs were given a strong counter shock for two seconds, five of them recovered. If there was a 30 second delay, 98% of the dogs lived, but if they waited for two minutes, only 27% survived.

The team worked for years trying to develop a practical device. In 1947, Dr. Claude Beck reported that he had revived a young man whose heart fibrillated in the operating room. In this case, the heart was already exposed, and electricity was directly applied.

In 1951, the Edison Electric Institute had another urgent meeting. Electrical use was increasing, and more linemen were being killed. They needed a defibrillator that would be applied to the closed chest of a man whose heart was in fibrillation. There was no time to rush workers to the hospital.

The Hopkins alternating current defibrillator was developed for hospital use. Artificial respiration could be applied for some time to give the body some circulation and oxygen. Then counter shocks could be applied, and the patient revived. In 1960, a city ambulance was called to the home of a retired baker. He wasn't breathing, and his pupils were dilated. The aid crew applied closed chest compression to supply air as they brought him to the hospital. He was defibrillated and he recovered. This was a big surprise to the medical community, because most people thought this was impossible.

In order to be portable, the defibrillator had to be powered by direct current, with large storage capacitors. High voltage electrical energy was stored in the capacitor for the shock. Police and ambulance crews began to carry the portable defibrillators, and small units were developed for airliners. Most heart attack victims have a reasonable chance of being revived if a defibrillator is available.

Doctors were not just interested in emergencies; they wanted something that turned a faulty heartbeat into a regular heartbeat. In 1899, John MacWilliam had suggested that pulses of electricity sent into the heart could restore an irregular beat to normal. It took a half-century to produce the first practical units.

In 1927, Michael Marmorstein unraveled the secrets of electrical stimulation of the heart. He found that the endocardium was more sensitive to electrical stimulation than the myocardium. When he stimulated the ventricular septum, the heart slowed down. When he stimulated the junction of the superior vena cava and the right auricle, it beat faster. The sinoatrial node was identified as the natural pacemaker.

Albert Hyman (1893–1972) once had a turtle heart stop during a college laboratory experiment. He asked Professor Cannon: “Why can’t this heart be started?” The professor answered: “Perhaps some day you may be able to produce an answer.” In 1930, he received a grant to explore the idea of an artificial pacemaker. It would use electrical pulses to time the heartbeat.

Hyman didn’t want publicity and used the pacemaker only on desperate people. He didn’t even publish his clinical results. Newspapers picked up the story, and he was deluged with abusive correspondence and even lawsuits that regarded him as tampering with the will of God! He couldn’t find an American company willing to make the pacemaker, so he had to get a German company.

Attitudes changed over time. Dr. John Callaghan developed a practical pacemaker at the University of Toronto. He could raise or lower the heart rate with the new unit. With the invention of the transistor, the units could be made small enough for practical use. Electrical heart medicine had reached its final goal.

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22. ELECTRICAL FIRST AID

“As each fresh important discovery in electrical science has been reached, men’s minds have been turned anew to the subject, and interest in its therapeutic properties has been stimulated. Then after extravagant hopes and promises of cure, there have followed failures, which have thrown the employment of this agent into disrepute, to be again after a time revived and brought into popular favor.”

H. Lewis Jones 1901

Dating from 1745, the Leyden jar is a capacitor devised to store electricity. The inventor Petrus van Muschenbroek (1692–1761) wrote in a letter that he was struck by its shock in his arms, shoulders, and breast. He lost his breath and it took him two days to recover from the effects of the shock. He remarked that he wouldn’t take a second shock for the Kingdom of France.

Joannes Henricus Winckler shocked himself, got convulsions in his body, and used refrigerating medicines to deal with it. He felt a great heaviness, in his head and the shocks gave him nosebleeds on two occasions. His wife received the shock twice and was so weak she could hardly walk.

Other experimenters regarded the shock as a great experience. Large circles of people held hands so they could experience the shock together. Christian Richman wanted to die by electric shock, so his death would be the subject of an article for the *Memoirs* of the French Academy of Sciences.

The condition known as catalepsy is much like being in a coma which can last for weeks. The electrical experimenters found that the left nipple was the most sensitive point of the body. A woman fell into a cataleptic sleep for 48 hours and had no signs of sensibility. When a faradic shock was applied to the left nipple, she gave a groan and woke up.

Another woman was subject to severe cataleptic attacks. The next day, doctors applied electric shocks to all parts of her body. When a shock was applied to the left nipple, the patient sat up and spoke.

The first electrical first aid was done with static currents. A woman stepped from a streetcar onto a pile of snow. She fell on her thumb and severely injured it. After four static treatments, the severe

pain was gone, although it took two months before the thumb was back to normal. There are hundreds of such cases in old literature.

In 1986, there was a curious report that the Waorani Indians of Equador were using shocks to cure snakebite, which was very common in the dense jungle. Many old medical practices involve counter-irritation. After a snake bites you, an electric current bites back to cure you! Many Indians now have boats with outboard motors to travel through the rivers of the snake-infested jungle. When bitten, they pressed a spark plug wire against the bitten spot and gave the motor a few starting pulls.

This gave them a shock of about 20,000 volts for a short duration. The shock treatment was tried on 34 people. Usually all pain was gone in 10-15 minutes and no further treatment was needed. The treatment might be applied several times in the first 30 minutes. Seven people refused the shock treatment and experienced the usual complications; two needed limb amputations.

Two patients were not treated with shocks until about two hours after being bitten. They had intense pain and swollen limbs. Seven sessions of shocks were given, producing pain relief in 30 minutes. Twelve hours later, the swelling had progressed but there was no bleeding. The swelling disappeared after three days. A stun gun was used to treat these patients.

Jack Cover (1911–1999) was a physicist at Hughes Aerospace who read an article in the *Los Angeles Times* about a man who was frozen on a downed power line for four to five hours. He wasn't harmed, but he couldn't release himself. Cover built a high-voltage, low-current, pulse device. He tried it on himself, his sons, other volunteers and animals. Its name he coined from "Thomas A. Swift Electric Rifle," based on a favorite childhood book of his.

The Taser[®] gun got its power from eight nine-volt batteries. It shot a jolt out of two wires with a maximum range of fourteen feet. It used 6-8 pulses per second at two microamps and 50,000 volts. The wattage was about the same as a small Christmas tree bulb. The police model used a pulse rate of 12-14 pulses per second to disable violent suspects.

The Los Angeles police first used the stun gun in 1981. Two thin pulses shot out from a flashlight-sized device. Sparks leaped from the end, and tough criminals fell to the ground. The device attracted great attention, and many people hoped that it would replace guns in difficult situations. An inexpensive model was made that worked by pressing it against a person in close situations.

After Ron Foster was bitten by a rattlesnake in rural West Virginia, he used a stun gun to aim six 40,000-volt shocks at three puncture wounds. He couldn't see the fourth puncture, and it developed into a hemorrhagic ulcer. The other three punctures healed quickly.

The stun gun was used on 21 cases of suspected or confirmed spider bite in Oklahoma. Most bites are made by the brown recluse spider *Loxosceles reclusa*. Spider bites are often worse than snakebites. They often occur at night, and healing is very slow and painful. They often lead to skin necrosis, chills, fever, and severe illness.

A 51-year-old woman had a brown recluse spider bite on her chest and right armpit. Six days later she had a reddish purple area measuring 7 × 9 centimeters. She heard of the stun gun treatment and requested it. The skin lesion began to shrink, and no graft was required.

After a 47-year-old man awoke with a cough, wheezing and shortness of breath, a brown recluse spider was found in his bed. He was given cortisone injections and antibiotics. Three days later he had pain and swelling under his left arm. High voltage shock was administered through the center of the area followed by shocks on all sides. The patient reported relief of pain in less than ten minutes.

A 10-year-old girl awoke with pain in her left upper shoulder from a brown recluse spider bite. This was treated with two shocks in the center of the area. The inflammation began to subside in 45 minutes, and pain decreased. A day later it had essentially disappeared.

By 1991, doctors had used stun guns to treat 147 cases of suspected or confirmed spider bites. The relief from symptoms was often immediate. One man had to use an inhaler to breathe. Ten minutes after multiple shocks, he had less pain and his breathing was nearly normal. Another man was severely nauseated. Ten minutes after the shocks, he was free from pain and nausea.

There are several indications that shocks can help sports injuries. Shocks given under anesthesia were used to treat tendinitis and heel spur, due to calcium buildup. The shock technique was tried on 20 athletes with tennis elbow. Following two shock treatments, 17 reported better mobility and less pain.

Electrical shocks might be of interest in dealing with disease. A farmer in Bunbury, Western Australia, was pinned up against a 7,500-volt electric fence by an angry bull. Several weeks before, he had gotten ill from the Ross River virus. His symptoms disappeared after he got shocked. He told a sick friend about his shocking encounter. The friend shocked himself and got well.

A man was severely allergic to bee stings and had to get emergency medical treatment. Once he accidentally stumbled into a beehive and ran home, chased by angry bees. Then he stumbled into an electric fence trying to escape. Much to his surprise, he did not become ill from the bee stings.

In 1991, William D. Lyman and his coworkers found that a small electrical pulse reduced the infectivity of the AIDS virus by up to 95%. They hoped that blood banks could use an electrical pulse to make sure donated blood was absolutely sterile. An electrical shock could make a major change in the disease, but nobody has tried this.

There are many stories of using the violet ray in first aid. One man sprained his ankle and wrote, "After I sprained my ankle, I limped around for about a week with a cane, and it seemed to get no better. Finally I went over and got my Renulife violet ray machine from some friends to whom I had loaned it, and to my surprise, I obtained immediate relief upon using it. I used it steadily until my ankle was completely cured."

A young woman sprained her ankle and could barely hobble. The first treatment enabled her to walk with little stiffness or pain. After the third treatment, she was completely normal.

A young man fell while playing soccer, resulting in extremely severe pain in the sciatic nerve. After ten treatments with the violet ray, the pain ceased and he could walk without pain. It returned to a lesser degree but more treatments eliminated it.

A woman sprained her hand and right arm. She went to several doctors and took different treatments. She couldn't do needlework or play cards without real pain. Steam baths and massage didn't help. Then she took violet ray treatments and was able to play cards and sew without pain.

Another person wrote, "For eight years, I was afflicted with a stiff sore neck. After taking three Renulife treatments, to my great surprise, I felt some relief, and after eight treatments, I was entirely cured and could turn my head and twist my neck without the least pain."

A flooring installer had his right knee swelled to the size of an orange. It kept recurring, and no treatments worked. After he took 28 five-minute violet ray treatments, the problem didn't come back. Many other cases of bursitis responded just as well.

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23. ELECTROLYTIC CARE OF METAL POISONING

"Be it known that I, John Campbell, have invented new and useful improvements in the electrical extraction of poisons from the human body. For vegetable poisons I employ a vegetable receiver instead of a mineral or copper one, and for animal poisons I use an animal receiver, such as raw meat. The device is capable of being used with the mineral, vegetable, or animal receivers without further change than to equip it with the kind of receiver applicable to the kind of poison desired to be extracted or removed from the human system."

United States Patent #606,887

The human skin is a layered composite that admits water with great difficulty. It is protected by a layer of fats and oils that are impermeable to most ordinary substances. At the same time, it has sweat glands that release fluids to cool the body under hot conditions.

In 1807, Sir Humphrey Davy immersed his fingers into a glass jar filled with distilled water and connected to the negative pole of a battery. He found that alkali was excreted from his body and deposited into the water. If he put the positive pole into the jar, the electrical current pulled phosphoric and hydrochloric acid into the water.

The idea became the basis of the electrical bath. An insulated bathtub was filled with water and electrodes were placed at the head and foot of the bath. Putting the positive pole on the head was found to be more relaxing.

During the 19th century, lead poisoning was a huge problem. Benjamin Franklin, a printer, used lead type for his newspaper and almanac and suffered from lead poisoning several times during his career. He wrote a memoir on how lead poisoning had destroyed the careers of printers and how he had narrowly avoided this.

The old metal stills were a big source of lead poisoning. Metal technology was poor, and a spiral coil cooled the alcohol vapors that arose from the still. Since connectors were leaky, and there was no welding, lead was used to fill the cracks. Brewers who used cheap stills

caused epidemics of lead poisoning, and there was no good treatment for lead poisoning. Often people went to Bath, England, to drink and soak in the spring for months in hope of removing their bodies' lead.

In 1852, Andres Poey told the French Académie des Sciences of an electrochemical procedure for removing metals from the body. A metal plater who gilded gold and silver developed severe ulcers on his hands. Various remedies had been tried in vain. He plunged his hands into an electrochemical bath near the positive pole. After 15 minutes, a thin film of gold and silver formed on the negative pole. Poey recommended baths with hydrochloric or nitric acid for the removal of mercury, gold, and silver from the body.

In 1872, Dr. Samuel Wilks treated a case of lead poisoning with an electric bath. The person was put into a tile bath with a trace of sulfuric acid to make it acid. A copper electrode, not touching the patient, was put into the bath and the patient grasped the positive pole. The treatment was repeated three times, and the patient reported that he felt much better.

Wilhelm H. Erb discusses several cases of lead poisoning in his 1882 electrotherapy book *Handbuch der Elektrotherapie*. He used an electric wash with a zinc plate put on the patient's back or stomach. The positive pole was inserted into the rectum. After a few treatments, the patients were free of pains and left the hospital. This seems unlikely to correct the problem, but it could reduce pain.

Alfred Smee (1818–1877) developed the Smee bath in England. He wrote a book on electro-metallurgy to offer his industrial knowledge to people. Individual containers were used for each hand and foot. The positive and negative electrodes could be configured to pass the current several ways. When the direction of the current was upwards, it was always felt more sharply.

One of the purposes of passing current through the body was to remove metals. Doctors wrote reports stating that they either had good results or no results. The mixed results may have been due to the voltage and the way the current was applied. Perhaps the temperature or the solvents in the solution allowed metals to pass through the skin. Often results were slow. The idea deserves careful modern investigation.

Dr. J. Auriol Armitage treated several people who worked with lead. A woman had been exposed to lead from the age of 17. Her hands and legs began to ache, and her legs felt so heavy that she could hardly drag them along. Her hands and feet became swollen and inflamed, and she became so crippled that she could hardly feed herself.

After two weeks of treatment with bipolar baths, she could raise her hand to the back of her head. In a month, her fixed knees began to yield. After 11 weeks, her wrists straightened out. She was nearly well after eight months of electric baths.

In 1907, Henry Lewis Jones treated a case of chronic lead poisoning with an electric bath, showing that he could eliminate lead from the body with an electrified bath.

T. Maltby Clague was a London chemist. He used electroplating and knew that when an electric current is passed through a salt solution, the acid collects at the positive pole and the metallic base goes to the negative pole.

Thomas Oliver experimented with Clague's system by giving a rabbit drops of lead nitrate. Soon the rabbit became completely paralyzed. The front feet of the rabbit were put in a bath with the negative terminal, and the rear feet were placed in another bath with a positive terminal. The animal recovered the use of its limbs and soon was hopping about.

Clague suggested that a bipolar system be tried. A solution of salt water was made to conduct electricity. Patients hands were put into jars of salty water and connected to the positive pole, and the feet were in basins connected to the negative pole. He recommended using a 16-volt current for 20-40 minutes a day depending on the severity of the case.

Many mines and lead smelters had problems with poisoned employees. An employee at a southwest lead smelter had four attacks of lead poisoning. These were marked with colic, loss of appetite, and obstinate constipation. He was treated with induced vomiting, potassium iodide supplements, tonics, and laxatives. There was a marked blue line on his gums, and he had anemia. His hands and feet were put into separate salt-water baths and he got eight treatments lasting 30 minutes at 25 milliamps of current. After the fifth treatment, the

blue line on his gums disappeared, his bowels moved regularly, and he was able to return to work.

Another employee worked at the smelting furnaces and came to the hospital weekly for purgatives and tonics. He was extremely anemic and was unable to work the previous two weeks. His gums showed the characteristic blue line of lead poisoning. After eight treatments he felt cured, although the blue line had not fully disappeared.

An employee worked in the lead smelters for ten years. He began having epileptic seizures, which always came on at night. He didn't have the usual symptoms of lead poisoning, but he was losing weight. After given 35 treatments lasting for 30 minutes, he felt much better and gained 30 pounds. His epileptic attacks stopped.

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24. ELECTRIC MEDICATION

"It is difficult to imagine how ludicrous it will appear in the future, our present-day method of scattering through the whole body harmful substances. They are particularly noxious to the most delicate and important tissues, such as the nerve centers, in order to act upon a very limited part of the body, which happens to be diseased. It should be one of the aims of medicine to replace general treatment as often as possible by local treatment, and to attain this ideal, the electro-ionic method offers resources, which no other method affords. It allows us to introduce into each cell, impermeable to most remedies a whole series of ions, and to obtain as many different actions as there are ions. A variety and multiplicity of actions of all sorts can be produced by saturating the cells of the skin exactly to the degree and depth that one wishes with the electrolytic substances. Then you may be surprised to see medicine remaining content with applications to the surface. Ointments and pomades can only act only superficially and an infinitesimal fraction penetrate into the interior."

Stephane Leduc

Most medicines are not electrically neutral; they have charged chemical groups and they will migrate with an electric current. This property is used in chemical separation. A direct current flows through a mixture of chemicals, separating the substances by individual speeds which they travel with the current.

Michael Faraday called substances that travel in an electric field "ions," which means "travelers." Our blood is a solution of ions, which creates osmotic pressure in the cells. Pure water is irritating to the throat because it doesn't have any ions.

In 1747, Giovanni Francesco Pivati was the first man to have the idea of driving drugs into the body with electricity. Static electricity won't do this; it had to be low voltage direct current. When Alessandro Volta invented the "couronne de tasses" [battery] in 1800, it wasn't useful for this purpose. It would not provide a steady current for any period of time because of rapid polarization at the terminals.

In 1802, Francesco Rossi tried to drive mercury through the skin with a battery. He wasn't successful, luckily for the patient. The belief that mercury cured syphilis endured well into the twentieth century.

In 1836, John Daniell perfected his battery, and this offered a dependable source of direct current. The new battery opened the door to the telegraph, which required a steady current of electricity.

The first demonstration that electricity could carry substances directly into the body was made in 1833. Bernard Raymond Fabre-Palapret put a compress of potassium hydroiodate on one of his arms and a solution of starch on the other. The current carried iodine into the body and then out of the body at the other terminal. The starch turned blue; this is still used as an analytic test for iodine.

Fabre-Palapret tried to cure sick patients with quinine. He mixed quinine with the battery fluid instead of putting it under the electrodes. The electric homeopathic quinine didn't work at all this way.

Georges Bourguignon (1876–1963) showed that chemical substances are deposited along the path of the current as determined by the position of the electrodes. He showed that ions are driven into the blood and also removed from the blood by the current. He demonstrated by oscillography that the peak of ion transfer occurs after about 20 minutes of current flow in transcerebral electrophoresis.

A 40-year-old woman had an obstinate case of neuralgia. The slightest touch or breath of air was exceedingly painful to her. Everything had been tried. An anode with a 10% solution of cocaine was placed over the area and a sponge connected to the cathode was held in the right hand. The patient was relieved from pain for four to five hours, and further treatments reduced the pain for longer periods.

Dezso Deutsch used a 0.1% solution of histamine acid phosphate applied from the positive pole for introduction to the body. Histamine is an anion and carries an electrical charge. The positive electrode is covered with a moistened pad and a piece of blotting paper soaked in a diluted solution of histamine. This produces immediate skin hyperemia. The temperature goes up 2-3° C. and red wheals appear on the skin. He reported very favorable results in muscular rheumatism.

He treated more than 250 patients with histamine carried into the body with an electrical current. He reported that 83% were cured or greatly improved. Ten of 13 cases of infectious arthritis were greatly improved. He was able to improve seven of eight cases of rheumatoid arthritis. He improved 15 out of 25 cases of osteo-arthritis. Most of these were knee joint problems. It took from six to 23 applications to cure or give them major help.

This success resulted in a search for less irritating compounds; the search focused on choline compounds. One of the best compounds was cetyl-beta-methylcholine chloride. When used electrically, it produced vasodilation and hyperemia. It was tried on leg ulcers which wouldn't heal. After two to three electrical applications healthy granulation tissue appeared around the ulcers. It produced good results in 18 out of 19 patients.

The compound was tried in Raynaud's disease of the fingers. The patients took from six to 165 treatments. It usually took many treatments in order to produce a reasonable success.

A 50-year-old woman complained of stiff and painful fingers and toes for five years. After exposure to cold they would turn blue and become painful. The movement in her finger joints was nearly zero. Nineteen treatments gave her reasonable help.

The choline compound was used in many cases of pelvic inflammation. Vaginal pads containing a 1% solution were used with a current of 15 to 20 milliamps for up to 20 minutes. A study showed that seven of 10 woman with extensive pelvic inflammation were completely cured. One woman had severe pain in the lower abdomen for 14 years. After seven treatments, the pain was gone. The treatment was normally given every other day.

Skin problems were treated by driving quinine into the area with pads soaked in a solution of quinine chloride. The quinine gave help in acne rosea seborrhea and red nose.

A woman suffered from trigeminal neuralgia for 15 years and the complaint increased in severity. She was unable to chew solid food or drink hot or cold liquids. An electrode pad was applied lengthwise from her temple to the lower border of her jaw. A 2% solution of quinine hydrochloride was attached to the positive pole. The treatment was given daily for the first week, and then three times a week. The pains rapidly decreased in frequency and severity until they ceased after six weeks. There was no return of the pain for ten years.

Curare is the powerful nerve paralysis agent that was the active ingredient of the Amazon poison used in blowguns. It is an alkaloid with a positive electrical charge. It was applied to the skin with a fine porous sponge covered with a metal screen. Curare relieves muscular spasm, reduces local pain and stiffness, and increases motion.

A disturbing facial tic was treated by curare applied with electricity. After 11 treatments, the tic was nearly gone. Curare treatment resulted in complete relief of pain in painful scar tissue.

Two patients with neck pain due to osteoarthritis of the cervical spine were treated with curare. It relieved painful muscle spasms when applied to the back of neck. Curare relieved muscular spasm in back pain when the negative electrode was placed over Scarpa's triangle. It gave great help to three people with osteoarthritis of the knee joints.

Scar or burn tissue often remains painful throughout the rest of the person's life. It can be treated with a thick gauze pad soaked in 1% sodium chloride solution. A metal plate is put over the soaked gauze pad and connected with the negative pole, and the current is gradually increased to a comfortable toleration. A few treatments soften the scar tissue and relieve pain.

A 40-year-old man was treated with sclerosing solutions for three years, resulting in pain and inflammation. He was given six treatments with salicylate ionization. The pain and inflammation began to disappear, and after 10 treatments, the leg became normal in all aspects. The cure was complete in 13 treatments.

Sodium salicylate is a form of the common aspirin. A 57-year-old woman had old varicosities and phlebitis of the right leg for two years. She had violent pains in the lower right leg and couldn't walk. There were severe varicose veins all over her lower leg. After a dozen salicylate treatments, her leg healed.

A soldier suffered from a leg wound that resulted in severe inflammation of the right leg. He tried vaccinothrapy, autoserotherapy, protinothrapy, diathermy and ultraviolet light, but nothing gave relief. Salicylate ionization was tried over the inflamed portion of the leg. The first treatment resulted in relief, and after ten treatments, the inflammation was gone.

A 2% solution of sodium salicylate was placed on the forehead of people suffering from trigeminal neuralgia, and the cathode was applied. The anode was applied to any other part of the body. A current of about 20-40 ma. was applied. In one case, a painful tic douloureux lasting for 35 years disappeared in three treatments. There was no return of pain over the next two years.

One woman suffered for ten years and endured a variety of treatments. Her teeth were extracted, but the problem didn't go away. She would have calm periods lasting three to four months, and then any cause would set off severe pain lasting several minutes several times a day. After a period of three weeks, she took seven treatments of 20 ma. of current, and the problem was gone for good.

One curious effect was discovered by treating infected wounds during WWI. Dr. Charles Russ found that all bacteria are attracted to the positive pole when a current is passed through a dilute solution of sodium chloride. The current stimulates healing and kills germs without injury. A positive electrode is placed in the bath, and the wound is immersed in a salty solution. The negative pole is applied to the body, and the current is slowly raised to about 20 milliamps. Several half-hour treatments yield excellent results in septic wounds.

Dr. Frank Fowler treated a case of a soldier with an infected leg wound. It was full of pus, and soon the leg would be amputated. He used a Schnee bath with the hands and feet soaking in salty water. The positive terminal was put on the injured leg and the current was used for a half-hour at each treatment. The infected leg cleared up and began to heal.

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25. ELECTRIFIED ZINC

"Tonic medication is a method of treatment in which electric currents are used for their power of setting constituents of a saline solution in orderly motion in a definite direction. From the point of view of electrical conductivity, the tissues of the body may be regarded as a saline solution, and the laws of the conduction of electricity in solutions may be applied to the interpretation of the effects of currents traversing the tissues. Ionic medication is used for the introduction of drugs into superficial parts of the body through the surface, and also for modifying the chemical constituents of the parts of the body, such as joints, fibrous tissues or nerves, by the setting up of chemical interchanges throughout their substance."

H. Lewis Jones 1914

"This ion [zinc] is an antiseptic of the first rank, and when applied electrically it can be made to penetrate the tissues of the skin to any desired depth. There is no wound or ulcer which cannot be disinfected by its employment provided its surface can be reached by the electrodes."

Stephane Leduc

Zinc is a trace element in nature that is necessary to the health of plants. It is present in small amounts in the human body, and is a key element in several enzyme systems. There are areas of the world where people's growth is mysteriously stunted. It turns out that the lack of zinc in the soil is the cause of the stunted growth.

Dupont scientists once tested a series of metallic ions to see if any had an effect on viruses. They found that zinc ions inactivated the common cold virus. Scientists investigated a mysterious healing ability of an African tree on liver disorders. It turned out that the leaves had an exceptional amount of zinc—the mysterious healing factor.

Stephane Leduc did a careful study of ionic medicine. He found that solutions of zinc salts were the best disinfectants. He used a zinc salt solution for chronic ulcers and abscesses caused by tuberculosis. He would surround a zinc pencil with a lint pad soaked with zinc salt. The current was increased until it was as strong as the patient could comfortably bear.

The zinc ion works in skin infections such as boils, carbuncles, and ringworm. Dentists electrically applied zinc to control gum infections and save the teeth. Copper ions have been used in gonor-

rhea and sycosis, but zinc works just as well, and it doesn't irritate the body so much. Silver ions do not penetrate far and have no advantage externally over zinc or copper.

The treatment is normally made with a solution of 1 or 2% zinc chloride or zinc sulfate. The positive pole contains the pad soaked with zinc salts. The ions migrate towards the negative pole, which is placed on any convenient place on the body.

In 1908, A. A. Doyle reported on the treatment of seven cases of chronic leg ulcers by ionic medication. He applied Vaseline to the areas around the ulcers, which he didn't want to treat. In one case an ulcer, lasting 14 years, was healed after a single treatment of electrically applied zinc. He wanted to compare the effects of different ions, so he used a divided pad of zinc and copper salt was placed over an ulcer. The zinc half healed much faster. He found that the best current strength was 2.5 ma. per square centimeter for two to four minutes.

When he treated a leg ulcer, he found out that the patient had an anal fissure. He wrapped a zinc rod in lint soaked in zinc chloride and used a current of 15 ma. for 12 minutes. A week later, the ulcer was much reduced in size. A second treatment was given, and the ulcer healed ten days later.

Doyle treated two cases of bedsores. He tried silver nitrate, for this is strongly antibacterial, but it caused a great deal of pain. Zinc healed the bedsores, which had resisted other treatments. He treated an ulcer on the inside of the cheek of a patient, which healed rapidly.

A man had a gall bladder operation but the incision broke down, and ulceration was rapidly spreading in all directions. It extended to five inches by nine inches and was profuse and foul smelling. The positive electrode was applied to a cotton pad containing a 2% zinc sulfate solution. A large negative electrode pad was applied to the man's back. A ten-minute treatment was given, and two days later, a striking change took place. The inflamed zone subsided, and the discharge was less profuse and almost odorless. The temperature of the patient fell. The treatment was repeated eight times every five days. The ulcer completely healed.

Rodent ulcers are rough-looking skin ulcers, which usually resist healing. They were first treated with zinc salts in 1905, and a single treatment generally healed them in two to three weeks. They have been treated with X-rays, surgery, and radium, but the only thing that really works is electrically applied zinc. Some inflammation occurs after treatment, and it is necessary to wait two weeks before doing a second treatment—if necessary.

Small cancerous growths were treated with zinc ions. A zinc needle was put into the growth, and it was covered with a zinc salt pad. After zinc was driven into the growth for an hour or so, the growth would become gray and slough off, leaving a healthy wound to heal by granulation. Six cases responded completely to a single treatment and eight cases responded to three treatments or less. Five other cases required more electrical treatments.

H. Lewis Jones once treated a cancer of the nose with zinc ionization. Three weeks after treatment, the ulcerated nose completely healed and the woman returned to normal.

A zinc needle with a pad of zinc salt was used to treat corns. The captain of a woman's hockey team at Oxford was troubled by a painful corn. Zinc treatment quickly removed it. Warts were removed after a minute's treatment with zinc.

Moor's ulcer of the cornea is slow to heal; its damage to the cornea can result in blindness. In 1907, H. Lewis Jones treated a patient with it at St. Bartholomew's Hospital. Months of treatment hadn't helped, so he introduced zinc ions to the eye using a current of 1 ma. for one minute. Both ulcers began to heal rapidly and were completely cured in a month. Other cases of eye ulcers responded in the same way, although the current was generally applied for several minutes.

Moor's ulcer seems to be caused by bacteria. The organism is probably killed or inactivated with the zinc ion. The eye is given local anesthesia, then a wool pad dipped in 1% zinc sulfate is applied. The positive electrode is held against the ulcer and the current is applied for several minutes.

Zinc ions were used to treat keratitis and ulcers of the eyes. A local anesthetic was first applied to the eyes. Then a 0.5% solution of zinc sulfate was applied to the eyes. The treatment lasted from 60-90

seconds. The patient was sent to bed to rest the eyes. Usually improvement could be seen by the second day.

A miner had a three mm. ulcer of the eyes. Current was applied for two minutes, resulting in pain for two hours. Seven days later, the ulcer had completely healed. A mason was treated for eye abrasion, which developed into an ulcer. There was little pain and the ulcer was gone two weeks later. The average time of healing of 27 cases of corneal ulcers was 17 days.

Dr. Margaret A. Cleaves recommended using zinc ions for treatment of vaginitis, leucorrhea and other conditions using a special douche electrode. Dr. Samuel Sloan published a full account of ionic medication in gynecology using zinc ions, although copper, mercury, and hydrastine are mentioned. The zinc ion is said to be an effective treatment of endometriosis when applied for 20 to 30 minutes.

Ear infections are often terribly difficult to conquer. Medicine cannot always get into the pockets of the ear in which the infection hides. The ear is carefully cleaned, then a cotton pad dipped in a solution of zinc sulfate is put in the ear and attached to the positive pole.

Zinc iodide was a good treatment for middle ear catarrh. A 3% solution was put on a cotton pad. During the treatment a current is reversed several times. A positive current carries the zinc into the ear, and then a negative current carries the iodine. This salt clears up resistant ear infections.

A 45-year-old woman had deep pus pockets around the upper and lower molars, where the discharge was greatest. The teeth were loose and probably needed to be pulled. She was given 12 treatments with zinc ions over five weeks. Then she got one treatment a month until she was completely cured.

A 55-year-old man lost all his upper and lower molars from pyorrhea. His front teeth had pus pockets and were loose. After eight treatments of electrically applied zinc, his teeth were firm and healthy.

In 1927, Demetriades demonstrated to the Vienna Eye, Ear, Nose and Throat Clinic a way of treating rhinitis, which he termed "iontophoresis." The nose was packed with cotton saturated with zinc and calcium salts. The positive pole was connected and 2-3 ma. of current was used to treat hay fever and nasal congestion.

Philip Franklin modified the method by using 1% zinc sulfate for the electrolyte. He applied a positive electrode for 20 minutes. In 1931, he reported on 22 cases of hay fever and three cases of nasal inflammation. He found that most cases required two ionizations for complete relief without side effects.

Harold L. Warwick mixed zinc and tin salts to give better results with less irritation. He first anesthetized the nose and then used electricity for ten minutes. When the current was turned on, there was a metallic taste and increased saliva and tears. The nasal tissue became gray or whitish after treatment. The patient might have itching, watery eyes, and sneezing, but the experience was short. All allergic reactions were gone the next day. He found that 31 of the 40 patients required one treatment for complete relief; 7 required two treatments. This offered relief for one to three years. The patients also lost their sensitivity to food allergies.

The treatment was used on frontal headache, pain in the jaw, and increased nasal discharge when lying down. A wire shaped like a hairpin was wrapped in cotton soaked in zinc salts. The most current that could be used was 5 milliamps. The current had to be raised and lowered slowly or it would make the patient dizzy.

If one is allergic to something, the allergist will probably try to remove the offending substance or try to make the patient insensitive to it. Most allergists use gradually increasing shots of the offending material to desensitize people. The success isn't that great, and the treatment is often continued for years.

Dr. Abraham Hollender used a mixture of glycerin and 0.5% to 1% zinc sulfate in the nose. He found that it was best to treat one nostril at a time, so there was less irritation. The current produced a gray coating that disappeared after a few days. There is marked relief from breathing discomfort in three to seven days. The improvement lasted from several weeks to several years. In 32 cases of allergies, about half were relieved of all symptoms for a prolonged period of time.

A woman was operated on for a chronic nasal condition on the left side of the nose. Three years later, she still had profuse discharge from the left side. A single treatment with zinc ionization resulted

in relief for nine months. When she returned, a second treatment resulted in freedom from symptoms for two years.

A housewife had symptoms of vasomotor rhinitis for five years. She was sensitive to house dust, but desensitization was ineffective in bringing about relief. After zinc ion treatment, there was complete long-term relief.

A student found that swimming produced symptoms of a severe cold with sneezing and tears. Zinc ionization produced complete relief of these symptoms.

Most people suffering from hay fever received marked relief, and often a single treatment would last the entire season. It was rare to take more than two treatments to produce marked relief. Sometimes the treatment would last several years. Generally a single treatment at the beginning of the season produced relief for the whole season.

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26. BENEFICIAL IONS

"[An electrolytic solution is like] a ballroom containing dancers united in couples, which represent the neutral molecules, and a certain number of isolated ladies and gentlemen, who represent the dissociated ions. There is a large mirror at one end of the room, and at the other end a buffet supplied with champagne and good cigars. The ladies make their way to the mirror, while the men go to the buffet, and the dancing partners separate to follow the movement. The room presents the picture of an electrolytic solution at the moment when the current is passing."

H. Lewis Jones 1918

Water was first separated into hydrogen and oxygen in the year 1800, just after the battery was invented. The process of separating compounds by means of electricity was not understood until Michael Faraday invented new terms and described the process.

Ionic medication will never supplant oral application or injection, but can carry charged substances into the areas where they are needed. The electrically carried ions travel through the plasma of every cell through which the current passes. The current needs to be turned on and off gradually for the safety and comfort of the patient. If the face and head are treated, rapid current changes result in dizziness.

Positive ions travel to the negative pole and negative ions to the positive pole. Zinc, copper, and sodium are positively charged and repelled from the positive terminal. Negatively charged groups such as sulfuric, iodide, and salicylate are repelled from the negative terminal and driven to the positive terminal.

The pain of gout is due to sodium urate crystals in the joints. Sir Alfred Garrod (1819–1907) showed that the crystals could be dissolved by soaking them in a solution of lithium carbonate. Too much lithium in the body produces toxic symptoms. When lithium salts are taken by mouth, the stomach turns them into lithium chloride which doesn't work well as a solvent of uric acid.

In 1890, Thomas Edison had a man put his right hand into a 2% solution of lithium salt and his left hand into a dilute solution of sodium chloride. The positive pole drove lithium into the body which showed up in the urine. He treated the hands of a gouty man with lithium salts. The swelling of his hand and fingers diminished and pain completely disappeared.

In 1895, Miss E.P. was hardly able to walk, because her right knee was so stiff and painful. Her finger joints were so bad that she had to give up needlework. After lithium ion treatments, she could walk well and use her hands for sewing without pain. She continued to have problems, but she was able to live with them.

Laborat studied ways of electrolytically reducing urate crystals. He implanted urate crystals into the paws of a rabbit and then applied lithium to the area. He found that large crystals were steadily reduced by the electric current treatments. He used an alkaline solution of lithium chloride. He wrapped the toes or joints afflicted with gout with cotton soaked in lithium solution. He applied a positive current for 40 minutes. The first treatments usually reduced the pain, redness, and swelling.

Stephane Leduc began formal treatment with a wide variety of ions in Nantes, France in 1900. He presented a paper at the International Congress of Electro-biology and ion therapy was officially born. Many doctors read his papers and tried ionic medicine.

Leduc treated the painful eye condition of iritis by soaking cotton with salicyclates and potassium iodide. A negative electrode was applied to the eye, and the positive electrode was applied to any part of the body. The current to the eyes was slowly turned and increased to 5 ma. After 15 minutes, it was reduced. The eyes received two to three treatments per week. Usually pain and swelling rapidly disappeared.

Copper is the most fungicidal of the metals and can be used for infections. Until 1940, copper salts were used for the treatment of chronic cervicitis. The copper has a toxic effect and the area to which it was applied sloughed off about a week later. The treatments were repeated at intervals of 10 to 14 days.

One of the important applications of 'ionic surgery' was the treatment of fungus infections of the hands and feet. Athlete's foot is particularly difficult to treat. The fungus embeds itself deep into the skin, and topical remedies don't penetrate enough to kill it. After the person stops using the ointments, the athlete's foot fungus returns to the surface and the cycle goes on.

Copper is highly toxic to fungi, but soaking the feet in copper sulfate doesn't do any good. Electrically applied copper was tried in

37 patients with dermatophytosis with long-lasting infections. They soaked their feet in enamel pans for 20 minutes while a current of 6 ma. was applied. A special circuit slowly built up the current when the hands and feet were immersed. This took care of shocks.

The average number of treatments to stop the problem was about six, but the total number of treatments ranged from four to 18 over eight weeks. A few people weren't cured, but the feet were greatly improved, and the cure simply took more treatments. The doctors tried treating only one foot in several patients as a check, but the other foot didn't improve in a common salt solution. After a few copper ion treatments, the feet began to stop sweating.

One patient had vesicles on his feet for 25 years. He walked on crutches for seven months and had been unable to do much of anything, because of blisters on his hands. When copper ionization was applied to his hands and feet, improvement was rapid and steady.

In 1858, Theodore Clemens began using the electrical treatment of iodine to treat small skin tumors, goiters, and itching. Iodine has a good effect in treating scar tissue. Sometimes this results from an injury or operation and there is constant pain. A housewife had an operation to remove a bunion, and her scar gave her real pain while walking. Gauze pads were covered with an iodine solution and applied to the negative pole. The current was gradually increased and held constant for 20 minutes, causing warmth and mild tingling. After five treatments, most of the pain went away and she experienced a full range of motion.

Dr. William Rolfe experimented with treating pruritus ani with ions. Itching around the anus is common and difficult to treat. The patient washed the area with hot water and soap. A 2% solution of Lugol's iodine solution was used at the negative pole. Treatments twice a week for two to three weeks usually cured the problem. A mild current of 2-3 milliamperes was gradually increased until the patient felt discomfort. If iodine didn't work, then zinc ions were used.

Silver is a very powerful antiseptic, but it doesn't travel well with electric current. Skin infections were treated with cotton soaked with 2% silver nitrate. Nine of 20 patients showed a sustained improvement after applying a 2 ma. current for five minutes.

Silver generated at the anode by weak electrical current is extremely effective for inhibiting bacterial growth in vitro. Silver compounds have a little toxicity, but the skin darkens in light, for this is like photographic film. Colloidal silver seems to have little effect.

Robert Becker discovered the power of silver ions in an unusual way. He treated a soldier who broke both legs in a car accident. The hospital put the soldier in traction with pins to hold the bones together. The pins had to be removed due to infections. The man lay in bed for over a year unable to leave the hospital. He grew despondent and angry. Silver wire electrodes were put into the injury, and the infection went away and the fracture began to heal. Silver salts didn't work, but the current injected the silver ions over a wide area and took care of the infection.

The worst forms of infection take place in injuries involving the bones. Antibiotics often fail to reach the hidden infections, and the injury never fully heals. A silver anode is put into the injury, and a weak current is applied. The bacteria are killed without significant injury to the tissue. This treatment was successful in 12 of 14 people with bone infections.

Some people have severe problems with sweating of the hands and feet, which is so severe that it interferes with social activity and leads to ostracism. Sweat glands respond to emotion, and sweating is increased by pilocarpine and inhibited by atropine. A series of ionic solutions were tried in persons with sweating problems. A solution of 0.2% copper sulfate resulted in 48% cures, and significant improvement in 25%. Aluminum chloride was tried in 15 patients. Ionic transfer reduced the sweating in five to 13 treatments. Plastic trays were filled with tap water and mixed with aluminum salts. The current density was slowly increased and then decreased at the end of the treatment. It was continued until the hyperhidrosis disappeared.

It is known that taking large amounts of magnesium orally will often get rid of multiple warts. Magnesium salts could be used to treat multiple warts or erysipelas. The back of a woman's right hand covered with warts. A pad with a solution of 3% magnesium sulfate was applied, and the positive pole was connected to it. A current of 5 ma. was passed for 15 minutes. A week later, another treatment was given, and the mass of warts disappeared two weeks later.

Glaucoma is a serious disorder in which the eye pressure rises far above normal. The outward curve of the eyes is maintained by pressure, and a pressure that is too high damages the optic nerve and the light receptors. Calcium iontophoresis was used to treat chronic glaucoma.

Low blood calcium is favorable for the development of cancer. High calcium supplements are used to treat the pain of cancer. Calcium is a carrier of oxygen, and cancerous tumors thrive on low oxygen surroundings. Calcium salts can be injected into the cancer or transferred into it by electricity. Calcium ionization was used to treat three cases of breast cancer in France.

A 1% solution of calcium chloride was added to distilled water. The positive electrode was attached to a special pad in the mouth, and the negative electrode was attached to the lower neck. There was rapid recalcification of the jaws and weak areas of the teeth. There was rapid repair and reduction of pain.

A solution of common salt can be used electrically to treat several conditions. Cotton wool saturated with a 1-2% solution is wrapped around the part to be treated. The current is slowly increased to the level of comfort.

A soldier had ankylosis (bending and stiffness) of the fingers after a hand abscess. He was treated in a military hospital for six months by different methods, but nothing worked. The cathode was applied to the solution of salt. After 30 minutes with a current level reaching 30 ma., he completely recovered the power of movement.

The knees of a forester became completely immobile with arthritis. Over a two-month period he took nine electrolytic treatments lasting 40 minutes. This enabled him to walk normally. After recovering from typhoid fever, a young woman found that her knee joints would no longer bend. She took 12 electric treatments with a salt solution applied with a cathode on her knees. The pain and immobility disappeared.

A 70-year-old woman suffered from pain in the lower back as a result of a fall. The "lumbago" became so severe, that she could only walk a short distance. She took diathermy treatments and this helped, but the pain came back. Electrically applied salt treatments almost completely relieved the pain and she had no return of the complaint.

A woman suffered since childhood from painful feet. She could only walk a short distance. The doctors called it "rheumatism of the feet," and couldn't treat her successfully. A few ionization treatments applied to the soles of the feet restored her ability to walk normally.

A positive disc electrode soaked in salt solution was used to treat Bell's palsy. It was moved across the face over the branches of the trigeminal nerve. The negative pole is attached to the underside of the ear. A few treatments caused a remarkable change in facial paralysis.

A baking soda solution has been used to treat inflammatory swelling of the hands. A half teaspoonful of sodium bicarbonate is put into a jar filled with warm water, and the positive electrode is put into it. The other hand is put into a jar with the negative electrode. The current is gradually increased from zero to 10 ma. and maintained for 10 to 20 minutes. After a few sittings, the hands are often greatly improved.

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27. FARADAY TAKES THE NEXT STEP

“He [Michael Faraday] plays like a magician with the earth’s magnetism. He sees the invisible lines along which its magnetic action is exerted, and sweeping his wand across these lines evokes this new power. Placing a simple loop of wire around a magnetic needle, he bends its upper portion to the west; the point of the needle immediately swerves to the east; he bends his loop to the east, and the needle moves to the west... And then his thoughts suddenly widen, and he asks himself whether the rotating earth does not generate induced currents as it turns round its axis from west to east.”

Professor John Tyndall 1890

Michael Faraday was born in the slums of London in 1791, where his father was a blacksmith. He was a cockney and had to learn standard English. He had no schooling and was apprenticed to a book-binder at 14 years of age. He began to educate himself by studying the books he was binding. He attended lectures and determined that he would pursue a career in science.

After attending a set of lectures by Sir Humphry Davy, Faraday sent him a beautifully bound set of notes and asked for a job. In 1813, he was hired as an assistant at the Royal Institute of Science, where he spent the next 54 years. He was put to work as a bottle washer; then he became a laboratory assistant and finally the superintendent of apparatus. In 1821, he wrote his first scientific paper and became a fellow of the Royal Society three years later. In 1825, he became director of the laboratory and gave regular lectures on scientific subjects for the members.

Faraday was a deeply religious man who joined the Sandemanian sect in 1821. John Hutchinson founded this in order to follow the Bible perfectly. Sandemanians didn’t believe in wealth, and the members lived simply. Faraday was poorly paid, although he did receive money from his books and lectures. The sect was strict, but members didn’t renounce the theater, novels, or alcohol, provided this was done in moderation.

Faraday seldom talked about religion, although he was a Sandemanian preacher. One Sunday he was invited to have lunch with the queen, so he missed the church service. He was told to repent, but when he refused, he was expelled from the church for a time.

Only about 100 Sandemanians lived in London; perhaps another 500 in Britain. The group wanted to be a pure gathering, so they excommunicated the impure members. Eventually only a few pure believers were left, and they gradually died off. John Hutchinson, the founder, believed that the Father, Son, and Holy Ghost corresponded to fire, light, and air. In 1844, Michael Faraday speculated that God might have spoken "power into existence," around the points in space making up atoms. Faraday felt that by discovering the laws of nature, he was discovering the laws of God established at the creation.

By age 50, he was the grand old man of British science. His traditional Friday night lecture was well attended by the upper class of London. When he died in 1867, there was no funeral service, because the Bible didn't specify one! It was a tradition to bury the great of England in Westminster Abbey, but the family wouldn't allow it. By 1931, there were so few Sandemanians remaining, that a memorial tablet was placed in Westminster Abbey.

Much of his scientific studies were connected with electricity. In 1821, he showed the magnetic rotation of current in a magnetic field. William Wollaston suggested the idea, but he couldn't demonstrate it. He made a magnet rotate endlessly around a wire, giving rise to the idea of an electric motor. In 1870, Zenobe Gramme invented the ring armature and made a practical motor.

Hans Christian Oersted discovered that a current-bearing wire possesses a magnetic field, and will deflect a compass needle. André-Marie Ampere worked out the relationship between electricity and magnetism between the years of 1820 and 1826. The "ampere" became the unit of measuring electric current. Ampere had converted electricity into magnetism, but Faraday converted magnetism into electricity. George S. Ohm taught school at Cologne, Germany. He found that the current in a wire is proportional to the voltage and is inversely proportional to the electrical resistance. The combined work of these men brought electrical science into being.

In 1831, Faraday wound 200 feet of copper wire around a block of wood and used another 200 feet to make a second winding. He attached a battery to the first copper winding and a galvanometer to the other one. When he closed the switch, there was a sudden movement of the galvanometer. He hoped that the meter would show current flowing continuously through both windings. Current flowed in the second coil of wire only when the first coil changed. He had discovered the basic principle of the transformer.

He devised experiments to show that a magnet or magnetic field could produce an electric current. He showed that the essential link in the generation of electricity was a moving magnetic field. The output of his simple induction machine was alternate positive and negative pulses of electricity. The simple machines from his experiments were the first sources of low-frequency alternating current, but this was not a sine wave current.

He introduced the idea of "lines of magnetic force" in 1831, and showed that wires cutting the lines of force induced a current. In his notebook, he asked whether the rotating earth generates induced currents as it turns around its axis from east to west.

He began to study the magnetic properties of gasses by blowing bubbles of oxygen and nitrogen between a magnet. Oxygen bubbles floated over to the magnet while nitrogen bubbles floated away.

Faraday is considered the father of alternating current, although the term "faradism" refers to pulses generated by coils from making and breaking direct current. This provided the first source of low-frequency alternating current.

By 1834, two good electrical generators had been made that resulted from his experiments. Joseph Saxon's generator gave powerful shocks and heated a platinum wire. Hippolyte Pixii showed that he could decompose water and charge a Leyden jar with his generator.

In 1842, Joseph Henry suggested that the phenomena accompanying the discharge of a Leyden jar include oscillation. In 1850, Bernhard Feddersen found by using a rotating mirror that a spark discharge oscillated in a millionth of a second. He was the first to show that a high-frequency oscillation could exist. Joseph Henry was able to obtain oscillating current in a sustained manner and aroused interest in rapidly alternating currents in 1866.

Faraday was the source of two distinct electrical revolutions. He invented the word *electrolyte* to describe any substance which can be broken into parts with an electric current. The process of decomposition was called *electrolysis*. The positive electrode was called the anode, and the negative one was the cathode. The anion and cation were produced at the electrodes.

He had become the Linnaeus of electrochemistry. The word anode means “up road,” and cathode means “down road.” He asked William Whewell for advice on terms that would accurately convey the experimental situation. Electrode, ion, anion, cation, anode, electrolysis, and electrolysis are the products of this work.

Faraday didn’t apply his work to medicine, but he mentions two doctors in his notes. One was simply a correspondence; the other was a doctor who maintained that there was no difference between sulfuric and nitric acid. Faraday remarked, “Without a knowledge even of the first requisites to an honorable but dangerous profession, he assumed to himself its credit and its power, and dashed at once upon human life with all the means of destruction about him, and the most perfect ignorance of their force.”

Faraday didn’t use his discoveries for medicine, but Dr. Golding Bird did, when he established the electrical department at Guy’s Hospital. In 1847, he referred to Faraday’s contribution as: “The next mode of exciting electricity is of late discovery—one of the many contributions to physical science for which we are indebted to the talents of our illustrious countryman, Dr. Faraday. It furnishes us with large quantities of electricity of tolerably high tension, and possesses advantages for medical purposes which no other mode of exciting electricity affords.”

His work was used by Guillaume Duchenne, who in 1855 published *De L’Electrisation Localisée*. He used Faraday’s inductorium to study the actions of muscles in disease and paralysis.

The next person to use the discoveries to study the body was Hugo von Ziemssen, who used the inductorium to make the first motor-point chart. The motor points are sites where the least amount of current is required to stimulate a muscle group. The inductorium is an electrically driven coil with a make-break train of waves called a faradic stimulus.

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28. FARADISM

"Before I conclude, I would beg one thing (if it be not too great a favor) from the gentlemen of the faculty, and indeed from all who desire health and freedom from pain either for themselves or their neighbors. It is, that none of them would condemn they know not what; that they would hear the cause before they pronounce sentence; that they would not peremptorily pronounce against electricity while they know little or nothing about it. Rather let every candid man take a little pains to understand the question before he determine it. Let him, for two or three weeks (at least) try it himself in the above named disorders. Then his own senses will show him whether it be a mere plaything, or the noblest medicine yet known in the world."

Desideratum John Wesley 1760

Faraday's experiments produced the inductorium, resulting in an alternating current pulse by making and breaking the primary current. Henry Letheby was a lecturer in chemistry at a London hospital. He designed a version of the induction coil in which the electric current traveled in only one direction. He used a pair of spoked wheels so the current from the "make" or "break" would pass in a single direction. This was similar to the Leduc current.

Dr. Golding Bird was busy at the 'electrifying room' at Guy's Hospital. He had a static machine, a Leyden jar, and a battery. He began to use the induction coil more often on patients. He kept careful records, and every effort was made to see exactly what electricity did. There were so many patients waiting to take electrical treatments, that careful studies were nearly impossible.

Most of the patients at Guy's Hospital took off as much clothing as necessary, and sat with wet feet over a sheet of copper attached to one electrode. The other electrode was a sponge soaked with salty water applied to the area of the body to be treated. During treatment the movable electrode was moved back and forth over the affected part. If it was removed there was a shock. The current strength was gradually increased. A certain amount of fluctuation of current was unavoidable, as it was impossible to maintain an exactly uniform pressure.

In 1841, Bird wrote a report on the value of electricity in the treatment of disease. Nearly all cases of cholera were helped. Many

of the women at the clinic were treated for lack of menstruation or irregular menstruation. He cured 20 of the 24 cases coming to the clinic. He found that electricity was useful in treating facial paralysis and paralysis of the limbs.

Nearly a century later, in 1933, a review was made of work in the electrical department since WWI. The department now had diathermy, surged current, and the Morton current. Of 4,000 patients, 2,000 had been cured and 1,000 improved. Many of the patients suffering from the pain of trench foot had immediate relief from diathermy and electricity.

Faradism was usually produced with low-voltage and low-frequency alternating current. Back trouble was treated with a moistened pad electrode of 4 × 6 inches placed on the abdomen, and another of equal size directly opposite on the back. The alternating current was surged with gradually increasing strength until definite contractions of the abdominal wall were evident. The contractions were synchronized with the speed of breathing, about 20 breaths per minute.

Faradism was most useful when patients had obscure pains in the back, buttocks, or thighs. James Mennell applied the dispersive electrode anywhere. Then he used the movable electrode to probe the sensitive area and increased the current until the patient could feel it. When the sensitive spots were found, they were marked with a red pen. He would treat the sensitive areas with ultraviolet light. Often this alone would result in marked relief.

Mennell stroked a tennis elbow until the patient said: "There it is." He put an electric pad above and below the sensitive area and applied current until the muscle contracted. This produced a soothing effect on sore muscles.

A woman was in a car accident that resulted in pain in her back, which kept her awake all night. Diathermia and galvanism did little to relieve her pain. A dispersive electrode was placed under the arm, and the moveable electrode was adjusted so it could just barely be felt. The entire area of the back was tested, and the painful area was located between the first lumbar vertebra. When the sensitive spot was found, the electrode was kept over the area, and a strong current was briefly applied. She had immediate relief; eventually there was a complete cure of her condition.

Doctor Henry Hales treated 40 cases this way including neuralgia of several weeks duration and severe headaches resulting from influenza. The treatment was almost painless, and the percentage of success was high. The test was also used to detect fakes. The patient was prevented from seeing what was happening over the back. The real patients had pain in the same places each time. The fakes had a wide divergence in the site of pain.

In spastic conditions the muscles are continuously pulling together. A dispersive electrode is put on any part of the body to be stimulated. A faradic current is applied at 100 hertz to give tetanic contractions.

A young man had paralysis and spastic contractions in the upper left shoulder and lower left leg after an auto accident. Four months of treatment restored the motions of the shoulder and elbow. Electrical stimulation and submerging the hand and wrist in hot water for 15 minutes resulted in slow improvement.

A 46-year-old man with multiple sclerosis developed progressive marked spasticity of the upper and lower body. Electrical stimulation allowed him to stand on crutches and walk with a little help.

The famous neurologist Joseph Babinski (1857–1932) demonstrated faradic currents to his classes. He would treat people with tabes and severe ataxic phenomena who could scarcely walk. After faradic stimulation, they could walk better.

The currents shouldn't be interrupted more than once or twice a second, because the periods of rest between stimuli are too short. Prolonged contraction with rest quickly fatigues the muscles and is harmful. Pain and fatigue indicate that the currents are too strong. If the intensity of the current is increased rapidly the patient feels pain. After the patient is comfortable, infrared light is used to warm the parts.

In some conditions the faradic current is interrupted infrequently. The muscle has a single strong contraction instead of the tetanus produced by higher frequency current. In treating incontinence of urine, the indifferent electrode is placed on a pad on the lower back. The active electrode is the size of a small button. It is placed on the perineum, the triangular area between the anus and the sexual organs.

An eight-year-old boy had to urinate frequently and always wet his bed. After three applications, he showed marked improvement; he was cured after eight treatments.

A six-year-old boy suffered from infantile paralysis. He had urinary incontinence day and night. He was treated by infrequently interrupted faradic currents for 20 minutes every other day for six weeks. There was improvement during the day after ten treatments, and he became normal after six weeks of treatment.

A nervous eight-year-old girl passed urine involuntarily with the slightest excitement. After six weeks of treatment, she improved. The treatment was discontinued for a month, and then was resumed for another six weeks when she was determined to be cured.

The treatments were also used for anal incontinence using two electrodes placed together in the high side of the anus. The pulses were increased until there were marked contractions of the sphincter muscles; the stimulation enabled function to become normal.

The stimulation produced by faradic currents often cured or helped kidney disease. A man suffered from stomach indigestion and back pain. His urine had a deep color with 5% albumin in it. Faradic current was applied 70 times to the area of the kidneys. This resulted in only a slight trace of albumin.

A woman suffered from headaches and dizziness. Her urine was scanty with much pricking and itching. After 38 treatments with faradic currents and vibration, she had completely recovered.

A faradic current was generated at 100 hertz from an induction coil to give the maximum motor response. The treatment alters the nerve response. The general health improves, and the clouds of black thought lifts.

A woman suffered from telegrapher's cramp [repetitive fatigue syndrome]. There was severe pain in the right arm, shoulder, and fingers. She had been a tennis player, but had to give it up. Massage and diathermy were tried. The doctor believed that further stimulation of the nerves was wrong. Many diathermy treatments didn't work, and as a last resort, low-frequency treatment was tried. The dispersive electrode was placed on the neck and the active electrode was moved slowly down the arm. She was able to resume work and continued with one treatment a week for the next six months.

A healthy athletic lawyer developed brachial neuritis in the arm and fingers and couldn't sleep even with sedatives. Diathermy didn't work, and massage only increased the pain. After four treatments of faradic current, he had considerable relief. He took a vacation, and the rest restored his condition to normal.

A woman had some infected teeth removed, but intense pain developed on the sides of her left index finger. The pain was severe and sleep was impossible. After two treatments with faradic current, she had relief. Nine more treatments restored the finger to normal.

Faraday looked into the promised land of alternating currents, but really didn't enter it. Faradic currents were the result of mechanical interruption of a battery, which generated an induced current. The interrupter was a vibrating spring that was attracted to an electromagnet and then bounced away. Entering the promised land required a different type of circuit. In 1842, Professor Joseph Henry called attention to the phenomenon accompanying the discharge of a Leyden jar. Research led him to suggest that it was oscillatory in character. This was confirmed by Lord Kelvin in 1855, and also Hermann von Helmholtz

A slowly interrupted current produces a sudden muscular contraction followed by relaxation. As the frequency is increased there is first tetanism of the muscles, then little feeling.

Frederick Morse of Boston made another form of alternating current. This was a sine wave generator that produced a current of 21,000 alternations per minute. It could produce wave variations; the surged current was used to treat bronchitis.

The new forms of alternating current were widely used in medicine for many conditions. A worker suffered a spinal concussion in a railroad collision; his left side partially paralyzed. A doctor gave him an unfavorable prognosis. Morse wave current was applied twice to the cervical and mid-dorsal regions of his spine. In two weeks, he was able to go home. Two months of electrical treatment cured him.

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29. SHOCK TREATMENT

"The subject was chosen for the first experiment of induced electric convulsions in man. Two large electrodes were applied to the frontal parietal regions. I decided to start cautiously with low-intensity current of 80 volts for 0.2 seconds. As soon as the current was introduced, the patient reacted with a jolt, and his body muscles stiffened; then he fell back on the bed without loss of consciousness. Naturally we who were conducting the experiment were under great emotional strain, and felt we had already taken quite a risk.

The electrodes were applied again, and a 110-volt discharge was applied for 0.2 seconds. We observed the same instantaneous, brief, generalized spasm, and soon after, the onset of the classic epileptic convulsion. We were all breathless during the tonic phase of the attack, and really overwhelmed during the apnea as we watched the cadaverous cyanosis of the patient's face. It seemed to all of us painfully intermittent. Finally, with the first stertorous breathing; the blood flowed better not only in the patient's vessels but also in our own."

Dr. Ugo Cerletti 1936

Ten years after the Leyden jar was invented in 1745, Richard Lovett claimed to have successfully treated mental illness by electric sparks and static current. John Wesley was so impressed by Lovett's electric treatment that he observed in 1759: "I doubt not but more nervous disorders would be cured in one year by this single remedy, than the whole English *materia medica* will cure by the end of the century."

Just after Volta invented the first electric battery, Giovanni Aldini tried it in a case of mental illness. Louis Lanzarini was a farmhand, living in a lonely dreamlike world. Aldini attached one wire to his face and the other one to his hand. The shock surprised Lanzarini. The next day, Aldini applied shocks through his ear, and the cure progressed rapidly. The man's melancholy disappeared, and Aldini took him into his house and helped him get a job.

Spontaneous seizures from whatever cause can cure catatonia and schizophrenia. Seizures can occur after alcohol intake and head injury. When barbiturates are withdrawn after prolonged treatment, seizures often occur. If the person happens to be mentally ill, a remarkable cure could result.

The origin of modern shock therapy began in 1934, when Ladislav J. Meduna studied the antagonism between epileptic convulsions and schizophrenia. A large-scale study found that epileptics didn't get schizophrenia. Meduna tried to inject camphor to give schizophrenics epileptic seizures. He began with a Budapest laborer who lay rigidly in bed staring into the distance. Catatonic schizophrenia was considered so helpless, that it was untreatable. Meduna injected an oily extract of camphor into the patient's right buttock. This produced convulsions, and a series of additional camphor treatments were given. After the fifth set of convulsions, the patient asked doctors where he was and if he could have breakfast.

Meduna treated five patients this way, and they all recovered. The injections were painful, and a long delay occurred before the seizures started. There were bad side effects, so he tried to think of other ways to give mental patients epileptic convulsions.

The researchers tried treating schizophrenics by putting them into an insulin coma. The blood sugar level fell so low after an injection of insulin, that it produced a type of shock. This didn't work well and was dangerous to the patient.

Ugo Cerletti and Lucio Bini decided to try electric shock. They went to a slaughterhouse in Rome where pigs were killed by electricity. Butchers took hold of the pigs with a large scissors-shaped pair of pincers. This was connected to two toothed electrodes enclosing a wet sponge. The pigs fell on their sides as the shock jolted them.

Cerletti tried applying current across the head, neck, and chest. He found that the chest current was the most dangerous and the head current was the least dangerous. The pigs normally regained consciousness in about five minutes and got on their feet.

Cerletti found that passing current across the body from hand to hand was more dangerous because it crossed the heart. He passed current from the mouth to the rectum. He found that the dangerous aspect was the duration of the current. A brief current could be endured safely, but a prolonged current killed.

The butchers slashed their necks so the pigs bleed to death while they were in shock. Pigs would recover from shock if they were not bled after about five minutes. Using the knowledge obtained by working on pigs, Cerletti and Bini decided to try this on a human patient.

Nobody knew who the first patient was, for he was completely irrational and schizophrenic. He was about 40, and wandered around near the railroad station. The researchers fixed two wet electrodes to an elastic band around his temples. They gave him a 70-volt shock for 0.2 seconds. The patient jumped and collapsed without a loss of consciousness. The patient shouted "Not a second. Deadly!" The voltage had been too low.

The scared researchers tried it again. This time a 110-volt discharge was sent through his head for 0.5 seconds. The muscles cramped and epileptic fits began to take place. The researchers were in their own state of shock—they didn't know if they were killing the man! After the convulsions, the patient came to and sat up. Ugo Cerletti asked: "What has been happening to you?" The man answered: "I don't know. Perhaps I have been asleep."

They gave him 11 shock treatments over a two-month period. He got better rapidly and supplied the data needed to identify him. He began to take an interest in his surroundings. He noted that the tire-some whistling in his ears that troubled him for years disappeared.

There was a great deal of concern that shock treatments might have some hidden danger. Two patients had slight cataracts, but they were pre-existing. There didn't seem to be any real problems.

In 1942, Lucio Bini tried shocking some patients several times a day. The "annihilation" method results in severe amnesia reactions that have a good influence in obsessive states, psychogenic depression, and in some paranoid cases. Several treatments daily were given for three to four days followed by a three-day rest.

A 36-year-old doctor had manic-depressive psychosis that lasted five months. After the first shock treatment, he hallucinated and felt that people were talking about him. After the second treatment, he quieted down and became depressed. A third shock treatment restored him to normal, so he was able to return to work.

A 20-year-old woman had severe tics involving her head, face, arms, hand, and legs. She had been sniffing, coughing, and grinding her teeth since age three. She felt tense and woolly in her head. After nine shock treatments, she felt nearly normal.

There was a curious study in 1945 by Boussinet and Jacob. After shock treatment, the blood plasma of shocked patients was injected into mental patients. Often there were remarkable changes in sleep and the general nutrition condition. The properties of shocked blood grow weaker and disappear in two months. They called the mysterious shock substance in the blood "Acoagonine."

The shock treatment was generally very simple. Some of the first treatments were nothing more than a normal 110-volt power line connected to a hand switch. The technician rapidly closed the switch and opened it by hand. It was just about the right amount of time needed to give a shock treatment. About half the schizophrenics subjected to the treatment showed a major improvement.

One doctor used a Model T Ford spark coil and a six-volt battery. He put one electrode on the forehead and the other on the nap of the neck. He used this to give ten shocks with a one-second interval between each shock per treatment. An enema was given before treatment, and breakfast was deferred.

A 34-year-old woman developed auditory hallucinations, and the voices told her to end her life. She was taken to the Psychiatric Ward of the Minneapolis General Hospital in 1939. After four treatments with the spark coil, her hallucinations left. After the sixth treatment, her speech and behavior became normal.

In 1973, the California legislature banned the use of electroshock. The law was struck down in the courts as an improper excursion into medicine. The famous book *One Flew Over the Cuckoo's Nest* has the story of the protagonist suffering both electroshock and lobotomy at the hands of his caretakers. L. Ron Hubbard unleashed a national attack on psychiatry and electroshock with the Church of Scientology.

There were considerable doubts about the treatment and the wisdom of shocking the brain. It has been called sledgehammer psychiatry which often produces prolonged memory loss in patients. Modern placement of the electrodes produces less memory loss. Shock treatment does work on people for whom nothing else has any effect. Modern drugs have reduced dependency on shock therapy, but they do not cure. Shock therapy often produces a long-term cure.

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30. WILLIAM MORTON APPROACHES THE FUTURE

"The high-frequency effluve fills the therapeutic indication demanded by clinical experience; it has an evident action upon the chemistry of respiration; it increases the respiratory capacity; diminishes the frequency of respiration, the production of carbon dioxide, the total amount of oxygen consumed and absorbed by the patient; as a result, it raises the coefficient of oxidation and lowers the coefficient of absorption. This action is not temporary; it continues even after the cessation of the treatment."

Henri Thielle 1905

"Electricity assists the innate endeavor by which nature tends to restore the sound state."

Tiberius Cavallo 1777

In 1879, William Morton traveled to France to study under the neurologist Jean Martin Charcot. He was greatly interested in electric treatment and studied the French electric therapies. Returning to New York in 1881, he brought two Holtz electrostatic generators.

He devised a special circuit with the static generator connected to two Leyden jars. He called this the static induced current, but it became known as the Morton wave current. The negative terminal was grounded, and a wet sponge or a metal disk electrode was connected to the positive terminal. The result was a pulsed static current acting like the violet ray current and having nearly the same therapeutic qualities. The current increased metabolism, promoted tissue drainage and stimulated circulation. If the spark gap was set a certain way, it could become a high-frequency sine wave.

The electrodes attached to the patient supply pulses of high voltage direct current, which is unidirectional and produces polar effects. This means that the negative electrode will generate hydrogen ions H^+ and produce an acid effect. The reversing sine wave current of the violet ray neutralizes the electrochemical charges.

Many early therapists believed that William Morton had beaten Professor Jacques-Arsène d'Arsonval in producing the first high-frequency currents. For the next 40 years, nearly every electrotherapist in the U.S. had a Morton wave current generator. Medical literature confuses the Morton wave current, the violet ray, and diathermy, by referring to them as "high-frequency therapy."

Static electrical treatment evolved through four steps. The first was the static bath used as a general sedative. The patient was placed on a well-insulated platform and the current was passed into the body. The patient felt little, except for a sensation of wind passing over him or her. Also, the patient's hair stood up.

The second means of treatment was the static spark. This began in 1734, when Abbé Jean Nollet began to use these in treatment. People can tolerate static sparks if they know when to expect them. Short sparks were used on the facial muscles, and long sparks were used on the big muscles or the main joints. A long spark could leave a mark like an old vaccination scar that lasted for several hours.

The third treatment was the static brush described in 1786 by Tiberius Calvallo. The negative pole is grounded, and the positive pole of the machine is attached to the patient; an ordinary whisk-broom is used to draw sparks to the therapist who is connected to the static machine. When it is held about two inches away, there are little sparks, feeling like a blast of hot sand on the area.

This form of treatment had a dramatic effect on sprains and fractures, and swelling often diminished during the treatment. An area of gout, too painful to be touched, was quickly soothed. Static currents raised the blood pressure when they were applied over the spine.

The fourth static treatment was the famous Morton wave current. The patient was placed on an insulated platform and connected to the positive terminal with a copper wire. The Morton wave current operator remembered the phrase "purple-positive." The sparks from the negative terminal were brighter and whiter. If the sparks flowed too rapidly, they caused tetanic contraction of the muscles; if they were too slow, there wasn't a full therapeutic effect. A rate of 120 to 160 sparks per minute for about 20 minutes was considered ideal.

The Morton wave current had the problem that all static generated currents had: the equipment got dirty and the voltage dropped. In damp air the voltage dropped, and occasionally the machines would reverse polarity so that the positive became a negative. The therapist had to check the polarity or the treatment would be less effective.

One of William Morton's first patients suffered from the shooting pains known as locomotor ataxia from syphilis. The 31-year-old man had pains in his nerves, constipation, urinary incontinence, and he was unable to stand with his eyes closed. After two months of electrical treatment, the shooting pains ended, urination was normal, and he was able to return to normal.

Morton treated a woman who was bedridden with severe migraines for a week each month for 15 years. She had daily headaches and was so despondent and nervous that she was hardly surviving. After two weeks of treatments, her headaches were mild and there was only a feeling of "congestion in the head." After three months of treatment, she began gaining weight and her constipation disappeared. Her tongue turned from a coated white to a normal red. After six months, her migraines were almost gone.

A 30-year-old woman showed the usual signs of rheumatoid arthritis. It affected her knees, and she became a near cripple. After daily treatments for three months, her hands and knees were almost normal. All of her joint swelling was reduced to near normal.

A woman suffered from abdominal cramps for five years. She consulted with her family doctor who advised surgery to remove the fibroid tumor. Her sister died during an operation for a fibroid tumor, so she didn't want it. The Morton current resulted in a symptomatic cure and a reduction of the tumor by a third.

The Morton current worked well on neuralgia. A Navy lieutenant was exposed to cold damp conditions on a torpedo boat. A dull aching pain quickly developed in his shoulder and arm. The arm felt asleep, and he suffered intense pain through the night. He began taking morphine and sulphonal to deal with the pain. When he came to William Morton, he had not slept for 12 days. After 15 minutes of treatment, he had no pain. The pain returned the next afternoon, but it was bearable. He got up only once during the next night. The treatments were repeated, and after two weeks there was a complete cure.

A 45-year-old doctor fell in a snowstorm and felt his back twist. By the next morning he had severe pain and his leg was cold. He began taking morphine and drinking whiskey to cope with the pain. Medical treatments failed to help him. After a 20-minute electrostatic treatment, he was able to sleep nearly all night. He was then able to walk, although he limped. After occasional treatments for the next six weeks, he was entirely cured.

A 60-year-old woman was subject to attacks of sciatic pain in both legs. She had gnawing, dull aching pain in the right leg and hip. This usually woke her up at 2 a.m. and kept her awake until morning. She took 16 treatments in four weeks. She then slept through the entire night without pain, felt lighter, and was able to walk normally.

The Morton wave current was tremendously valuable in first aid. A man sprained his ankle at his home in New Jersey. He hobbled to a taxicab on crutches. The static wave current was applied for 20 minutes. A static brush discharge was applied over the painful areas. He felt great relief from pain but there was still marked stiffness. Static sparks an inch in length were applied until the muscular tension was relieved. The patient walked out of the office carrying his crutches. Two additional treatments completed the healing.

An army captain was riding a horse when he was thrown on his left shoulder. His arms were bandaged to his side in a helpless painful condition. The static wave current was applied to the injured shoulder, and static sparks were applied to the tense muscles. After the first treatment he was able to move his arm and wear his coat. After three treatments, he returned to normal.

A worker was loading empty ten-gallon oxygen tanks onto a truck. One of the tanks happened to be filled with water, and he sprained his back. He was brought into the office in a nearly helpless condition. He was given the Morton wave treatment with long static sparks. There was prompt relief of pain, and with one more treatment, the problem was gone.

The Morton treatment was often able to cure kidney conditions. Dr. Alphonse D. Rockwell reported that four of five patients with albumin in the urine were cured by the static wave. A widow had severe indigestion and swollen ankles. She was given 20-minute treatments three times a week. The static current was applied to the liver, kidneys, and solar plexus. After three months of treatment, the casts disappeared from the urine. She felt well and was able to return to work.

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31. EDISON FUMBLES THE FUTURE

“You see, electricity puts into the tired body just what it most needs—life force, nerve force. It’s a great doctor, I can tell you, perhaps the greatest of all doctors.”

Nikola Tesla

“In the convalescence of the system from fright, mental panic and states of worry and suspense, there is no rival to electricity. When a man sees his business threatened with wreck, when he faces losses that spell ruin, when his every view of the future is through the bluest of glasses, when he carries his heart in his throat and the slightest turn of the market sends a knock-out blow to his solar plexus, the signs point to the fact that such a man needs electricity to tone him up. It can do it with an energy and promptness that will make him regret that he did not know it before. It is the nerve tonic *par excellence* of the *materia medica*.”

Electricity in Health and Disease Samuel Monell 1907

Thomas Edison’s father joined an unsuccessful insurrection against the Canadian government in 1837. As a result, he fled from Ontario to Milan, Ohio. He developed a prosperous shingle manufacturing business and then moved to Port Huron, Michigan. His son Thomas Edison was born at Port Huron in 1847. He had only about three months of formal schooling. He was largely self taught, and made his way by riding the trains to sell newspapers. By the age of 12, he was so deaf that he could only hear loud voices. He also acquired the habit of going for long periods without sleep.

He was said to have dramatically rescued the child of a telegraph operator from an oncoming train, and the grateful telegrapher taught him the art. The child wasn’t in real danger, and Edison knew the telegrapher, who probably would have taught him anyway. In 1863, he became a telegraph operator, and worked in 10 different locations with an average stay of about six months. He was often fired for lack of attention to his job. It was the time of the Civil War, and he was too young to join the army, but telegraphers were needed everywhere.

At one location, he found a large stock of abandoned equipment and began to think of making improvements in the telegraphy

devices. He found a Rhumkorff induction coil that produced high voltage alternating current. He used it to give strong electrical shocks, telling friends that it could cure arthritis, gout, and sciatica.

The first telegraph wires could only handle one message sent in Morse code. Edison made improvements that enabled the telegraph to send two, then four, and finally many messages at once. These inventions were tremendously valuable. It is costly to string up hundreds of miles of additional wire, when many messages could be sent over the existing wire. In 1870, he received \$40,000 for improving the stock ticker system. He set up a 50-man laboratory, and six years later moved it to Menlo Park, New Jersey.

While working on telegraphic experiments in 1875, he noticed strange sparks which he attributed to a new force. The "etheric force" was actually "electromagnetic waves" and the basis of radio communication. When he announced his discovery, scientists subjected him to great ridicule, so he didn't delve into that area again.

Thomas Edison was a little-known inventor until he came up with the phonograph. Nobody was working on it, and nobody seriously believed that sound could be recorded. This invention is all the more remarkable, since Edison was quite deaf. When it was announced, prominent scientists ridiculed him.

He took his phonograph to the offices of *Scientific American*, and so many people crowded into the office that the editor feared that the floor might collapse. It was taken to the capitol at Washington, D.C., where the entire congress crowded around this remarkable device. President Rutherford Hayes invited him to the White House, where they talked until 3:30 a.m.

The newspapers had ignored his telegraph inventions, but suddenly he was a huge celebrity. Horatio Alger books described the great genius, who started with nothing and parlayed simple things into great industrial inventions.

Alexander Graham Bell invented the telephone, but it was an impractical instrument with poor sound quality. Edison replaced the crude mechanical diaphragm with a carbon button microphone. The invention added clarity and made the telephone into a practical device that could be heard over a great distance.

Edison next turned his talents to electricity and lighting. He was not the inventor of the first electric light, but he did develop the first practical electric light. In order to light the lights, he had to develop a complete electrical system. During his life he patented 389 inventions dealing with electric lights and power. He had to invent light sockets, switches, fuses, fixtures, and meters.

Telegraphy was pulsed direct current, which Edison understood. When he began to work with power-generating equipment, he thought only of direct current. This resulted in a huge problem. The direct current at the generator might be 100 volts, but 50 miles away, it might be only 50 volts. The light bulbs burned brightly in the homes near the power plant, but they emitted a dim red glow at the end of the line. In 1882, Edison began manufacturing direct current generators, and in 1883, he began to manufacture electric lights.

George Westinghouse grew up in his father's machine shop in Schenectady, New York. At age 21, he invented a practical railroad air brake and began manufacturing it. This was a highly valuable invention, and he made a great deal of money. He bought the Tesla patents and began to manufacture electrical equipment.

There was a great struggle between the direct current Edison companies and the Westinghouse Company with alternating current between the years of 1885 to 1895. Although Edison lost a number of his linemen through electrocution, he believed that alternating current was exceedingly dangerous. Edison tried to get states limiting alternating current to only 200 volts. George Westinghouse knew that if the laws were passed, most of the advantages of alternating current would be nullified.

Edison tried another tack to win the struggle. His men convinced the State of New York to use "dangerous" alternating current for legal executions. In 1890, New York electrocuted William Kemmler at Auburn Prison, using a Westinghouse alternator. Doctors studied the first executions with electricity. There was a theory that the blood was forced to the head, resulting in death.

The Edison companies bought the rights to distribute electricity by alternating current from the Hungarian inventors. They also bought patent rights for another alternating current system from the French inventor Lucien Gaulard and John Gibbs. This system used

wiring in series, which produced problems. George Westinghouse bought the superior patents of Nikola Tesla, and the rest is history. Tesla thought that 60 hertz was best, so that is what we use.

Edison had several chances to recognize his mistakes, but he was obstinate. In 1892, two of his researchers were working at the Edison Laboratory on the effects of alternating currents. They noted that alternating currents above 2,000 hertz produced anesthesia. Above that frequency, the nerves became so deadened that pricking with a needle didn't cause pain. The higher the rate of vibration, the greater the anesthetic effect.

A young woman had a painful felon on her left forefinger. Electrical anesthesia was produced, and the fingertip was lanced. As soon as the current was detached, the painful sensation returned.

Edison was interested in X-rays and did a great deal of work on them. Seven weeks after starting his investigations, he discovered that calcium tungstate crystal fluoresced in X-ray beams. He made a simple device to view the feet, while the person tried on shoes. Many shoe stores had these devices, but they were quietly shelved as the dangers of X-rays were realized around 1950.

Edison experimented with X-rays in 1896 in hopes of restoring sight to the blind. If the retina of someone blind is intact, X-rays are seen as light. Edison conducted hundreds of tests on this idea. Nobody realized that X-rays were dangerous radiation at this time. His laboratory people developed headaches, vomiting, and diarrhea. Edison experienced difficulty with his eyesight, his skin began peeling, and clumps of his hair fell out. He stopped the experiments.

His assistant, Clarence Dally, wasn't that lucky. Cancer developed on his fingers and spread upward into his arm. Surgeons did several amputations, but he died from the cancer.

By 1888, Edison seems to have lost most of his huge ambitions when an associate swindled him out of a large sum of money, and he became a cautious defender of the status quo. In 1892, he engaged in a huge mining project spending \$2 million in seven years. The discovery of the rich iron ore deposit at the Mesabi Range in Minnesota ended the project. When Edison was asked about the project he said, "Well, it's all gone, but we had a hell of a good time spending it."

In 1897, Edison sat next to Henry Ford at a dinner. Ford told him of his plans for building gasoline-powered cars. "That's it, young man, keep at it," Edison said. Edison had plans for cars, too. He began a 10-year search for the perfect alkaline battery. He felt that when he found the right battery, he would put the noisy gasoline cars out of business. He never found the perfect battery, and in 1907, the new Model T cut the market out of his battery cars.

In 1914, Edison's West Orange Laboratory burned to the ground, and his inventive career virtually ended. He spent the last years of his life working with Henry Ford on a new method of making rubber tires from a hybrid goldenrod. When he died in 1933, people regarded him as the third greatest American behind George Washington and Abraham Lincoln.

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32. NIKOLA TESLA LEADS THE WAY

“When a person is subjected to the action of such a coil, the proper adjustments being carefully observed, luminous streams are seen in the dark issuing from all parts of the body. These streams are short and of delicate texture when the number of breaks is very great and the actions of the device are free from any irregularities. But when the number of breaks is small or the action of the device imperfect, long and noisy streams appear, which cause some discomfort. The physiological effects produced with apparatus of the kind may be graduated from a hardly perceptible action when the secondary is at a great distance from the primary, to a most violent one when both coils are placed at a small distance. In the latter case only a few seconds are sufficient to cause a feeling of warmth all over the body, and soon after after the person perspires freely.”

Nikola Tesla 1898

The word “tesla” is the Serbian word for the broad ax, which was once used for squaring timber. Nikola Tesla’s father began his career in the army, but the tough discipline wasn’t suitable for a poetry writer. He married and began work as a pastor in the Velebut Mountain community of Smiljar near the eastern shore of the Adriatic Sea.

As a boy in the 1850s and 1860s, Nikola had particular ability to see light and images about him. It had just snowed and the snow left a luminous trail with flares of light from his snowballs. When he was an older man, he told the story of his discovery of electricity as a boy. He sat in the house stroking Macak, the finest of all cats in the world.

“I felt impelled to stroke Macak’s back. What I saw was a miracle which made me speechless . . . Macak’s back was a sheet of light, and my hand produced a shower of crackling sparks loud enough to be heard all over the place.”

“My father told me that this was electricity. My mother told me to stop petting the cat lest I start a fire.” He thought to himself, ‘Is nature a gigantic cat? If so who strokes its back? It can only be God.’”

He was sickly as a young boy, and it didn’t look as if he would survive. He credited his survival to reading a book by Mark Twain, giving him the will to live. When he was in his teens, he became ill

with cholera and almost didn't make it. His family pressed him to become a minister, but he wanted to become an electrical engineer. His parents lost their oldest son, and they didn't want Nikola going off into a world they didn't understand.

He showed tremendous ability in mathematics. He could visualize the answer almost as soon as the problem was stated. When he was seven, his family moved to Gospic, where he finished grammar school. Then he entered the Polytechnical Institute at Graz in Austria, where he studied mathematics and physics. He finished by studying philosophy at Prague for two years.

In 1881, he began his career by working in Budapest for the telephone company. In 1882, he moved to Paris to work for the Continental Edison Company. The company opened a new generating plant in Strassburgh, Germany, and Emperor Wilhelm I was present at the dedication. A short-circuit explosion blew out a wall. The company sent Tesla to do the difficult job of soothing over the Germans and repairing the plant. He was promised substantial compensation if he could successfully resolve the difficulties. He worked miracles in getting the plant operating and resolving the anger. When he asked for his reward back in Paris, the company simply ignored him.

As a result he quit his job, sold his belongings, and boarded a ship to the United States. He landed in the United States in 1884 with a few cents in his pocket, a book of poetry, and an introduction to Thomas Edison. Edison put him to work fixing the direct current generators and making them more efficient.

He was given the job of designing direct current dynamos with short field pieces to replace the original Edison generators. He was put to work for \$18 a week on an emergency basis and promised \$50,000 if he could accomplish the tasks. He worked 18 hours a day for seven days a week. When he tried to collect from Edison, he was told it was only a joke.

Tesla quit the job, and in 1886 dug ditches for \$2 a day in order to survive. The foreman of the ditch digging crew introduced him to A.K. Brown of the Western Union Telegraph Company. He then was able to organize and finance the Tesla Electric Company. He constructed alternating current motors, generators, and transformers. He

was granted seven patents in 1887 and five more patents in the next few years on the basic alternating current system.

George Westinghouse was working on a system of alternating currents, but he recognized the superiority of the new system and bought Tesla's patents for \$1 million. His engineers were using 133 hertz, but at Tesla's recommendation, they standardized AC power at 60 hertz. Now he could accomplish his dreams of harnessing Niagara Falls to produce large amounts of power.

In 1895, the first alternating current generator at Niagara Falls began to supply 5,000 horsepower. In 1896, a 22-mile transmission line carried power from the falls to light Buffalo, New York. It took ten-kilowatt hours of electricity to make a pound of aluminum. Charles Hall was now able to get enough power to make the process a commercial success. In a few years, Niagara Falls was feeding the largest industrial plants of the world. By 1902, the falls was generating 80,000 horsepower.

In 1891, Tesla gave a lecture to the Society of Electrical Engineers. He had spectacular demonstrations of giant sparks and sheets of flame. Newspapers gave him great publicity, and he was invited to lecture in Europe in 1892. The 1893 World's Fair in Chicago was lit with Tesla's system.

In 1892, he went to Europe to lecture on alternating current. He would never repeat a lecture, but while traveling in England, James Dewar sought to get him to repeat a lecture to a group of scientists. He escorted Tesla to Michael Faraday's chair and brought out Faraday's last bottle of whisky, which had remained untouched since his death in 1867. After a good drink, Tesla gave the lecture.

When he returned from Europe, Tesla began to work on his big dream. In 1895, fire destroyed his laboratory. This loss set him back a great deal, but he was able to find backers for his new inventions.

His great ambition was to broadcast power, so that houses, airplanes, boats, and cars with a small antenna could pick up the power they needed. In 1889 to 1900 his men worked in Colorado Springs, Colorado. They built a building around a gigantic tesla coil, with a high antenna linked to a copper ball above the building. The currents were so high, that during preliminary tests, he and his crew walked

about with four-inch rubber pads on the bottoms of their shoes. He asked his men to work with their left hands in their pockets to prevent electricity from shorting across their chests and killing them.

When he threw the switch, lightning strokes 135 feet long streamed from the antenna on the roof. The thunder could be heard at Cripple Creek 15 miles away. Then the generator at Colorado Springs went dead. It overloaded, and the insulation began to burn. But Tesla's men were able to fix it and complete their work.

Tesla believed he had discovered the resonant frequency waves of the earth. Now he could broadcast electricity to any point on earth. There is an unconfirmed story that during the Colorado Springs experiments, he lit 50 light bulbs 26 miles away. When he returned, he tried to get financing for broadcasting electricity. J.P. Morgan gave him some money, but not enough to continue his experiments. Morgan was concerned with the idea that if electricity were freely broadcast, people wouldn't pay for it.

In 1902, Tesla worked on his great Wardenclyff station. It was supposed to be a world broadcasting system and send out power. He also intended to mount a death ray on it to protect the U.S. from planes, ships, and missiles. He couldn't get money to finish it, and was deeply in debt. Eventually the building was sold and destroyed to pay his debts.

His great career as an inventor seemed to be over at this point. He never got enough money to finish the great dreams he had. He eventually was able to pay off his debts, and he largely became a forgotten man. He did make several minor inventions such as the car speedometer, which brought him enough money to continue working. He gave interviews, popular in newspapers, on the great projects which he hoped to do.

In 1932, he had friends pull the gas engine from a new Pierce Arrow car. An 80-horsepower electric motor was mounted in place. He installed a mystery box about two feet long, a foot wide, and six inches in depth, with two rods coming from it. He drove the car at speeds up to 80 miles an hour. He later wrote to Robert Jonson, saying he had an electrical generator that didn't need an outside power source; that he was able to harness cosmic rays to operate a car.

His early experiments led him to the idea that high-frequency currents had important medical uses. He could thrust a heavy bar of iron into a wire loop carrying the currents. The iron would quickly grow red and melt. He could thrust his arm into the same loop, and nothing would happen.

When Professor Stephane Leduc announced the discovery of electrosleep, Tesla remarked that he had discovered the narcotic effect of electric currents. He passed high currents through his head and didn't lose consciousness. There was warmth all over his body and sweating. He could hardly keep his eyes open afterward and he fell into a deep lethargic sleep as quickly as he lay down.

Manufacturers of the violet ray mention him as the inventor, but this is only partially so. He did discuss building medical devices with Jacques-Arsène d'Arsonval and Paul Oudin in 1892 in Paris. The next year Paul Oudin built the first device that later became known as the violet ray. Tesla met with Frederick Strong in 1896 while testing an electric motor. The next year Strong came out with the American version of the violet ray.

Nikola Tesla talked about taking electric showers. When he subjected himself to currents of several million volts, small particles adhering to his body were removed. "I find that not only firmly adhering matter such as paint is thrown off, but even the particles of the toughest metals are torn off."

He invented a vibrating platform, which had a powerful laxative effect. Mark Twain often visited his laboratory. One time Twain stood on the platform for several minutes. Tesla asked him to get off, but Twain kept enjoying the vibrating effect. He finally ordered Twain to step off, resulting in a quick emergency trip to the bathroom.

Tesla worked on X-rays, which he initially believed would stimulate the brain. In the spring of 1897, he was ill for weeks. He realized that the X-rays were dangerous to the health and gave a talk to the New York Academy of Sciences about the need for lead shielding.

During Tesla's great period of invention, George Scherff was his accountant. He kept advising Tesla to work on smaller inventions that would bring in money, but Tesla was interested in his world radio, death ray, and electrical current broadcaster. He wasn't interested in

small things; he wanted to revolutionize the world. But without the small things, there was no money for the big things!

George Scherff tried to get him to complete work on the Tesla pad in 1898. This was a high-frequency pad, which would work the same way that we now use a hot water bottle. It was a type of diathermy device, but Tesla never finished work on it.

In 1903, Scherff tried to get Tesla to produce a better violet ray. Newspaper stories and interviews resulted in letters from many doctors asking for a small high-frequency medical oscillator. Tesla was working on his world communication system and wasn't interested.

In 1910, the Tesla Ozone Company was organized with capital of \$400,000 to develop a process with commercial uses including refrigeration. Ozone was of great interest to doctors, and the high-frequency currents generated it easily. Nothing came of the venture.

Throughout his life Tesla believed in the ability of high-frequency currents to refresh the body. He proposed burying high-tension wire in classrooms to stimulate students. He talked about a high-tension dressing room, so actors would be properly stimulated before going on stage.

The money to finish the great dreams didn't come. If he had concentrated on small things he might have been like Thomas Edison, and perhaps he could have realized his great dreams. By the late 1930's, he was a gray-haired recluse engaged in feeding and caring for sick pigeons in New York City. When Tesla died in 1943, he left a legacy of giant dreams, and a creative imagination that has never been surpassed.

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33. ARSÈNE D'ARSONVAL MEASURES THE WAY

"Look here my dear d'Arsonval, this cannot be serious. You assure us that the human body can be traversed with impunity by currents a thousand times more intense than those that can destroy us by lightning! Not only are they not productive of any evil effect, but we do not feel them. Can it be possible? Then, what are these currents which change their direction a million times a second? What is the instrument so delicate that it can measure a millionth of a second? Get along, repeat your experiments, I wish to spare you the disgrace of publication, lest you are discovered in enormous error."

The secretary general of the French Academy of Science advises d'Arsonval.

"I am convinced that the therapy of the future will employ as remedial agents physical modifiers (heat, light, electricity and agents yet unknown). The barbarous means which under the pretext of curing us consist of poisoning us with the most toxic drugs of chemistry shall cede their place to physical agents, the employment of which has at least the advantage of not introducing any foreign body into the organism."

Jacques-Arsène d'Arsonval

Jacques-Arsène d'Arsonval (1851–1940) came from an old noble family that lived in the area of Limoges, France, for centuries. His college studies were interrupted by the German French war of 1870–1. He had plans to become the fourth generation of doctors of his family.

While a student, he attended a lecture by the physiologist Claude Bernard. The galvanometer didn't work during a demonstration, and he went up and fixed it. Claude Bernard offered him a position in his laboratory preparing experiments with electrical equipment. He became one of the editors of the *La Lumiere Electrique*, one of the earliest electric medical journals.

When Claude Bernard died in 1878, Charles Brown-Sequard succeeded him, and d'Arsonval continued working in the laboratory. He made calorimeters that were remarkably accurate. He used small animals to measure changes in metabolism. He found that feathers were better for insulating an animal than fur.

D'Arsonval became the star worker of the laboratory and was given his own laboratory in biophysics at Rue St. Jacques. He directed this laboratory until 1920. He studied the nature of muscle excitation and found that the contractile parts of muscles were Ranvier's disks. He made a frog muscle operate the mouthpiece of a telephone. The weak current contractions of the muscle enabled a functional voice to be heard. He called this the myophone.

D'Arsonval showed that when a muscle is subjected to alternating pulses of light, the muscle would act as if it had been electrically excited and contract. The contraction was very weak and could be detected only with special equipment.

He studied the action of low temperatures on living tissues, and manufactured liquid gases in his laboratory. To preserve the gases, he invented the double-walled bottle named the 'thermos bottle,' which he reported to the Society of Biology in 1888. This was five years before James Dewar, who merely silvered the inner surface with mercury. The thermos bottle is really the invention of d'Arsonval.

He was the first to suggest tapping the thermal energy of the oceans. The deep ocean waters are cold, while the warm surface waters provide a great thermal difference. It is possible to tap the energy using low boiling point fluids to generate energy, but the technological problems are great.

D'Arsonval's early laboratory work was largely connected with electricity. He made a galvanometer of great sensitivity to study weak electric currents. He used this to study the electric discharge of the torpedo fish. He found that the electric organ was a modified muscle. He showed that the fish could produce up to 7 amperes at a power of 2,000 watts for a brief period of time.

In 1891, d'Arsonval demonstrated that alternating currents over 10 kilohertz produced no muscular reaction. On one occasion, he joined hands with his co-workers in a circuit with six electric lights drawing 720 watts of power. They felt nothing, but the lights were brightly lit.

At low frequencies the muscles jerk, as there is an isolated shock. At 20-30 excitations per second, the muscle becomes tetanic. The degree of muscle contraction rises to a maximum at 300 hertz, and then drops off to become nearly undetectable at 10,000 hertz.

D'Arsonval used crude frequency generating equipment in his early experiments. The device to generate higher frequency currents was simply a revolving gear wheel with a spark break. In 1893, he began using a Ruhmkorf coil in a circuit to generate higher frequencies.

Nikola Tesla had observed the same phenomenon a few months later with much more advanced equipment. There is a story that when Tesla went to Europe in 1892 he visited d'Arsonval with the idea of suing him for infringement of patents. The two men became great friends, and any animosity was forgotten.

While d'Arsonval may have been the first person to describe the phenomenon and measure the frequencies that became the basis of the violet ray, he did not make that device. He did make and experiment with two therapeutic devices using high-frequency principles.

Michael Faraday had developed the concept of "field," which James Clark Maxwell used to develop the fundamental equations describing the behavior of electromagnetic energy. D'Arsonval's experimental subjects stood inside a giant wire coil while current oscillated through the circuit. They didn't feel anything, but if they held a light bulb in their hands, it would light up. Sparks can be drawn from the body while standing in the field. A strong electrical field was passing through the body.

The wire helix treatment became popular in France, but such exorbitant claims were made for it, that the work was seriously criticized almost from the beginning. D'Arsonval and his followers wrote many papers on its value for treating diabetes, gout, obesity and other conditions.

A strong field was said to have cured a case of obstinate backache in five sittings of 20 minutes. A valuable St. Bernard dog was cured of palsy in the hind legs in three sittings. It also was supposed to cure migraines and writer's cramp.

The second therapeutic invention was the autocondensation couch. This was a recliner couch chair made of beech wood covered with rubber cushions acting as a dielectric. The patient grasped the metal handles while lying on the couch. There was no contact with the metal layer under the rubber pad. A light bulb held on a patient's lap would light up.

The autocondensation couch was really a large Leyden jar, or what we generally call a condenser. An insulator separates two electrically conducting surfaces. The patients became one of the plates of the circuit.

D'Arsonval did a number of experiments on patients. They lay on the couch and experienced the electrical fields. Then he treated gout, arthritis, obesity, and diabetes. The fields lowered the muscular reaction, inhibited the nervous system, and lowered the blood pressure by dilating the blood vessels. They stimulated the elimination of urea in the urine. During treatments, the amount of carbon dioxide in the breath increased from 17 liters per hour to 37 liters. Both static electricity and autocondensation increased the metabolism.

Each treatment caused a fall in blood pressure of 4-10 mm. and a rise in pulse rate of 2-8 beats per minute. After treatment it would gradually rise, but a slight drop remained. The effect on blood pressure remained after the treatment was over. It took many treatments to produce a substantial reduction in blood pressure. Many doctors used this, but they found that the effect wouldn't continue long enough to make a real difference.

A doctor in Illinois was troubled with insomnia. He would lie awake most of the night and then fall asleep just before dawn. He began to feel so exhausted that he was unfit for work. Then he became unable to sleep a single minute for three days. After he took three treatments in the condenser couch, his sleep returned.

In 1894, Georges Apostoli and Augustin Berlioz worked with d'Arsonval to clinically assess the effects of autocondensation. They treated 75 patients and reported that it produced better sleep, appetite, and higher energy. Diabetes was helped, but not cured. In arthritis and gout, there was great help.

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34. EDGAR CAYCE SAVES THE VIOLET RAY

"The vital force is not enclosed in man, but radiates within and around him like a luminous sphere. It is a radiating essence, and in these semi-material rays, the imagination of man produces healthy or unhealthy effects. But of these invisible causes of disease popular medicine knows next to nothing. Men who are devoid of the power of spiritual perception are unable to recognize the existence of anything that cannot be seen externally. There are some who have learned so much that their learning has driven out all their common sense. Medical science may be acquired by learning, but medical wisdom is the gift of God."

Paracelsus (1493–1541)

"Life in its expression in a human body is of an electrical nature. The vibrations from low electrical forces, rather than the high vibrations, produce life-flowing effects."

Edgar Cayce

The violet ray was almost completely forgotten by 1960. Historians wrote nothing about it, and no books were available. Yet many people knew about the device, and it could be obtained for medical use because of Edgar Cayce. The interest in his readings kept the device from dying.

Edgar Cayce was born in 1877 on a farm near Hopkinsville, Kentucky. At the age of four he witnessed the drowning of his grandfather. He then had visits from his grandfather's ghost as he was growing up. At the age of 13, a light filled his bedroom, and he experienced an angelic being who promised him that he would become a healer. He thought that it was his mother, so he ran into her bedroom, but she quickly sent him to bed. When he returned to bed, the figure said: "Thy prayers are heard. You will have your wish. Remain faithful. Be true to yourself. Help the sick, the afflicted."

He had been a poor student, but after the vision became a good student. He discovered that he was able to sleep over a book at night, and he would awaken knowing everything in the book.

Cayce was a deeply religious teenager who became president of the "Glad Helpers Society," a group that visited jails and hospitals. When the famous evangelist Dwight L. Moody came to town, Cayce told him about his visions and meetings with invisible beings. The evangelist quoted the Bible verse about stoning people to death with 'bad spirits.' Then Moody talked about God appearing to people in dreams and an experience of his own that had come true.

In 1898, Cayce moved to Louisville, Kentucky, to work for a store. He slept on the company catalogue and instantly memorized it. His abilities were quickly rewarded, and the business became more prosperous.

In 1900, he joined his father in traveling sales work. Once there was an outbreak of smallpox, and they had to remain in a small town. A hypnotist tried entertaining the trapped travelers. He hypnotized a man so he was able to play the piano. Then he hypnotized Cayce, and he, too, was able to play piano.

A year later, Cayce began to have headaches and lost his voice. He consulted doctor after doctor and after a year passed, he was only able to speak in a faint whisper. Now he was a hundred pound skeleton and looked like he was dying of tuberculosis.

In desperation he went to the hypnotist Al Layne. When he was put into a trance, he was able to speak normally. "Yes, we see the body. In the normal physical state, this body is unable to speak, due to a partial paralysis of the inferior muscles of the vocal cords, produced by nerve strain..." He began to suggest remedies for himself, and after awakening, was able to speak normally.

A few days later Al Layne called on him. Layne was suffering from stomach trouble, and wanted to see if Cayce could help him. Edgar didn't want to be hypnotized, but he felt obligated to try. Under hypnosis he was able to describe Layne's problem and suggest remedies.

He was through with this experience—or so he thought. Then he lost his voice again and had to go to Al Layne. The cycle kept repeating, and Al Layne began asking him for help for other needy people. Cayce gave a reading for the sick daughter of a medical doctor. The reading said that she had swallowed a celluloid collar button. Eventually an operation was performed to remove it and the girl recovered.

A newspaper reported this, and Cayce tried to escape the publicity by moving to Bowling Green, Kentucky. People went all the way there for help, and Cayce continued to wrestle in his mind about the appropriateness of helping them this way. The case that enabled him to feel that he was doing right was his reading for the principal of the high school at Hopkinsville, Kentucky. She suffered from flu, which resulted in convulsions. Her mind went blank without any reasoning power, and it looked like she would die. Her relatives followed his advice in the reading, and soon she was in perfect health.

A sick relative gave him the new perspective "Old man [a childhood nickname], God has given you something He has given to few people. You must consider well what use you put this gift He has given you. Do not abuse it, but use it. Do not be ashamed of it as you have been, but help poor suffering humanity, such as I."

When the readings proved correct, people began asking the sleeping Cayce about the horse races and stock market. He would give accurate answers, but the next day would suffer from bad headaches. He was once asked about a dry well drilled in Texas. The drillers were told to shoot explosives at a certain depth, and the well would begin to produce. They did this and got 600 barrels of oil a day. But everything that Cayce did for financial gain seemed to fall apart.

He rarely dealt with crime, but on one occasion he did a reading about a Canadian murder mystery. A girl was found dead in a home, and her sister was shrieking hysterically, unable to say anything. The reading said that the sisters quarreled over a boyfriend, and one shot the other and threw the pistol down a drain. The police retrieved the gun, and the sister confessed.

In 1911, Cayce's wife became ill and steadily got worse with tuberculosis. No air at all was going through one lung, and she was bleeding internally. Cayce finally did a reading for her and gave the answers to the druggist, who wasn't sure that he could make the formula. When she was given it, the bleeding stopped, and in a few days the fever went down. In two weeks she was feeling better, although it was months before she was back to normal.

Dr. Wesley Ketchum believed that he had appendicitis and needed an operation. He believed that Edgar Cayce was simply hoax-

ing people, but he got a reading anyway. The reading turned out to be true; he did not need an appendix operation. Ketchum became a faithful supporter.

Cayce made his living as a photographer during most of his early years, but pressure on him kept growing to do readings full time. When he was in Selma, Alabama, he found Gladys Davis, who became the perfect stenographer and helped transcribe his readings. Now he began to read professionally and founded the Cayce Research Institute in Dayton, Ohio.

Gladys Davis suffered from dull headaches while transcribing the first readings. She finally asked for a reading, and it attributed the headaches to eye strain resulting from bad posture. It told her to do neck stretching exercises, discard the glasses and use the violet ray three times a week. She did so, resulting in no more headaches. She didn't need glasses until the age of 50 when her eyes began to change.

In 1923, Cayce was secretly called to Washington, D.C. to give a reading for President Woodrow Wilson. We don't know if the advice was followed, but Wilson didn't recover and died in 1924.

In the same year, his first readings mentioning karma and reincarnation were given. Cayce realized that many Bible passages became clear with the recognition of reincarnation. One of the gospel stories tells of the blind man of whom the disciples asked: "Who sinned, this man or his parents?" If the man's blindness was a result of his actions, it must have been in a previous life.

During his readings and dream experiences, Cayce began to remember going to the "hall of records." An old man would hand him a large book, which contained the record of the individual who sought the information. The mysterious health problems all had a cause, but often it lay in the distant past.

In the next 20 years, he gave 14,000 readings and mentioned the violet ray some 900 times. During the 1920s, the violet ray could be bought at many drugstores, so the treatment was easily obtained. He recommended it for arthritis, skin disorders, digestive disorders, physical exhaustion and lethargy. For those who were tired, the violet ray was to be used along the spinal column, to "charge the centers of the nervous system."

A person with general debility had this reading: "This will give the pickup or the stimulation that is needed for what might be called the recharging of the center along the cerebrospinal system, so that there is better coordination between the ganglia of the cerebrospinal and sympathetic nerve system."

Cayce recommended the violet ray for all cases of "demonic possession." People who heard voices or had mental problems were to run it over their body regularly. "These treatments will tend to make for the raising of the vibration of the body, dissociating the effects of repression in the system, producing better coordination throughout."

For a person with anemia he spoke: "Still using the electric forces as would be applied from the violet ray, that we may bring more of the blood supply through the nerve reaction in and through the tissue in exterior portion, as well as through the deeper tissue. Apply across the abdomen very thoroughly, that we may waken the functioning of the liver, spleen and those portions in the digestive tract."

A person with eye problems had this recommendation: "With the application of the violet ray to the eye proper, we will find that there will be more response from the optic centers proper, and the relief gradually through the stimulating of the circulation to remove those pressures on same as cause the neurotic or the neuralgia-like condition as exists there."

A patient with goiter was given this advice: "We would have each day the violet ray treatment along the spine and over the throat where there are the tendencies for the nonactivity of the glands and those accumulations and the fullness that appears in the throat. These will naturally be somewhat irritated at times by the electrical vibrations, but with the taking of properties for the glands themselves, the body will gradually adjust itself. We would use the bulb applicator along the throat, up to the head and down the cerebrospinal system for at least three to five minutes. Then we would hold in the hand the applicator, where the body charges, and is charged by the electrical forces passing through same, for about five minutes. Do this each day, preferably before retiring at night. These will make for better conditions and electrify, as it were, the energies of the system."

For glandular problems he remarked: "This is a high-voltage [device] stimulating all centers that are as the crossroads, the connections between the various portions of the physical body functioning, the mental attitudes and attainments, as well as the sources of supply, which arose by the choice of the entity in entering this particular temple, this individual temple."

A woman with menopausal problems was told: "After at least four or five of the complete adjustments osteopathically are made, we could use the violet ray in the evening before retiring to soothe the nerve forces of the body. Begin at the base of the brain, a circular motion along either side of the cerebrospinal system, extending all the way to the lower portion of the spine; then down the sciatic nerve to the bottoms of the feet. Do this for periods of a week to two weeks, rest from the same a few days, and then begin again."

During World War II, there were terrific demands on his time, and his health began to fail. Readings on himself said the demands on his energy were killing him. A reading on his failing health told him that his work would be finished on a certain day, which was the day of his death. He died in 1943, but his work was never completely forgotten.

In the 1960s, there was an explosion of interest in his philosophy. In 1967, Thomas Sugrue published *There is a River; the Story of Edgar Cayce*. In the same year, Jess Stern published *Edgar Cayce, the Sleeping Prophet*. These books had great success and exposed a new generation to "new age" ideas that had been circulating 50 years before. The Cayce Association kept many of the formulas alive mentioned in the readings. They made the violet ray available in spite of opposition of the Food and Drug Administration.

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35. THE VIOLET RAY

“The properties of the high-frequency current are: it does not kill, it does not tetanize or even contract muscles; unless concentrated at a point, it does not burn; it does not cause pain, and the body seems to offer but little resistance to its passage, as seen in the X-ray photographs. No matter where it enters the body it penetrates every organ and tissue, and, when a Geissler tube is held by another person near to the person saturated with electricity, the escaping vibrations will light the tube, even when held, for instance, close to the shoe of the person taking the electricity. In its passage through the body it seems to contract or modify the vibrations of individual cells everywhere, changing or stimulating abnormally vibrating cells, bringing them back to their normal vibrations, and thus restoring their health and function, as well as stimulating healthy cells to increased action.”

Howard van Rensselaer 1912

The “violet ray” is first mentioned by that name in a dental journal in 1913. In 1916, the Roger’s Electric Company publicized a small hand-held device under the name of violet ray. The name quickly caught on and soon the public was using this term. Before 1916, most medical literature calls it “high-frequency” treatment. By the 1920s, both the French device and the American Tesla model were called “violet ray.” It was known by several names, before it became the violet ray. By the time the device had become the “violet ray,” the earlier names had been forgotten.

The idea began in 1891, when Nikola Tesla gave a widely publicized lecture on electrical therapeutic devices. He was not interested in marketing or building medical devices; they were just a byproduct of his research. He found that he could pass intense currents through his body that would have killed him, if they had been of a lower frequency. The currents relieved pain and produced deep sleep. He felt that this would become the medicine of the future, but he had greater plans and didn’t pursue the medical applications.

In 1892, Tesla made a widely publicized lecture tour of Europe and met with Jacques-Arsène d’Arsonval and Paul Oudin. The three men quickly became good friends. d’Arsonval is said to have tried using the Tesla circuit device on a patient, but it nearly killed him with a powerful shock. This ended his work with the device.

Paul Oudin devised a spiral solenoid of copper wire in 1892. He was using a circuit first made by Oliver Lodge in which one end of a d'Arsonval spiral was grounded, and the other end went into a knob that gave a brush discharge. He believed that the skin would act as a dielectric, and the body would vibrate from the electric oscillations spreading through its mass. The body was a container of water vibrating like it was struck by a stone. He called the apparatus a "résonateur." It was often called the "Résonateur de Oudin" or the "Montage en Oudin." In 1908, a portable French apparatus known as the "anemos" was marketed; the "effluvogene" came on the market in 1911. In 1913, the French Electrotherapeutic Congress voted to call the treatments "d'Arsonvalization."

Paul Oudin used two spiral windings end to end to create the high-frequency current. The Oudin Résonateur proved to be useful in therapy and highly useful in dermatology. In 1896, Oudin made the first French X-ray, and he also was the first to publicize the dangers of X-rays. He was one of the first to work with radium and diathermy, which represented the cutting edge of medicine at the time.

The violet ray device consisted of three major parts. The first was an oscillator generally producing a frequency of half a million to a million oscillations per second. Some models used a lower frequency. The frequency of the device depended on the size of the capacitor. The voltage of these circuits varied from 20,000 to 50,000 volts.

The second part of the circuit was an interrupter. There is no constant oscillating current; it is regularly interrupted in short pulses of a few milliseconds. The first interrupters were mechanical or mercury. A simple doorbell buzzer interrupter was used in many models. The initial purpose may have been to keep the heat from building up with a steady current. The interrupted current may work the same way we do when we have a stuck car. We don't give it a steady push; we give it short alternating pushes to get it out of the snow or mud. Mercury interrupters were first tried, then centrifugal interrupters and ring-type mechanical interrupters.

In 1905, Reinhold Wappler devised an efficient mechanical interrupter: a metal strip acting as a spring with a piece of soft iron with two platinum points as contacts. The magnetic iron core draws the soft piece of iron and interrupts the current.

The third part of the device was the applicator. Paul Oudin used Tesla applicators with his circuit. Frederic de Kraft invented the blue pencil electrode, which was a rubber tube filled with asbestos and capped with a brass ring at one end. When you turned on the device, a purple effluve was visible, extending from the end of the electrode put to the skin. The blue pencil was mainly used for static generators. The blue effluve was applied to the skin. When it was pulled away, the discharge was a purple feathery character.

When the blue pencil was put over a black eye, it would remove the marks quickly. It would treat the spasms of bronchial asthma, herpes, and wounds. If the polarity of the static generator was wrong, the discharge irritated the area, but the blue discharge had a sedative and pain-relieving effect.

The people with static generators knew that the violet tint showed them the negative pole, while the whitish light was the positive pole. The basis of all static treatments was a good general electrification. The first mention of bluish light is found in Martin's essay on electricity, quoted in the 1871 edition of John Welsey's *The Desideratum; or, Electricity made plain and useful*. "When it is a little condensed, it appears *bluish*; when a little denser, it appears *purple*; when denser still, it appears *yellow*; when highly condensed, it is clear and white, like the light of the sun."

Blue and violet are colors which were seen in other healing modes of this time. The blue "od" light is seen over the north pole of an electromagnet in the dark. As Edgar Cayce became more aware of his gift, he found that he was filled with purple silvery light while traveling to the hall of records. When the conducting wire of a d'Arsonval-Dopuin apparatus was seen in the dark, bluish rays strike it at right angles along its entire length.

Frederick Strong reinvented the violet ray in 1897 in the United States. He had met briefly with Nikola Tesla while he was testing an electric motor. He didn't know about Paul Oudin's work, and he set out to produce a useful electrical medical treatment.

Strong was influenced by Tesla's article on the therapeutic possibilities of electricity and was determined to find a suitable applicator. Metal electrodes produced a painful spark. He tried putting a sheet of glass on his patients and passing the output of the Tesla circuit

through the glass. The flat glass didn't cover the areas he wanted to reach. He took an ordinary test tube and turned it into a vacuum electrode. This proved to be very useful, so he worked to perfect it.

In 1834, Sir W. Snow Harris showed that the spark-length of an electrical machine increased in inverse ratio to the pressure of the gas through which it passes. He was able to exhaust his tubes down to $1/500^{\text{th}}$ atmosphere, and the discharge became violet-pink. In 1838, Johann Geissler experimented with improved vacuum pumps and was able to get the air pressure down to $1/1,000,000^{\text{th}}$ of an atmosphere. The discharge changed from violet to pure white.

A New York company sold glass electrodes to electrotherapists. They didn't pay much attention to the vacuum in the glass applicators. As the air was removed from the glass tubes, the color changed from rose pink, violet, blue, blue-white, and finally to a yellowish-white, and in a high vacuum, there was no color at all. A perfect vacuum didn't conduct electricity well. Strong believed that a moderate red vacuum was the best therapeutic applicator. The standard eventually became a "violet vacuum" of about $1/500^{\text{th}}$ atmosphere.

Paul Oudin's circuit consisted of a series of disks of light of equal thickness. They were much like the pulses often seen in fluorescent lights. The Tesla circuit produced long threads of purple light.

Frederick Strong used an interrupter on the high-frequency currents to give pulses. He found that this produced greater vitality and stimulated the circulation. He tried imposing sound waves on the high-frequency currents to produce a musical or speaking arc. He believed that imposing a voice wave over the high-frequency current could enable a totally deaf person to hear when put over the ears. Strong opened a "High-Frequency Clinic" in Boston.

There isn't a great deal of difference between an X-ray and a violet ray. The X-ray has a high vacuum tube with a slanted metal electrode at the end. Its voltage is higher, and the electrons travel through the vacuum at high velocities slamming into the metal releasing X-rays. The higher the vacuum, the shorter and more energetic the X-rays. A special X-ray applicator for the violet ray devices was available from some manufacturers.

The third therapy resulting from these experiments was the generation of ozone by high-frequency discharges. The violet ray generates small amounts of ozone, but this is not generally considered part of the electrical treatment. Ozone is a powerful disinfectant, and modifications to the device used tubes with many small metal points to produce ozone. Special glass applicators made to generate ozone were made for the violet ray.

Strong's first devices were the size of small refrigerators. The units had to be wheeled around a doctor's office. Tesla's experimental units used giant coils soaked in oil, for no insulation would contain the high-voltage electricity. The first Tesla units were dangerous to operate. The key to making practical units was efficient insulation for the wires. Vacuum tubes eliminated the noisy spark gap circuit.

Strong continued to refine his design and produced a smaller simplified coil known as the "Ajax." Then he devised a combination unit to generate high-frequency currents, X-rays and ultraviolet rays.

In 1904, Frederick Strong patented the first true violet ray, which he called the "Midge." All of the parts were arranged concentrically around a paper tube. It was only five inches long and could easily be held in the hand. The voltage could be adjusted, and glass tubes adapted to various needs could easily be replaced.

In 1908, the General Electric Company offered "electromedical apparatus" in its catalogue. Buyers could select either the Oudin or the Tesla device. The buyers were told: "Strong violet rays are produced on the surface of the skin by means of a special electrode." Niels Finsen won the Nobel Prize in 1903 for his work in using ultraviolet light for treating tuberculosis. People worried about TB, and they wanted ultraviolet light. The violet ray did not produce ultraviolet light, and light wasn't the key to its healing abilities. The advertising statement by General Electric grew into the name "violet ray."

Some models were made with the larger low-frequency coil separate from the high-frequency coil. An electric cord connected the large low-frequency unit to the small high-frequency hand-held coil. This produced a lightweight, hand-held model.

In 1915, the Bleadon-Dunn Company put out a compact hand-held high-frequency generator that it called the "Violetta." This proved so successful that the next year the company issued a "Baby Violetta" selling for \$15. In 1916, the Victor Electric Company put out a small portable high-frequency apparatus. They advertised it as a "violet ray" containing a "Tesla circuit." Four more manufacturers would produce the device in North America and continue until the Depression destroyed sales.

The glass applicator of the device was rubbed over the area for up to 10 minutes. The coils heated up and then had to be cooled for about 20 minutes. Talcum powder or starch was often dusted on the skin to make the glass tip glide over the skin. If used at a short distance from the skin, it sparked, which produced some stimulation.

Some companies sold a special glass electrode cap fitted with a cotton tampon saturated with a solution of silver nitrate or iodine. The pulses of high-frequency drove the substance into the skin. For lupus, a pad was saturated with an aqueous solution of a bismuth salt.

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36. THE VIOLET RAY IN HEALING

"Sometimes a majority group of these body cells, or a large minority in some section of the anatomy of man 'lay down on him' because they have not been treated kindly, or are worn out and exhausted by the excessive strain thrown upon them. Then man gets peevish and cross and goes to the doctor. This always is a wise thing to do under the circumstances, but very often the circumstances could be prevented were the cells treated properly.

To aid in the proper treatment of the cells, science has invaded the home with a new and domesticated apparatus for the application of the violet ray. The duty of the violet ray, hitherto confined to the elaborate and expensive apparatus of the laboratory or the special practitioner, is to massage gently the tired-out cells and make them feel good.

The violet ray is a first cousin of the X-ray, but unlike its relative, it is utterly amiable and docile, producing no irritating effect. For this reason, and because cellular massage is much more penetrating and gentle than the common or muscular variety, the violet ray apparatus bids fair to become as important as an adjunct to the home as is the Victrola, which massages dull care away from the mind."

From a 1920s advertising bulletin for the Violetta

Joseph Rivière was a close follower of developments in medical electrical research. He made a duplicate of d'Arsonval's electrical device and treated a musician for neurasthenic symptoms. After a few treatments with autoconduction, the man's insomnia was gone. During treatment he accidentally received a stimulating but harmless spark. He had an ulcer on the back of one hand that had been treated without result. He decided to try applying sparks and current, and it soon healed.

This aroused interest in using the violet ray to cure ulcerations and injuries that healed slowly. A 41-year-old person was injured on the face and arms, with healing was so slow that it was expected to take five weeks. After the first treatment, healing could be seen on the second day. Six treatments were given; healing took two weeks.

A contused wound with ragged edges didn't heal in the first 23 days. After the first violet ray treatment, less fluid was seeping from the wound. After the second treatment, the wound began to heal

over. Paul Oudin used three treatments a week, and the healing was complete in ten treatments.

A 69-year-old man had a large purple ulcer on his right leg. There were many small ulcerations nearby, and the leg didn't heal over a three-year period. He was given two violet ray treatments a week, and the healing was complete in three months.

A 45-year-old patient had an ulcer the size of a shilling, which refused to heal for two years. It was carefully dressed and covered with an elastic bandage. The ulcer was given eight treatments in three weeks, and all of the pain and tenderness disappeared. It was completely healed after 18 treatments. The skin broke down again, and with another series of violet ray treatments, it was completely cured.

A 50-year-old lawyer had a severe bruise on his left foot, after a large swinging door struck it with considerable force. The pain was unusually severe, and there was a good deal of inflammation. The injury turned purple a week later, and there was severe pain. Gangrenous spots appeared on his foot. The injury was treated with five-minute violet ray treatments that were extended to ten minutes. After 12 treatments the pain lessened, and the injury began to heal.

A man banged his head against a faucet resulting in severe pain and swelling. It was massaged for two weeks, and the swelling was reduced, but the pain remained. The first violet ray treatment eliminated most of the pain, and seven more treatments healed the injury.

A woman used her violet ray to treat a painful sprain, which quickly gave her relief. Her husband remarked: "I wonder if that would do my face any good?" He had lupus for 15 years, with redness and ulceration of the face. After seven violet ray treatments, the entire surface healed over.

Professor Emmanuel Doumer used the violet ray to treat several cases of fistulas, which are hollow abscesses. An 18-year-old man had a fistula of the left leg for six years, which didn't yield to medical care. After three months of violet ray treatment, it healed completely. A 25-year-old woman had a dozen fistulas of the foot oozing pus, which lasted for 13 years. With violet ray treatments, they completely healed in 18 months.

Septic areas or local areas of infection readily yielded to treatment with Tesla currents. Frederick Cook made a fine wire effluve electrode that dispersed the current so that it didn't shock. Soon after this, a Paris manufacturer put Bisserie's Brush Electrode on the market. It was applied over the infected area or ulcer.

A woman working in Paris had a fistula of the right knee for three years. She was given two treatments a day, three days a week. The fistula was completely closed after the seventh week of treatment.

A grocer scratched his hand on a nail. His entire arm from the shoulder downward was red and swollen. The whole arm was treated with high-frequency current and bandaged. After three treatments over three days, the arm was cured.

A man cut his finger at work but didn't treat it. A week later it was swollen to twice its normal size. The doctors didn't think that violet ray treatments could do any good, but it looked bad, so they tried treating it twice a day for the next three days. The swelling disappeared, and there was complete restoration of function.

The electrical pulse directed to the spine and solar plexus aborted many varieties of acute infectious disease, if it was used to treat them early. Often colds, flu and sore throat were made to disappear or become so mild that they were hardly noticeable after persistent treatment. A friend of mine ran the violet ray over his sore throat and nose daily. This reduced the discomfort to such a low level that he was hardly bothered by the cold.

A manager of the Dominion Rubber Company of Ontario, Canada, bought a number of violet rays and put them in the first aid kits. When the electrical dealer asked him how they were doing, he wrote: "The violet ray machines which we purchased from you last year, have been very satisfactory. The reports we have from our different branch factories are to the effect that these machines are very useful in our hospitals. We feel quite sure they have saved us many dollars in keeping our employees at work. In cases of headache, they are treated in a few minutes, whereas they were formerly off duty for the entire day."

These observations and stories have all been forgotten as medical science moved on. The electrotherapy journals are quite rare, and only a few doctors have seen them or had an interest in their contents.

Now we are trying all sorts of expensive high-tech skin grafting procedures in ulcers and wounds that won't heal.

Modern work suggests that wounds and injuries have "currents of injury." These send a signal to the central nervous system to begin the healing. In normal conditions, the outer layer of the skin is negative, and the inner layer is positive. In injuries, the polarity breaks down. Healing work with direct current has been somewhat contradictory. The anode often has a stronger healing influence, but faster healing may take place by switching polarities every few days.

The optimum wound healing current has been found to be 600 microamps, which increases ATP synthesis. Calcium is important to the healing of cells, and electrical stimulation causes an increase in cellular use of this.

An experiment that confirmed the early violet ray tests was published in 1961. Twenty dogs were put under anesthesia and given a standard wound. Ten were returned to their cages and allowed to heal on their own. The remaining dogs were treated with pulsed high-frequency radio waves. This resulted in signs of marked stimulation. Strands of fat migrated towards the edges, and large numbers of white blood cells were seen in the wounds. Most of the indexes of wound healing took about half the time under the influence of high-frequency radio waves.

Another experiment that confirms the acceleration of wound healing with electricity was done in 1988. A group of patients was studied with high-voltage pulsed direct current. The patients who didn't receive treatment had ulcers 29% larger over a seven-week period. The ulcers in the treatment group were 100% healed in a period of 7.3 weeks. None of the modern researchers used the violet ray.

The violet ray may have other applications in general healing. An alcoholic had blood in the urine and signs of Bright's disease. The lower back was treated with high-frequency treatments three times a week. By the 16th treatment, the amount of albumin in the urine began to fall. After 18 treatments, it had dropped from 1.5 grams to 0.2 grams per liter of urine.

Multiple chemical sensitivity is difficult to treat and maddeningly difficult to deal with. Often it lasts for years and nobody can seemingly help the disorder. Hardy Heinke wrote an account of his experiences. He had done a great deal of work with the chemical solvent carbon tetrachloride. Now he had chronic fatigue syndrome and a poor memory. He found that magnesium supplements helped a good deal. He also felt that general violet ray treatments had restored his health.

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37. THE VIOLET RAY IN SKIN DISORDERS

“High-frequency currents, more especially those of the Tesla type, possess therapeutic powers which are not exhibited by any of the remedial agents known to the profession. In passing through the body of the person whose vitality has been almost exhausted through the encroachments of disease, these currents appear to promote circulation, increase metabolism, and more or less completely restore the general harmony between the different functions of the body, seemingly without the slightest expenditure of the scanty residue of vital energy stored up in the cells and tissues. In other words, we have in these currents a means of increasing vitality without the necessity of digesting, assimilating and storing the nutritive material which ordinarily carries the potential energy which forms the single source of supply for organisms belonging to the animal kingdom.”

High-Frequency Currents Frederick Strong 1908

In 1893, Paul Oudin told the Société d'Électrothérapie about his work on the treatment of skin problems with high-frequency electricity. He believed that the electrical currents stirred up the body, increasing metabolism and nutrition. He began with a case of psoriasis, which had resisted all other treatments. After two electrical treatments, the plaques began to break up and heal. It took a month of treatments to completely break up all plaques.

The next year, a 25-year-old man with psoriasis came to him. Large plaques covered practically all of his legs, so Oudin gave him three treatments per week. By the second week of treatments, the plaques were nearly gone. The treatment was interrupted for three weeks. After three more treatments, the remaining plaques on his back and arms disappeared.

A woman came to him with horrible skin with furrows all over it. He treated her skin four times a week with the high-frequency currents. The improvement was slow, but in about a month, her skin began to clear up.

A mechanic suffered with arthritis and a red face. After he took three treatments, his face began to look normal. The face turned red again after a week, so he returned for two further treatments. This brought his face back to normal.

A 34-year-old woman suffered from arthritis for years. She developed patches of eczema on her cheeks and ears. Doctors were unable to help her appearance. Oudin treated her face, and after five treatments, her skin began to look normal.

The device, now known as the violet ray, proved to be useful in nearly all skin conditions, and many doctors began to experiment with it. One patient had intolerable itching of the legs. There was a patch of dry eczema on the arms but nothing on the legs. The doctor did a series of 10-minute treatments over the legs, and the itching went away and didn't return.

Static currents and the static spray had been used to treat itching, but the violet ray proved to be more effective. One man was so sensitive that he was forced to undress and retire to bed because his clothes became unendurable. A current of cold air caused an extreme reaction. Positive static spray reduced the itching to normal.

A 72-year-old man suffered from senile pruritus. He consulted several skin specialists, who were unable to help. He itched and scratched day and night. Three treatments a week for several months completely cured the condition.

A 27-year-old man suffered from severe vasomotor ataxia with intense itching in both legs. There was no external evidence of irritation. The first violet ray treatments took five minutes for each leg. This checked the itching and gave relief for six hours. In 10 treatments, his condition was completely cured.

In ten treatments, the violet ray cured a case of ringworm that extended almost around the body. A second case of ringworm with thick crusts of chronic eczema was cured in 28 treatments.

A case of palmar psoriasis resisted all treatment for two years. After 11 treatments lasting five minutes, the trouble cleared up. The palms remained free of the disorder for the next 18 months.

The violet ray was used to treat common acne. The first result of the treatment was an intense hyperemia, which left the treated area very red and speckled. The acne usually disappeared in eight to 12 treatments. Any patient could be completely cured in a month.

A testimonial that was sent to Renulife company reads: "I had been subjected to pimples for almost five years and had tried everything, vibrators and all, but without clear results. I used your generator one week, as I was out of the city when it came. Today my face is as clear as anyone could ever wish for."

A woman had acne rosea of the nose for 10 years. The nose was bright reddish and greatly enlarged. She was treated with a needle point violet ray discharge. Small crusts formed on the area and fell off. Her nose and face became nearly normal.

A man had acne rosea of the nose for seven years, with increasing enlargement. He looked so offensive that he was given a lesser position at work so he didn't have to deal with people. His nose was large and covered with red inflamed pustules. The needle point discharge was applied to limited areas with each treatment for ten weeks. His face looked much better, and he was given his old job back.

The violet ray appeared to help excessive perspiration. One woman had severe perspiration under her arms. She used powders without real results. After six treatments, her sweat glands became normal. Another lawyer had to change his socks three times a day; he corrected the sweating with a few violet ray treatments.

The violet ray readily treats both dry and scaly eczema, after all other methods of treatment fail. Dr. Gaston Bloch of Paris reported that cases of eczema lasting more than 10 years were cured with half a dozen treatments.

A woman suffered from eczema exudans for 20 years. The eruption covered her face and almost every part of her body. She used nearly every remedy without result, and she was so discouraged that she didn't want to try the violet ray. A few treatments resulted in her complete cure without a return a year later.

A 60-year-old woman suffered from irritable eczema for ten years. The eruption affected chiefly the neck and scalp. The violet ray removed the eczema, but it returned. She used more treatments and applied boric acid powder, and that completely cured the problem.

One person wrote a testimonial to the Renulife company: "I had weeping eczema on my face and had spent not hundreds, but thousands of dollars and still wasn't cured. Before trying your Renulife Generator I noted good results after the first few treatments. I am now entirely well, and my face is perfectly smooth."

In one case a baby had infantile eczema over the entire body. It looked awful with constant oozing and swollen eyelids. Improvement began after the first treatment, and soon the skin was clear.

This treatment proved to be useful for boils. The violet ray aborted the condition as quickly as the treatment started. If boils formed in the area in the past, they ceased to form.

One doctor wrote: "A man came to me with a big boil on his forearm and his arm was so lame he could not lift it. I gave him a treatment with my violet ray machine, and the next day the boil was gone and the soreness was all gone out of his arm. This shows you what the violet ray will do."

One man had a continuous succession of large boils around his nose, mouth and chin for more than a year. Vaccine treatment failed. He was given three violet ray treatments weekly. There was immediate improvement, and no new boils arose. After four weeks of treatment, his skin was perfectly normal and he had no boils thereafter.

Lupus erythematous is a curious condition that results in a large butterfly-shaped rash over the face. This is believed to be a condition in which the enzyme that breaks down DNA is not working. Researchers shut down the enzyme that breaks down DNA in specially bred mice, and after 6-8 months most of the mice showed lupus symptoms. The enzyme takes care of cellular garbage. DNase is the enzyme that breaks down DNA. This enzyme has been used to treat cystic fibrosis.

In 1897, Emmanuel Doumer began to treat lupus with the violet ray. He gave one to three treatments a week; if there was an intense reaction, the period of time between treatments was longer. Some people could take three treatments a week; others only one treatment a week. He believed that stopping the treatment for a week or two was useful in some patients. It generally took about 20 treatments.

The area affected by lupus would become covered with a thin crust, which would fall off and leave a red surface after months of treatments. Dr. Frederic Bisserie reported that he was able to cure 33 out of 62 cases. Jules Jacquot was able to cure 39 out of 56 patients with the electrical treatments. Henri Bordier used a glass electrode with cotton soaked in a bismuth solution. This seemed to make the lupus disappear more quickly.

The high-frequency electrical currents were also used for herpes, impetigo, and chilblains. Chilblains were promptly cured by applications of the brush discharge. One patient had disfiguring scars on his face and hands as a result of a childhood accident with glass. After five treatments, the disfiguring scars were beginning to disappear.

Dr. Duncan Buckley reported on the use of the violet ray in birthmarks. A girl had a large port wine stain on her face. He used mild sparks and surface treatment, and the stain disappeared. A young woman with a huge birthmark was treated. After a week, it formed a crust. When it fell off, the tissue underneath was mildly pink, but it gradually whitened to a normal skin color.

By 1920, most of the high-class beauty parlors adopted the violet ray as an essential part of their equipment. It was used on all facial marks, warts, moles and wrinkles. Some schools gave their graduating beauticians a violet ray as part of their operating kit!

Patients in Europe were still treated with static generators and the violet ray until WWII. Then the therapy disappeared. There was an attempt in 1974 to find out if any doctors were still using electricity to treat skin conditions. No such doctors nor could any universities be found where any violet ray work was done.

A violet ray sat on a university shelf for nearly a half century. A man with a skin lesion for six years borrowed it. The lesion was a brown spot about the size of a quarter. It finally turned black and developed roughness, and parts would flake off. He borrowed the old violet ray and used it on the lesion. After about a month of treatment, the entire thing disappeared. Stories like this should have aroused interest, but the political climate against medical alternatives was so strong that it was impossible at this time.

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38. ELECTRICAL HAIR GROWING

“Study of the descent of man and of embryology shows that our ancestors were entirely covered with hair, as are the anthropoid apes. According to Darwin, the gradual disappearance of hair is due to repulsion felt by women toward hairy men; that is, to sexual selection.”

Monthly cyclopaedia of practical medicine and universal medical journal 1898

“Mary Butler, aged 86, living in Eagle-street, Red-Lion square, having been afflicted with the sciatica for more than twenty years, was last month electrified ten or twelve times, and has been easy ever since. It seems the electric fire in cases of this and of many other kinds, dilates the minute vessels, and capillary passages, as well as separates the clogging particles of the stagnating fluids. By accelerating likewise the motion of the blood, it removes many obstructions.”

Desideratum John Wesley 1871

Stephane Leduc used an electrical current to plant zinc ions in the skin of a rabbit. This induced a strong growth of hair. There is a theory that a lack of hair is a result of too much hormone or too little blood supply. Perhaps hair loss is a lack of scalp minerals, and the electrical current replaced them.

Lewis Jones treated a husband and wife who both suffered from patchy alopecia. This may have resulted from a microorganism one gave the other. The ionic implanting of zinc cured them both.

Dr. H. Marques treated a number of patients with zinc ions. He placed pads with a 2% solution of zinc chloride over the bald patches and used the negative pole. He administered three treatments a week, increasing the current to 15 ma. Hair began to appear in about eight days. One patient had no hair at all on his scalp. He began to sprout new hair 12 days after the ion treatment. About half of Marques' cases treated with zinc had hair regrowth.

In 1893, Paul Oudin treated a case of hair loss due to syphilis. There were separate tufts of hair over the head of the patient. Oudin used three violet ray treatments a week given over a period of four months, and most of the hair regenerated.

Henri Bordier was the next to treat hair loss with violet ray equipment. He used an Oudin device to irritate the scalp for four to five minutes. He then applied a shower of tiny painless sparks, which produced intense redness and then a slight crust. He would apply fine sparks for 20-30 seconds at one place. This would result in crusts, and when they flaked off, new pink skin gradually became brownish. This was followed by the appearance of white hair, which darkened and became normal in nine months.

Demetrios Vassilides reported that he had cured 14 cases of baldness with electricity. He cured a mild case in a month, but some cases required 16 months. He noted that the hair often changed to a darker color. It took longer to restore the color than to overcome the bald spots. Nine of the men began to grow hair within five months of treatment. One man didn't have a single hair on his head for the last ten years, but it began to grow with continued treatment.

A young physician applied violet ray currents to the bald patches on his head until they were bright red. He treated them three times a week for three weeks. The patches became smaller and fine hairs began to grow in at the edges. He continued with two treatments a week for two months, and his hair became completely normal.

A German woman who worked as a domestic servant had falling hair and extreme dryness. In order to save what little hair that remained, high-frequency currents were applied to her scalp. A few weeks later, there was definite growth on the right and left sides. The new hair was shiny when compared with the surrounding hair. The two patches expanded and merged into each other; eventually the entire scalp appeared normal.

In 1919, a 40-year-old woman came to Samuel Sloan for treatment. She didn't have a single hair on her head, and no eyebrows and eyelashes. She had gone to a number of prominent doctors and received no help. Dr. Sloan gave her 12 treatments with the violet ray until her skin became red and slightly tender. She was told to rub hazeline cream into the scalp and return after four weeks.

When she returned, she was still completely bald. Another 12 treatments were given. She returned three months after the treatments with several patches of dark hairs on her head. Her eyebrow and eye-

lashes of her left eye were beginning to grow. Another 12 treatments were given, her scalp covered with fine hair and her eyebrows and eyelashes started to return to normal. Soon she had a full head of hair.

George McKee used a version of the violet ray invented by Henry Piffard. He found its stimulation increased blood supply and resistance to germ invasion. It left hyperemia lasting for hours.

The hair of a 25-year-old woman began to fall out at an alarming rate. She was treated with capsicum, cantharides, castor oil and alcohol without results. After five weeks of violet ray treatment, new hair began to grow.

A 20-year-old woman suffered from seborrhea for several years. Her hair was falling out, and she was treated with the usual methods without result. Treatment continued irregularly until her hair was thick and steadily growing in length.

A 40-year-old man had very thin hair over the front of the head and a sparse growth at the top. He was given violet ray treatment for six months, but nothing happened. He decided to give up the treatment, but then a heavy growth of coarse white hair made its appearance. After ten months, he had a good growth of normal hair.

Nobel Eberhart treated a woman with vibration and the violet ray for hair falling out. She had numerous gray hairs, and wanted them pulled, but she didn't get it done. After weeks of treatment, Eberhart noticed that they were gone. The violet ray had turned them black.

Eberhart treated a case of lupus six days a week. He targeted a stubborn patch near the ear, which resulted in a patch of dark brown hair in the patient's gray hair. He believed that the gray was a result of disturbed nutrition.

The violet ray began to be used in beauty shops for treating hair. In the 1920s a version known as Roger's Vitalator began to appear in barbershops for treating dandruff and bald patches. The *American Hairdresser* noted: "Wonderful results have been obtained in the use of the Violetta, and many cases of gray hair restoration have been reported. The Violetta tends to revolutionize the whole profession. Dandruff was reported to disappear under the treatments."

The Marvel Violet Ray Company had this testimonial in its booklet. "I have had one of your violet ray outfits for about three months and have found it very satisfactory for every ailment that I have tried

it on. I have been using this instrument on a neighbor that has been bald for about 15 years and present indications show a good growth of hair.”

Almost no work has been done since 1930 on the use of electricity to grow hair. One trial was reported with a pulsed electrostatic field on the hair. Group A began with a hair count of 91 in a one-inch circular area of the head. Group B wasn't treated, and the hair content decreased from decreased from 111 to 91, although these measurements are uncertain. In the group with a pulsed electrostatic field, 83% showed an increase in hair count.

Electricity was also used to remove hair. In 1875, Dr. Charles Michel used electrolysis to remove hair. In 1882, George Fox introduced the use of a fine needle alongside of the hair follicle to remove hair. The operator uses slightly more voltage according to the thickness of the hair. There is a stinging pain when the current is passing, but most people can take this without problems. Fine pale hairs are more difficult to remove permanently. It is essential to have good light during the treatment to see the fine hairs. Steel electrodes cannot be used, for they leave black marks. A short piece of sharp platinum wire is attached to the positive pole. The electrical procedure leaves tiny scars with each hair.

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39. ELECTRICAL EYE TREATMENT

“Something might now be added about a certain very subtle spirit [electricity] that pervades all dense bodies and is concealed in them, by whose force and actions the particles of bodies attract each other when separated by being concealed in them. They attract each other when separated by very small intervals, or cohere when contiguous; and by which electric bodies act at greater distances, both repelling and attracting neighboring corpuscles; and by which light is emitted, reflected, refracted and inflected, and heats bodies; and by which all sensation is stimulated, and the limbs of animals are moved at will—for this is done by the vibrations of this spirit transmitted through the solid capillaments of the nerves from the external organs of sensation to the brain, and from the brain to the muscles. But these things cannot be explained in a few words, nor have we at hand a sufficient number of experiments by which to determine and demonstrate the laws of action of this spirit accurately, as ought to be done.”

Principia Isaac Newton 1713

In 1748, Joseph Bruni of Turin, Italy, wrote of treating a woman with a painful irritated eye. He electrified her and drew sparks from the eye. It appeared bloodshot, but that disappeared quickly. The next day the problem was better. He did the same thing twice more and her problem was cured.

In 1755, the parents of a blind son implored Dr. Charles LeRoy to try electricity. They heard of a seven-year-old boy cured of blindness by electric shock. Their 21-year-old son became blind after a high fever. The doctor gave him 12 shocks through a well-charged Leyden jar. The man saw electric flames from the discharges, but he remained blind.

John Wesley, founder of the Methodist church, was the first to treat the blind successfully with electricity. He put a Newcastle man, who had been blind for years, on an electric platform, and drew sparks from his eyes. After resting for a time, the patient could distinguish objects and walk home without a guide. After a second treatment, he was able to work normally.

Wesley treated a 17-year-old girl that became blind from small-pox 12 years earlier. He drew sparks from her eyes and gave shocks to her head and neck. After two 90-minute treatments a day for several weeks, she was able to see enough to function, although her vision was poor. These miracles certainly helped Wesley gain converts!

When Alessandro Volta began to experiment with his newly discovered battery, he found that a current applied to the eyes produced a sensation of light. Changing the direction of current produced different colors.

In 1801, Justus Christian Loder began to use electricity on the eyes of patients in his clinic. He claimed to have cured two patients with amaurosis, which is blindness caused by disease of the optic nerve. He also showed that direct current could help some problems caused by a diseased retina.

The physicist Hermann von Helmholtz found that when the cathode (negative) was applied to the eye, objects could be seen more clearly. The application of the anode made them appear darker and less distinct. He believed that the electric current increased or diminished irritability of the optic nerve. When the cathode was applied to the eye, it produced a blue center with a yellowish green color, as the current was interrupted.

William Neftel treated a patient with retinitis pigmentosa. The patient's vision was so poor that he couldn't read or cross the street without assistance. He was treated by placing the cathode on the eye, which greatly increased his vision. Soon he could walk without assistance and read for hours every day without problems.

Samuel Harris treated eye disorders with negative current applied to the eyes and the positive electrode attached to the neck. A woman came to him with atrophy of the optic nerve and vision of 10/200. After six months of treatment, this improved to 20/60. He began with daily treatments for ten days and then every other day for two to three months.

He was able to successfully treat iritis and glaucoma with negative current. Doctors told a patient who came to him that he would be blind at 30. The negative current gave him excellent eyesight.

The president of a big corporation had double vision, and objects became double images several feet apart. He had 12 operations without any permanent result. Both negative current and violet ray currents were applied to the eyes. After two weeks of treatment, he could focus on a candle and see only one image. He was extremely grateful for relief from his eye condition.

An oculist tried treating three cases of glaucoma with direct current. He applied the positive pole to the eye, but this resulted in pain. When the negative pole was put to the eye the pain was immediately relieved. The oculist had poor results from treating glaucoma by other means. He applied negative current through the eyelids, and attached the positive electrode to the neck. This produced immediate improvement, and 25 more treatments were given. Vision in the right eye went from 20/200 to 20/40. Vision in the left eye went from 20/160 to 20/30.

A second patient had no change in his left eye, but the right eye went from 20/160 to 20/40 after 14 months of occasional treatments. In a third case, iridectomy failed to help the disorder. After 11 treatments lasting three to 15 minutes, the eyes improved enough to enable the patient to count fingers at a distance of six feet.

Dr. Gustat Crusell applied negative electrodes to the eyes, and a positive electrode to the patient's tongue for cataracts. Short treatments dissolved the cataract. Dr. Friedrich Heidenreich reported that he was able to cure two cataracts and improve one, with current interrupted every five minutes and applied for an hour.

In 1912, William Franklin Coleman published a study on this way of electrical treatment. Both eyes of a glaucoma patient became blind, and pilocarpine injections failed to help. Specialists said that the vision of the patient's right eye was probably lost, and the left eye could only distinguish light. A cathode was applied to the right eye and the current slowly increased for 10 minutes a day. After four days, the patient could see to count his fingers and function with reasonable vision.

The negative pole was useful in improving vision; the positive pole was useful in stopping hemorrhages. In one case, three months of treatment made no impression, but positive current showed imme-

diate improvement, and after four months the patient was discharged with vision of 20/30. Some cases had phenomenal improvement, but others weren't helped. About two-thirds of those receiving electrical treatment got help from electricity.

Paul Oudin was the first to try the violet ray on the eyes. Cotton was soaked in salt-water pads, then wrung out and placed over the eyelids. Oudin found that blepharitis [eyelid inflammation] could be cured by 10-minute treatments in two weeks. He was able to improve retinitis pigmentosa. He cured eight of 10 cases of retinal hemorrhages. He had no results in treating glaucoma with his equipment.

Trachoma is a viral disease of the eyes, which is spread by flies. In tropical countries such as Egypt, trachoma was a terrible problem. Most people gradually went blind. A few doctors treated it with zinc or copper salts. These were irritating, but slowly cured the disease.

Cotton was soaked in salt water and then wrung out and put over the closed eyes. A special branching eye electrode was used to treat the eyes. A 10-minute treatment was administered every day for a week. Then a treatment every other day was given for the next two weeks. This would usually cure the most stubborn cases. Albert Geyser treated 18 cases of trachoma with vacuum electrodes over the eyes. He used three treatments a week, and the treatment lasted from three weeks to three months.

Conjunctivitis is a catchall term for eye inflammations. Helping this disorder took from 10-45 treatments. Sensitivity to light disappears after a few treatments. The treatment is effective in curing chalazion, which is a small growth on the eyelid. Generally 5-6 treatments would cure it. Acne and eczema around the eyes were cured quickly.

Dacryocystitis is inflammation of the tear sac, which may result in inflammation of the lids and conjunctiva. A vacuum electrode was applied to the eyes. The inflammatory symptoms were relieved in four cases in 24 hours, and in five more cases the problems cleared up with more treatments.

Dr. Lawrence Webster Fox found only one failure in treating 100 cases of eye inflammation. There was relief in iritis but not a cure; however, the treatment's effect on pain was magical. He treated three cases of toxic amblyopia resulting from alcohol and tobacco use. The

degeneration may result in blindness. He found that about 20 treatments restored the patients' sight.

William Snow was noted for his use of electricity in therapy. He remarked: "The use of the vacuum eye electrodes with the static current is of great value in the treatment of epiphora, when the tear duct is closed but not stenosed. If a vacuum electrode is held against the canal and a short spark gap employed, it will remove the infiltration and open the canal."

Edgar Cayce mentions the use of the violet ray in eye conditions. He advised treating the third, fourth, and fifth cervicals and the first and second dorsals on the back first. He recommended treating the eyes no longer than one minute. He suggested the eye applicator to clear cataracts.

A Chinese peasant was buried in earth by a shell explosion and was unconscious when dug out. Emergency treatment restored him to life, but he lost his sight. Both eyes had no light perception, but light reflexes were present. He suffered from headaches and blindness for 18 years. After his first violet ray treatment, his headache was less severe. After the second treatment his headache disappeared, and his perception of light returned. By the fifth treatment, he was able to recognize people. After nine treatments, he was able to read numbers and words.

A woman was treated in a hospital for optical nerve atrophy. She completely lost her color vision and could only count fingers at six inches away. Doctors couldn't help her, so she used the violet ray. After four months of treatment, she was able to read and write.

Glaucoma is one of the most trying disorders to treat. People fear eye operations, and if they wait too long their sight may be gone. A study on the violet ray for glaucoma was done in 1911. A woman had no vision in the right eye and very little in the left. She said that she was able to read and thread a needle two weeks before. Before telling her that her condition was hopeless, Dr. Samuel Risley decided to try the violet ray. She was given 10-minute applications over her closed eyelids. She then had a steady improvement in vision in her left eye.

A man had cataracts removed from his eyes. The pressure rose to 90 in both eyes, with a diagnosis of glaucoma. An operation gave him

some relief for weeks, but he had pain and an inability to see. Eye drugs didn't help him. After nothing else worked, he was given violet ray treatments. The ocular tension dropped to 50 after a month's treatments. Most of his vision was destroyed, but he could see a little.

A 78-year-old woman complained of excruciating pain in her left eye. The tension was 90. She was given myotics and violet ray treatments. In three weeks, the tension dropped to 50, and she felt comfortable. Then the eye tension dropped to normal and stayed there.

A man had an eye injury and became blind in that eye. Two specialists condemned the eye, and a surgeon wanted to remove it, but the man refused. He put the vacuum electrodes over the eye and alternated the treatment with a negative current. Vision returned to the eye, and the pain disappeared.

When the violet ray is used to treat cataracts, there is a "mackerel sky" appearance after treatment because of disintegration of the cataract. The vision is poorer for a few days, and then it becomes much better. The edge of the lens is the first to clear, where the opacity is thinnest. As the eye recovers, the ability to see green returns, followed by blue, red and yellow colors.

A 70-year-old woman had been blind in her left eye because of a childhood injury. She had a cataract on her right eye. She started violet ray treatments, and in two days, she was able to count the number of fingers a foot away and see the green leaves of the shrub in the pot beside her bed. A week later she could tell onions by sight and see the difference between peas and beans on her plate. After two months of treatment, she was able to read fine print and function normally.

A 62-year-old woman had a cataract in her right eye for four years and a cataract in the left eye for 15 years. After a week of violet ray treatments, the woman wasn't bumping into objects so often. After six weeks of treatment, she could see bumps in the sidewalk, instead of having to feel for them. She could now distinguish faces. After three months of treatment, she was able to write and could see her sister's face. The treatments were taken occasionally, and improvement was slow. Soon she was able to read magazines. A year after her first treatment, she could see the eye of a sewing needle and thread it.

A 15-year-old English boy was born with a cataract in his right eye and suffered from severe myopia in the left. He got a small portable violet ray from Canada and began to use it. After a week his vision began to clear. In three weeks, he could distinguish between meat and vegetables on his plate. After using it for three months, he was able to count the number of books on a shelf. Earlier, he couldn't tell the weeds from the vegetables; now he could weed the garden.

A six-year-old child had an unusually severe attack of chickenpox, which damaged both corneas and left him with poor vision. Violet ray treatment was given every other day for six months, and vision returned to 20/30.

The companies that made violet rays had testimonials from their customers. One wrote: "I purchased one of your Marvel Violet Rays and with it I cured my eyes that three doctors, two of them noted specialists, gave up as a hopeless case. I got results in the first treatment and could read without glasses – something I could not do before, and now I am practically cured.

Another customer wrote: "I wish to say a word in regard to your Marvel Violet Ray outfit. I have been using it on my eye for a pronounced cataract; it has nearly cured it. I have been loaning my outfit to a friend for the same trouble. He is benefited and is ordering one."

No treatment is a panacea for eye conditions, but many more cases where electricity made a major change could be cited. The violet ray was able to relieve the sensitivity to light known as photophobia. It greatly helped Bell's palsy, which was disturbing the vision of a patient. Negative current and the violet ray in eye conditions often produced wonderful results.

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40. ELECTRICAL EAR TREATMENT

“Before we bring this part of the dissertation to a close, it must be observed that doctors seldom persevere in the use of electricity with sufficient diligence, for we ought not to forget that though electricity removes some diseases all at once, and as if by magic, still in others it must be used with long patience; and though the patient may have received no benefit from it after two or three months’ use, still success is by no means to be despaired of, for it has removed, even after six months, diseases which could not be cured otherwise. But [William] Shenstone says: “Patience is a panacea; but where is it to be found and who can swallow it?”

Robert Louis Stevenson 1777

John Wesley was the first person to attempt curing ear conditions with electricity. A young man from Stockholm came to his clinic with deafness and ringing in the ears. Wesley drew sparks from the ears, and the man could hear better in minutes. After a few treatments, he was able to cure a man who had been deaf for 32 years.

Alessandro Volta was the first person to try direct current in the ears. He made a battery of about 30 or 40 pairs of alternating metals connected with pads of salted water. He put the electrodes into his ears and closed the switch. He experienced a sensation like the boiling of fluid. It was quite unpleasant, and he didn’t repeat the experiment.

In 1802, Johann Ritter made a battery out of 100 pairs of metals. When he put the electrodes into his ears, he experienced a distinct musical tone at the making and breaking of the current. In 1801, Carl Grapengiesser described the acoustic reaction as a peculiar murmur or noise. When a positive electrode was put in the ear, it produced the sensation of pressure in the head pressing outward. The acoustic sensations resembled buzzing, hissing, whistling and ringing.

Grapengiesser found that the negative electrodes in the ear were more effective than the positive side. He treated a man with Meniere’s disease, and it suppressed the tinnitus for about four hours after each session, but then it would return. The current was painful and caused nausea, so the man quit using the treatment. The cathode would generally increase the ear noise, but the anode would reduce ear noise in about half the people who tried it.

An attempt was made to produce electrical hearing by putting cotton soaked in salt water into the ear, and applying a varying electrical current across the ears. But the distortion was too great to understand speech,

William Neftel tried using electric currents to treat noises in the head and loss of hearing. A 60-year-old patient had impaired hearing from childhood. He was completely deaf in his left ear, and he could only hear loud voices in the right ear. Putting a current into the ear resulted in an acoustic reaction and improved hearing. Neftel treated another man with total deafness in his right ear and limited hearing in the left. After the first electrical treatment, the man could hear loud noise in the right ear. It did improve but still remained poor.

Many attempts were made to treat hearing problems with static electricity. Dr. David Yates put patients on an insulated platform. A hard rubber handle was connected to a "spark ball," which was moistened and held against the deaf ear and attached to the negative side of the static machine.

A 25-year-old woman was completely deaf in her right ear, and she could barely hear a watch placed next to the left ear. She complained of distressing noises in her ears. She had earache and suppuration from both ears. She couldn't keep her balance when it was foggy, so she couldn't go out. When she went swimming, her ears always got infected, resulting in earache.

After a month of static treatment, she could hear a watch ticking 18 inches away from the left ear, and she could barely hear a watch in the deaf right ear. With another month of treatment, hearing in both ears was completely restored.

A music teacher suffered from noises in the ears and earache. She was treated by an ear specialist without results. She could hear a watch at three feet from her right ear, and only an inch away from the left ear. Static wave currents were used in both ears. The noise disappeared, and after four treatments, she could hear equally well with both ears.

Doctor Yates treated Isaac Coleman, who was almost totally deaf in both ears. He could hear thunder or the whistle of a locomotive and the report of a gun. He was so deaf that he didn't learn to talk

and was educated at a school for deaf mutes. He was treated in the ears with static electricity for 30 minutes twice a day. After a month, he could hear a watch ticking at six inches with one ear. During treatment, Dr. Yates held objects up and said their names. In a short time he was able to talk about as well as a child.

This resulted in visits from three other deaf mutes to his clinic. Two were unable to hear anything, and one had slight hearing after the treatments. A four-year-old girl did nothing but cry during treatment, and it seemed impossible to work with her. But she began to listen to sounds and learned to talk afterwards.

Yates began the treatments by washing out the ears with hydrogen peroxide. He felt that he could improve any person who could still hear a watch ticking. He once had an old Negro walk into his office and yell: "Doctor, I want you to do something for me; I lost my hearing, and I lost my voice too. I can't hear and I can't talk; I lost 'em both at once." Since he couldn't hear himself talk, he assumed his speech was gone. After 10 minutes of treatment, the hearing returned. Yates thought the acoustic nerve had paralyzed from heat prostration.

Several major problems connected with hearing can be treated electrically. Often the ears get infected, and a deep-seated infection is very resistant to treatment. In infections, the ears were cleaned well, then a 1% solution of zinc sulfate was mixed with 3% glycerin and put into the ears and attached to a positive electrode. The current was gradually turned up to 3 milliamps over a 10-minute period. One doctor was able to cure 258 ear infections out of 318 cases. Another doctor reported that he cured 144 out of 177 infected ears.

The semicircular canals of the ears help the body maintain its balance. We balance with our eyes, but we unconsciously balance ourselves with our ears. If the senses are blocked, we can't stand upright and close our eyes without falling. The balance signals come from the semicircular canals in the ears.

A 32-year-old woman worked for a large publishing company for 15 years. She had throbbing in her head and frequent crying spells. She was unable to walk without falling down. Static currents were put into her ears, but that didn't help much. The violet ray was applied over the first vertebra at the base of the skull, then over the spine and ears, and this corrected the problem.

A storekeeper had attacks of vertigo several times a day. After daily treatment to the back of the neck, spine and ears, the attacks lessened and then disappeared.

Direct current was often able to relieve tinnitus aurium or ear noise. The anode usually reduced the noise, while the cathode usually increased the noise. The anode was usually put into an ear, and the cathode was attached to the back of the neck. The treatments were done daily for the first week and then twice a week until the patient was cured or it was obvious that it wasn't working. Occasionally the cathode reduced the noise, and then the terminals were reduced.

In 1902, Dr. Denoyes in Paris, began to use violet ray treatments on ear noises. A 55-year-old woman heard noises like the rolling of a train through a tunnel which greatly troubled her sleep at night. After the 13th treatment, she experienced less noise. It took 45 treatments to nearly eliminate the noise.

A 60-year-old woman heard noises like a train or the falling of water. It was worse during the day than the night, but the noises often left her troubled and unable to sleep. After six treatments, the noises were intermittent. After 16 treatments, the sounds would be gone on the day of the treatment. When treatment was stopped, the noises began to return. With continuing treatment, the noises became no longer noticeable.

In order to avoid sparking, cotton soaked in salt water was wrung out and put into the ear canal. When the noises in the head were not too long standing or too intense, improvement was usually noticed after five to 10 treatments. A severe case of ear noise resisted treatment, but after months, the noise finally disappeared.

For treating hearing loss, the violet ray was used for two minutes in each ear and the strength of the current was observed, because it produces heat. Mrs. S. lost the hearing in her left ear in childhood, and the hearing in the right ear was getting worse. A hearing specialist treated her for six years, but she didn't get any help. She was then treated with the glass vacuum electrode in each ear. She could hear conversation in her right ear at three feet. After three weeks of treatment, she could hear conversation at 20 feet.

A clergyman's hearing was failing for 18 years, and he had constant drumming noises in the ears. He could hear a conversation at 12 feet in the right ear, and six inches in the left. After violet ray treatments for six months, he could hear a clock tick up to 30 feet away.

A 20-year-old woman was being treated for another condition when she remarked that her hearing was very bad from an infection. She couldn't hear a watch ticking more than two inches away in the right ear. She was given 10 days of violet ray treatments. Each day the hearing distance of the watch tick was a little further away.

A 57-year-old man was deaf in his right ear for seven years and had to carry a large ear trumpet with him. After three weeks of violet ray treatment, his hearing had improved to the point that he didn't need the ear trumpet.

The manufacturers of the violet ray devices occasionally received glowing testimonials on ear conditions. One testimonial read: "My hearing has improved wonderfully. In fact, my hearing in the left ear is almost normal now."

Another testimonial said: "My wife suffers from catarrhal deafness. At Christmas I brought home a Renulife violet ray generator, and my wife found that an accumulation of waste matter had been dislodged in her sufficient to have some part of it cling to the ear electrode. This was removed at the time that she took the electrode from her ear. At the same time, a part of the congestion dropped into her throat, and from that moment she realized what it meant to have the use of her ears, as do those that have no afflictions."

Maud Webb wrote: "I took two treatments with the Violetta and they helped me more than anything I ever tried. I have not heard a bird sing for years, but now I can hear a canary we have here in a cage about 15 feet away. A few days ago I could not hear it sing, if I put my ear right on the cage."

Dr. Charles Bridges wrote: "I am having wonderful success in the treatments of partial deafness. The patients seem to improve with every treatment. Dr. Richardson of Englewood [Colorado] is a case of long standing, and even in his case, we are getting wonderful results."

A French doctor treated 14 cases of deafness with the violet ray. He had such good results that he believed that all cases of deafness should be treated this way before doing anything else.

Dr. Hamm of Brunswick, Germany devised an 'ototherm' for treating partial deafness. He attached two disk electrodes to the ears and applied high-frequency currents. The sitting varied 5-10 minutes, and there was considerable variation between patients. He believed that it was the diathermic heat stimulation that restored the hearing.

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