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Therapeutic Attractions: Early Applications of Electricity to the Art of Healing

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In the past few decades a number of studies dealing with eighteenth-century natural philosophy in England have pointed out its inextricable links with spectacle and public display. The commodification of cultural products, which was one of the main features of the Enlightenment, extended to science and scientific instruments, textbooks, and demonstrations, as well as to medicine. Pivotal works by Roy Porter have indelibly portrayed the vibrant marketplace in which medical practitioners operated. Even when they had a formal degree, "regular" healers had to compete both with "irregulars" and with a widespread culture of self-treatment (Porter, 1985, 1990, 1995; Porter & Porter, 1989; Schaffer, 1983; Stewart, 1992). In such competitive arena recently invented therapies attracted the attention of both patients and practitioners. From the 1740s onward, "medical electricity" was among the most attractive ones. The term indicated the applications of electric shocks and sparks to the treatment of various diseases, in particular palsies and "nerve disorders."

Electrical healing was first presented to the eighteenth-century public as a branch of experimental philosophy (Bertucci, 2001a). This essay analyzes the early diffusion of medical electricity, setting it in the context of the experimental culture from which it emerged. I deal with a relatively short span of time – the few decades during which almost instantaneously medical electricity came to be practiced in different European states – and I highlight the role played by itinerant demonstrators and instrument-makers in spreading what would soon become a fashionable, though controversial, healing practice.

Spectacular Treatments

It is commonly held that it was the invention of the Leyden jar, in the mid-1740s, that triggered wide interest in the new science of electricity (Hackmann, 1978; Heilbron, 1979). However, it is difficult to make causal connections among the events that in the span of a few years made electrical science the craze of the century. The Leyden jar became widely known in 1746, the same year in which most electricians began to investigate systematically the healing properties of the electric matter. The possibility that electrical machines, generally employed for entertaining paying crowds with amusing demonstrations, could also provide new ways of curing long standing diseases began to be discussed around 1744, mostly in Germany. The country was homeland to a group of electricians who envisaged the potential of the new science for attracting powerful patrons. The Wittenberg professor Georg Matthias Bose was a main actor in the transformation of electricity from an academic branch of natural investigation into a fashionable amusement. If, during the 1730s, both Stephen Gray at the Royal Society of London and Charles Du Chisternay Dufay at the Académie des Sciences in Paris devoted themselves to the investigation of the electric matter, it was Bose and other "Saxon virtuosi" that, as the *Gentleman's Magazine* acknowledged in 1745, made electricity a subject à-la-mode, with "princes willing to see this new fire that man produced from himself, and which did not descend from heaven." (*Gentleman's Magazine*, 1745)

In his several writings Bose highlighted the spectacularity of electrical experiments, providing also a theory of "male" and "female" fire that would explain attractions, repulsions, and luminous appearances. He also published a two-book poem dedicated to the most entertaining electrical experiments, such as the "beatification" (which he invented), the "flying boy," the circuit experiment, and the most exciting of all, the "electric kiss" (or *Venus electrificata*) (Figs. 1–3):

Once only, what temerity!
I kissed Venus standing on pitch.
It pained me to the quick. My lips trembled
My mouth quivered, my teeth almost broke
(Bose, 1754; Heilbron, 1979, p. 267n)

All these experiments required that spectators would directly experience the passage of electricity through their bodies. If their active involvement was one of the most thrilling aspects of electrical demonstrations, it was because of the inclusion of the human body in such amusing experiments that the physiological responses to the passage of electricity began to be noticed.

FIGURE 1. Bose's "beatification." From Benjamin Rackstraw, *Miscellaneous observations, together with a collection of experiments on electricity*, London, 1748

FIGURE 2. The "flying boy" experiment. From Nollet, *Essai sur l'électricité des corps*, Paris, 1746

FIGURE 3. "The electric circuit" experiment. From Windler, *Tentamina de causa electricitatis*, Neapoli, 1747

Around 1744, Johann Gottlob Krüger, professor of medicine and philosophy at Halle, reported that all the people who subjected themselves repeatedly to the "electric kiss" presented small red spots on their hands, a result that would disappear after several hours (Krüger, 1744, p. 544). Krüger noticed that electrification produced involuntary muscular motion and anticipated that electricity could be therefore applied to the treatment of palsies. Together with his pupil Christian Gottlieb Kratzenstein, he was the first to claim that electricity might be applied to medical purposes. Kratzenstein, in particular, measured the pulse before and after electrification and reported a constant increase, amounting to a third of the normal rate.

Aware of his colleagues' results, Bose conceived of an experimental demonstration that seemed to provide a mechanical explanation of the increase of the pulse and of other physiological responses to the passage of electricity. He prepared a metallic siphon and put some water in it. In normal condition, the liquid would intermittently drop off, but when the metal was electrified, the water flew in full stream (Bose, 1744–1745, p. 420), [Fig. 4, bottom right]. Bose also noticed that blood issuing from an opened human vein "streams off more quickly when the man is electrified [. . .] blood drops appear luminous like fire" (Nollet, 1750, p. 118).

As a consequence, he concluded that the electrification of the human body increased blood circulation, insensible perspiration, and the pulse. All diseases that may benefit from such effects could be treated by electricity. Kratzenstein, on his part, reported that electricity produced tiredness and concluded that it would be helpful to all whose

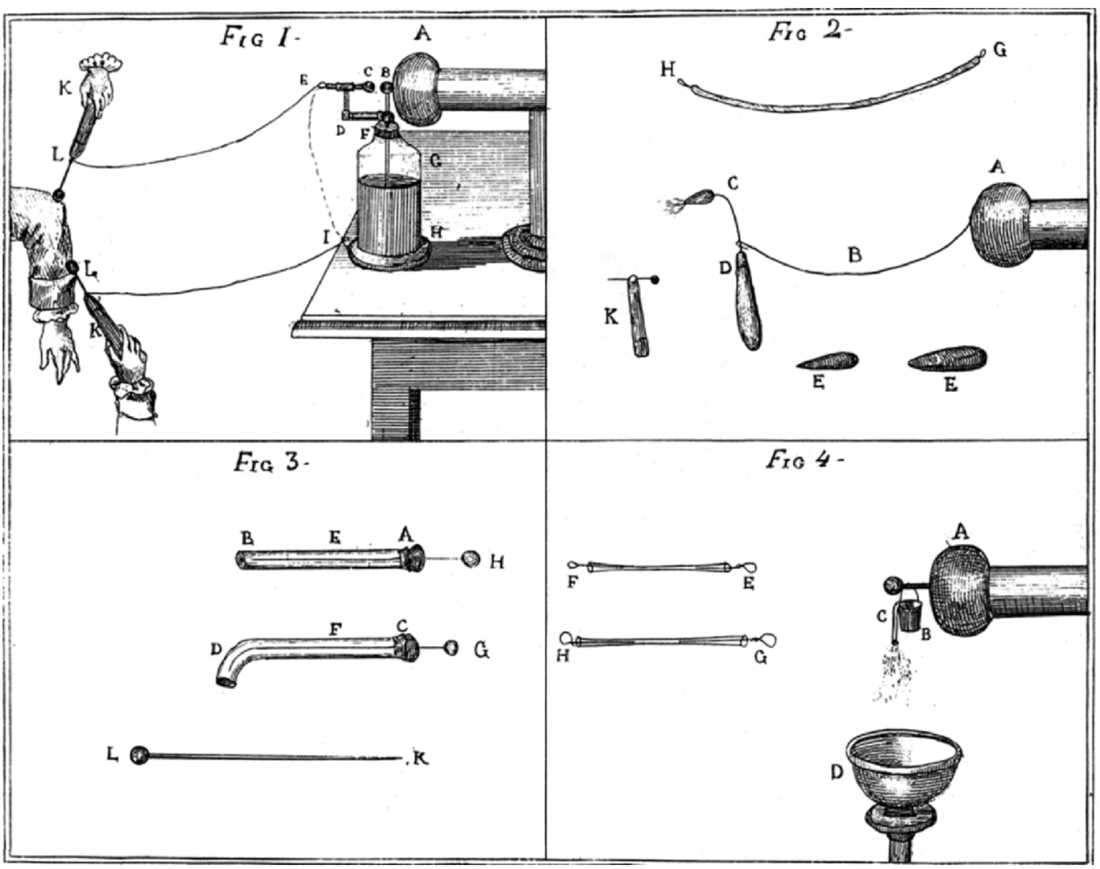

FIGURE 4. Table from Tiberius Cavallo's *Essay on medical electricity*, London, 1781. Fig. 1 (in the plate) shows the medical bottle, Fig. 4 represents the "electrified siphon"

"riches, sorrows, and worries prevent them from closing their eyes at night." (Kratzenstein 1745 in Snorrason, 1974, p. 37).

Kratzenstein's electric treatments soon became known in the rest of Europe and began to be replicated in Copenhagen, Vienna, Uppsala, Stoccolma, Rouen, Lipsia, where electricians engaged in applying medical electricity and reported positive results. News of prodigious cures was published in popular magazines more often than in academic publications. The possibility that electricity might have healing virtues added to the attractiveness of the spectacular demonstrations; Bose's "experiment of the pulse" became one of the attractions offered during electrical soirées. But the medical applications of electricity demonstrated also that the new science was useful as well as delightful; indeed, "electricity made useful" became synonym with medical electricity in a series of booklets on the healing properties of the electric matter (Cavallo, 1780; Lovett, 1756; Wesley, 1760).

In 1745, during the War of the Austrian Succession (1740s), the Saxon army physician Christian Xavier Wabst – later to become physician to the Empress Maria Teresa – settled in Venice, where he began to astonish local audiences with the spectacular effects of his electrical machine. It was the first time that the instrument reached Italian audiences and his demonstrations initiated a new fashion south of the Alps. As an army physician, Wabst was obliged by his Court not to leave Venice, but his terrific shows attracted spectators also from other towns. A number of them were looking for entertainment, others wanted to learn how to replicate the most recent experimental discoveries.

At the University of Padua, the professor of experimental philosophy, Giovanni Poleni, was particularly keen on public demonstrations. His "theatre of experimental philosophy," which was inaugurated in 1738, was the place where he offered his academic lectures, as well as the venue where he carried out experimental demonstrations for prestigious visitors. In an unpublished diary, he listed all the experiments he performed in front of cardinals, administrators, military captains, princes, and princesses.[1] When he got to know of Wabst's electrical performances, he became anxious to learn how to reproduce them in his theatre. Since Wabst could not go to Padua, Poleni sent his assistant Vitaliano Donà to Venice. The University refunded the fee of 24 *soldi* required by Wabst and, in 1747, Poleni began to perform electrical experiments during the public demonstrations he offered to his audiences (Salandin & Pancino, 1987, p. 654).

Whereas Wabst could not leave Venice, several itinerant demonstrators, mostly coming from abroad, traveled through the Italian peninsula showing the marvels of electricity to local aristocrats, academics, and the simply curious. As a Florentine literary magazine reported, in 1747, there were numerous "practical experimenters, or circumforaneous philosophers, who have found their way of living on the electric virtue by traveling the world with electrical machines coarsely made by themselves, as we have seen all over Italy." (*Novelle letterarie pubblicate in Firenze*, 1747, p. 654)

The "circumforaneous" (itinerant) philosophers announced their arrival by means of printed leaflets that listed their experiments. Locals would offer their own houses to host electrical soirées in exchange for a certain percentage on the entrance fee that each guest would pay. The shows would be replicated for one or two weeks in the same place. It was thanks to the activities of such itinerant demonstrators that electrical experiments became quickly known in the Italian states. Together with entertaining demonstrations, they spread the idea that sparks and shocks could be employed in the art of healing.

When the news of Bose's "experiment of the pulse" arrived to Padua, Poleni hastened to repeat it. In his theatre of experimental philosophy he involved his noble spectators, measuring their pulses before and after electrification, and included himself in the measurements. His results confirmed the increase predicted by Kratzenstein.

Italian aristocrats delighted themselves with electric shocks and attractions and, when news of the healing virtue of electricity spread in the peninsula, they engaged in putting it to trial. In Vicenza, a town in the Venetian mainland, the marquis Luigi Sale was one of the first to apply electricity as a healing therapy. He owned a large electrical machine in his villa and he corresponded with local electricians, such as the above mentioned Giovanni Poleni in Padua and Scipione Maffei in Verona, an

[1] Biblioteca Nazionale Marciana, Venice. Mss Lat, VIII, 158.

antiquary who in 1747 published accounts of his electrical experiments. After reading about the newest application of the electric matter as a medical remedy, Sale decided to test medical electricity on his servant Giambattista Negretti, whose unusual problem was quite well known in the area. Since the age of eleven, Negretti had suffered from a "most extravagant disease," which presented itself each year at springtime. In the middle of the night, he would get up from his bed and, still sleeping, he would look for food, drinks, money . . . he would even go to the local tavern without ever waking up (Maffei, 1747, p. 144).

The sleep-walker from Vicenza was a living marvel. Several booklets had been published on his case; they described his symptoms and the vain (sometimes cruel) attempts to wake him up. In February 1747, Sale began to electrify Negretti. The result was immediate. A few painful sparks drawn from his body – without making use of the Leyden jar – sufficed to wake up the irreducible sleep-walker, who declared himself extremely happy, thanked the marquis with "tears of consolation" and blessed the electrical machine.[2]

The cure of the sleep-walker from Vicenza circulated widely, but mainly in private circles. The medical virtues of electricity were still discussed in the Republic of letters, yet Sale and his entourage were not interested in taking part in an international debate. The cure of the sleep-walker can be regarded as an instance of the inclusion of electricity in the aristocratic culture of curiosity, with its love for prodigies, marvels, and strange facts.

Not far from Vicenza, there were other electricians who were pursuing different goals. A few months after Wabst's departure, an ambitious gentleman who lived in Venice, Gianfrancesco Pivati, claimed to have discovered a new method of applying electricity to cure instantaneously inveterate diseases. Having obtained the support of the prestigious Institute of Sciences of Bologna, Pivati published a short booklet in which he presented his invention, the "medicated tubes," and described the prodigious cures he obtained by this means. Among the people he healed, there was the bishop of Sebenico, a 75-year-old man who had been suffering of podagra and chiragra (gout) for decades (Pivati, 1747). The prodigious cure of the bishop, toured the learned world.

Pivati's method was quite different from others. His "medicated tubes" were sealed glass cylinders filled with healing substances; when the glass was electrified, according to Pivati, the medicines evaporated through the pores of the glass and diffused themselves in the surrounding air. Patients would only have to breathe in the healing atmosphere to be cured.

> Such news in our electrical experiments! How perfect! Such a success! [. . .] We substantiated them in such a way that made us think we were not guessing, and as to myself, I believe we surpassed everyone in matters electrical.[3]

With such words, the Secretary of the Bologna Institute of Sciences communicated Pivati's prodigious cures to his colleague Jean Jallabert in Geneva. In 1748, the Bologna Institute sponsored the publication of Giuseppe Veratti's *Physico-medical observations on electricity*, which confirmed Pivati's results. Only one year later, however, the physician Gianfortunato Bianchini discredited Pivati's tubes in his *Essay on medical electricity* published in Venice. In a span of few months, all over Europe several other electricians published their opinions about the medicated tubes. By making public the results of their trials, both supporters and opponents of Pivati's method spread news about the possibility that electricity might have healing virtues. I have elsewhere analyzed the controversy on the medicated tubes that climaxed with Jean Antoine Nollet's journey to Italy in 1749; it may be enough to note here that its great impact in the Republic of Letters triggered further work on the healing virtues of electricity and increased the public's interest toward electrical treatments (Bertucci, 2005).

The proliferation of presumed cures by means of electricity engendered caution among electricians working in academic contexts, especially the Abbé

[2] Bibliothèque Municipale, Nîmes. Vol. 9352, "Copia della lettera del Sig. Marchese Luigi Sale di Vicenza al Sig. Gian Ludovico Bianconi Medico di S.A. il Principe e Vescovo di Augusta" (12 March 1747). I am grateful to Ivano Dal Prete for attracting my attention to this document.

[3] Bibliothèque Publique Universitaire, Genève. Collection Jallabert, Correspondance, SH 242, ff. 186 (Zanotti to Jallabert, 1 July 1748).

Nollet at the Académie Royale des Sciences in Paris (the leading authority in electrical matters at the time) and William Watson at the Royal Society. Although the Royal Society refrained from publishing about medical electricity, the British public came to know of the healing virtues of electricity by means of itinerant lecturers. By the mid-eighteenth century traveling demonstrators were numerous in the country; it was by their means that Newtonian experimental philosophy had become so widely popular (Morton & Wess, 1993; Schaffer, 1983; Stewart, 1992).

Electricity was soon incorporated in the repertoires of popular demonstrators such as Benjamin Rackstrow, Benjamin Martin, and James Ferguson and, exactly like in other European countries, the spectacular display of shocks, sparks, and attractions became feverishly requested by the upper classes (Millburn, 1976, 1983, 1988). In 1770, James Ferguson published *An introduction to electricity*, a booklet clearly tailored to his audience. Although he was mainly interested in mechanical instruments, the popularity of electrical experiments induced him to add electricity to the other subjects of his lectures. His *Introduction* described simple experiments and included medical electricity as one of the wondrous effects of the electric fire. Hence, the electrical machines that he sold were equipped with accessories for the performance of both electrical experiments and electrical treatments.

Both Richard Lovett and John Wesley, the first authors who wrote texts on medical electricity in English, declared that they got to know the properties of electricity in the course of public lectures they were attending. Lovett was a lay-clerk at Worcester Cathedral, whereas Wesley was an Anglican preacher. Their advocacy of electrical healing, informed by their theological views on Christian piety, highlighted its cheapness and universality: electrical machines were easy to make, their cost could be shared among neighbors, anyone could learn how to administer electrical treatments (Bertucci, 2006).

Instruments and Therapies

In England, "electricity made useful" – as medical electricity was called by Wesley and Lovett – began to be advertised as a therapy that could meet the needs of the lower classes of society. In 1746, John Reddall, who corresponded with Lovett, organized a course of lectures on medical electricity in London that attracted more than a hundred people a day, even from the countryside. Reddall was convinced that "electricity in a little time will be generally practis'd" and that the several successful cures would bring it "into universal Practice" (Lovett, 1760, p. 35). Wesley included medical electricity among the free treatments offered by his Dispensaries in London and published lists of people who had been healed with the help of electrical machines. John Read, a cabinet-maker who had been healed by electrical treatments in Wesley's Dispensaries, devoted himself to making electrical machines especially designed for medical purposes (Wesley, 1760, p. 60). He put his manual skills to work and designed low-price portable electrical machines that could be bought by people living in the same neighborhood:

> [Read] has just invented a smaller One, that will take to Pieces, and pack up in a Box of about a Foot Square, and is endeavouring to reduce them to a very low Price, in order to make them as public as possible. (Lovett, 1760, p. 40)

Read's machines were acknowledged in Joseph Priestley's *History and Present State of Electricity* (London, 1767) as especially practical for medical purposes (Fig. 5).

Instrument-makers in England played a crucial role in spreading medical electricity. In a context in which experimental philosophy was firmly

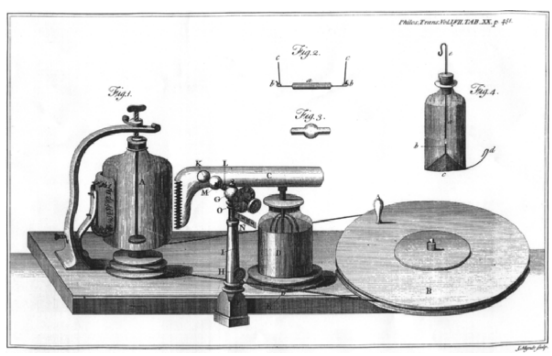

FIGURE 5. John Read's electrical machine with Timothy Lane's discharging electrometer. From Timothy Lane, "Description of an electrometer invented by Mr Lane," *Philosophical Transactions of the Royal Society* (1767), 57, 451–460, table XX, p. 431

grounded in a vibrant marketplace, medical electricity was for them business opportunity. This was specific to the English case, whose instrument-makers were world famous and their products were requested from customers all over the world. They soon realized that the medical applications of electricity would represent an effective means of advertising their goods. John Neal, a London instrument-maker whose shop was in Leaden Hill, specialized in the making of electrical machines. In 1747, he published *Directions for Gentlemen, who have electrical machines, how to proceed in their experiments*, in which he invited readers to submit cases of electrical cures, which would be included in a forthcoming booklet on medical electricity (Neale, 1747, p. 76).

The fact that medical electricity was profitable can be inferred from the analysis of a manuscript notebook that belonged to John Fell, a surgeon at Ulverstone, who, in the last quarter of the eighteenth century, decided to specialize in medical electricity. At the time there was no formal training to become medical electrician, so he got practical information from the several textbooks that had been published in the course of the years. He also got in touch with apothecaries, instrument-makers, and surgeons who practiced medical electricity in London. His expense-book shows that within a few months he completely covered all he spent to set up his laboratory, which he equipped with the best available instruments.[4]

The medical applications of electricity generally worried the academic establishment. In Italy, the physician Giovanni Bianchi was outraged by the craze for electricity that, in his opinion, congested the minds of almost all Italian philosophers. William Watson, on his part, regarded electricity an idle activity, with no useful application:

> If it should be asked to what useful purposes the effects of electricity can be applied, it may be answered, that we are not as yet advanced in these discoveries as to render them conducive to the service of mankind. (Watson, 1746, p. iv)

In France, the leading authority in electrical matters, Jean Antoine Nollet, spent a lot of his time testing the healing virtues of electricity upon a group of paralytic soldiers at the Hôpital des Invalides. He was the first to engage in systematic trials carried out in collaboration with the physician Morand and the head surgeon De La Sone, but he regarded the results they obtained "too uncertain to be worth mentioning." (Nollet, 1751, p. 19)

The first report that was taken seriously by the academic world came from Geneva in 1748. The physics professor Jean Jallabert, a respected electrician, published the account of his successful cure of a paralytic man called Nogues. On the 26th of December 1747, he began the electrical therapy in front of several witnesses, among whom there were a number of members of the Faculty of Medicine and Surgery (Jallabert, 1749, p. 173). Treatment consisted in drawing sparks from the paralyzed arm for 2 hours in the morning and 2–3 hours in the afternoon, for a month and a half. Nogues was also subjected to electric shocks at least four or five times a day. Jallabert notified his success to academies all over Europe, and above all to his correspondent and friend Nollet in Paris.[5]

Prompted by Jallabert's report, Nollet resumed his trials at the Hôpital des Invalides, but again, after months of failed attempts, he had to conclude that the movements restored by electrification were always involuntary (Morand & Nollet, 1753). Notwithstanding his own results, Nollet was aware that, however controversial, medical electricity increased public interest in the new science of electricity, as well as demand for booklets, demonstrations, and instruments. As an author, public demonstrator, and instrument-maker, he was unsurprisingly pleased. On returning thanks to Jallabert for his report on Nogues' cure, he acknowledged that it was "thanks to you that electricity has begun to sell really quickly." (Benguigui, 1984, p. 161)

Similar tones were used by another French academic, Boissier de Sauvages. He was Royal professor of Medicine at Montpellier and corresponded with Jallabert, who gave him advice on how to apply electricity to medical purposes. In a few months, De Sauvages cured a number of paralyzed patients by means of electricity. Among them, a 70-year-old beggar, whose left arm and right leg were completely motionless, received such benefit and in such a short time, that his wife believed he was granted a miracle (Jallabert, 1749, p. 367).

[4] Wellcome Library, London. MS 1175.

[5] Archives de l'Académie des Sciences, Paris. *Procès Verbaux*, Tome 67 (1748), ff. 43–44 (3 February 1748).

On the wave of enthusiasm, De Sauvages wrote to Jallabert that “thanks to your instructions electricity has become fashionable [;] in this town everybody wants to be electrified.”[6] In Montpellier, electrical healers began to have portable machines built so as to be able to offer electrical treatments in the patients’ homes, a practice that would become customary in England.

The rumor that such reports made in the learned world prompted even the skeptical William Watson to test the effects of electricity. In 1756, he published in the *Philosophical Transactions* the report of his successful cure of a case of tetanus by means of electricity. In the second half of the eighteenth century, in Russia, Sweden, the Netherlands, as well as in France and Britain, reports of electrical cures began to appear in academic publications. Yet the growing attention of the academic world toward this new healing practice did not entail approval or consensus. On the contrary, electrical healing retained its controversial character even in the following centuries (Bertucci & Pancaldi, 2001). But one result of the increased interest, both at the academic and popular level, was that treatments and instruments began to be more standardized.

In 1756, the first English textbook on medical electricity explained how to apply three methods of electrical therapy: simple electrification, drawing of sparks from the patient, and electric shock. The three methods relied on the conception of the healthy body as a container of a natural amount of electricity, whose accidental variation provoked disorders. According to the author, Richard Lovett, electricians should begin any treatment with simple electrification: the patient, standing on an insulated chair, was connected to the metallic conductor of the electrical machine; this way, lost quantities of electricity would be replaced. By drawing sparks from the patient’s body, on the contrary, excesses of electricity would be taken away; placed on an insulated chair, the patient was connected to the electrical machine, while the operator drew sparks from him or her by means of a pointed metallic rod which he kept from its insulated end. The electric shock, used to remove obstructions of bodily fluid, was produced by discharging a Leyden jar through a selected part of the patient’s body; the inner and the outer coating of the jar would be connected to the extremities of the limb, or the head, or other parts of the body, by means of insulated conductors (Fig. 6). In spite of this simple presentation, in their practice, medical electricians chose therapies without referring to theoretical conceptions. The real efficacy of simple electrification was controversial and most often practitioners applied only sparks and shocks.

In the 1750s, a kit of medico-electrical instruments was made of a small number of essential objects: a portable machine, similar to those made by Read, Leyden jars of different sizes, metallic chains to convey the electric fluid to the part of the body affected by the disorder, and an insulating stool for the patient to stand on while receiving treatment. With these instruments and with contemporary booklets on medical electricity, anyone could try the healing properties of the electric fire.

A new generation of medico-electrical instruments would appear in the following decade. In 1765, the London apothecary Timothy Lane, who worked also as a medical electrician, invented a discharging electrometer, meant to regulate the intensity of the electric shock (Fig. 5). Lane’s electrometer was incorporated in Leyden jars, that came to be called “medical bottles,” or directly in the prime conductors of the electrical machine (Fig. 4, top left).

If we look at the catalogues of instrument-makers, we realize that, by the 1780s, the range of instruments especially designed for electrical treatments had consistently increased. The treatments of specific disorders such as toothaches, deafness, and problems of the eye, led to the design of new tools for conveying the electric fluid from the electrical machine to the body. They consisted of a metallic wire fixed inside a glass tube, normally 15 cm in length, and two and a half in diameter, terminating with a brass knob outside the tube (Fig. 4, bottom left). During the treatment, the patient would be placed on an insulated stool and connected to the prime conductor of the machine. Subsequently, the instrument would be directed toward the affected part of the patient’s body, while the operator would bring the knuckles of his fingers at a small distance from the brass knob. As a result of these operations, a series of sparks issued simultaneously between the patient and the tube and between the knob and the operator’s knuckle.

[6] Bibliothèque Publique Universitaire, Geneva, MS 82: Collection Jallabert f. 41 (15 August 1746).

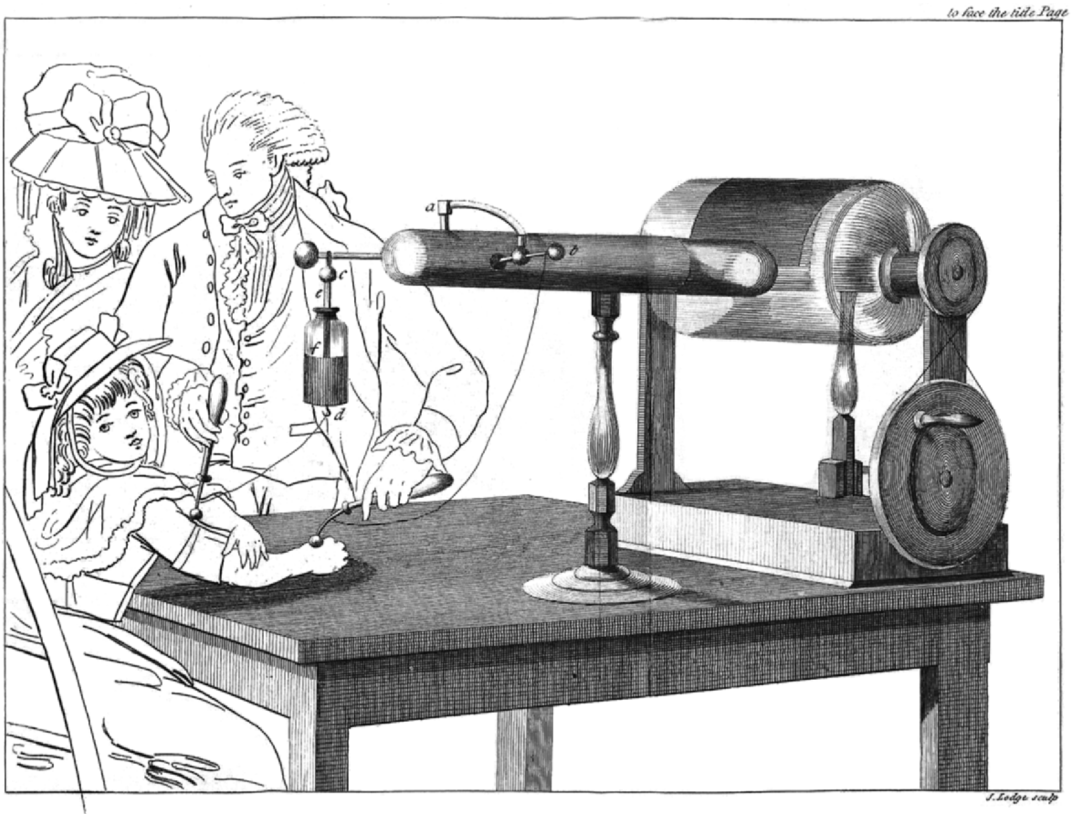

FIGURE 6. Frontispiece of George Adams's *An Essay on Electricity explaining the Theory and Practice of that useful Science; and the mode of applying it to Medical Purposes*, London, 1785

This type of instrument proved versatile. Not only could it be used for cases of deafness or eye-disorders, but it could also be employed to produce a new electrical treatment, called the "electric stream." This was literally a stream of little electric sparks emitted by a wooden or metallic point connected to the machine. The operator could select from wooden or metallic points of various sizes, according to the intensity of the stream he wished to produce (Fig. 4, top right). The wire could be bent according to the therapy, and the electric stream could then be applied to any part of the body. The method could be employed together with "drawing sparks through a piece of flannel," another new therapy that was particularly recommended for cases of rheumatism. The flannel was placed over the part of the body under treatment, and the insulated patient was connected to the conductor. The operator would then use a wire, terminating at the extremities in a sharp point and a brass knob. He would place the point into contact with the flannel, while he quickly shifted the knob from place to place, producing a great number of very small sparks (Cavallo, 1780, p. 46).

Medico-electrical practitioners introduced several variations on this theme. The instrument-maker to the King, George Adams, designed a new instrument that could be employed for a therapy that he called "gentle and refreshing stream." The instrument consisted of a glass tube, terminating in a capillary filled with rose water, or any other perfumed fluid. The connection of the tube with the machine produced a light shower of the scented fluid, which passed from the capillary to the patient.

This constellation of new instruments suggests that, in spite of academic skepticism, medical electricity was quite popular in the medical marketplace. A range of disorders were treated by electricity. Apart from palsies, rheumatisms, and eye–ear–teeth problems, tumors, inflammations, intermittent fevers, nervous disorders, headaches, ulcers, the gout, and St Anthony's fire, were also treated by means of electricity. In the late 1770s, the electric shock became common treatment for the "removal of female obstructions" (or interruption of the menses), as indicated in a booklet by the London surgeon Thomas Birch (Birch, 1780).

From the point of view of instrument-makers, the success of medical electricity climaxed with the patent awarded in 1782 to Edward Nairne for his medico-electrical machine (Fig. 7, Bertucci, 2001a). By then medical electricity had become very popular. In the booklet in which he gave directions on how to operate the patent machine, Nairne had to remind his customers that he was not a medical electrician.

It is also significant that, in 1785, George Adams chose as the frontispiece for his *An essay on electricity* explaining the theory and practice of that useful science; and as the mode of applying it for medical purposes, an image representing the application of electricity to the forearm of a young girl. The unfinished print showed the big electrical apparatus in full detail, while the human figures (the young girl, the operator, and the woman who accompanies the girl) were only sketched (Fig. 6). The image, a visual introduction to the contents of the book, highlighted the usefulness of electricity for medical purposes and drew the reader's attention to the electrical apparatus. Adams, like other instrument-makers in the same period, saw medical electricity as an activity that could stimulate new demand of electrical instruments.

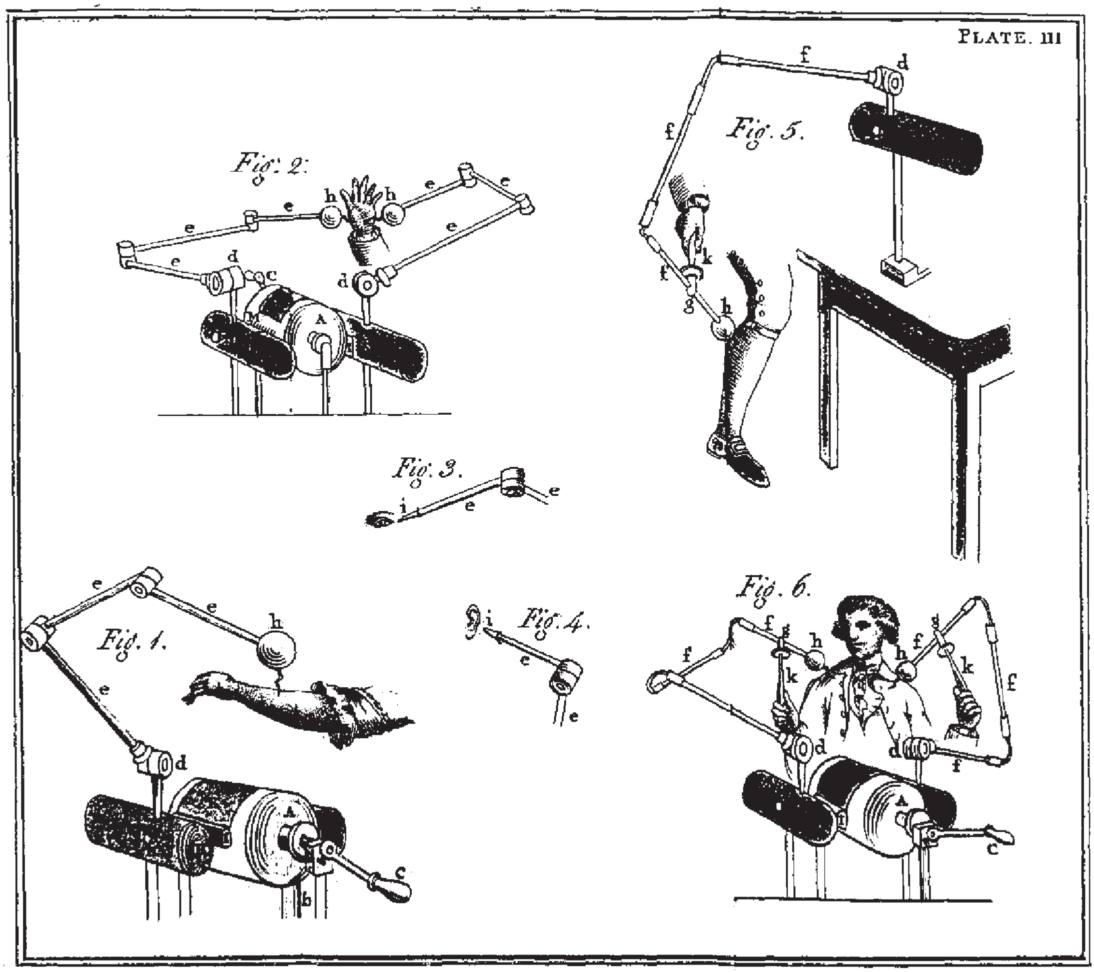

FIGURE 7. Edward Nairne's patent medical electrical machine. From Edward Nairne, *The Description and Use of Nairne's Patent Electrical Machine*, London 1782

Conclusion

If medical professionals were skeptical about a therapy whose success relied mostly on patients' assessments, medical electricity throve thanks to the variegated eighteenth-century market for health matters. In 1780 medical electricity became one of the most flamboyant attractions offered in James Graham's Temple of Health. Graham was an imaginative quack and the "Temple" that he set up in the fashionable quarter of Adelphi in London consisted of ten large rooms, in which several alternative remedies were offered to the rich as well as the poor. Relying on contemporary society's dissatisfaction with medical professionals, Graham made the entrance in the Temple a "total" experience for his patients; all the senses were excited by sounds, smells, colors; healthy goddesses of health recited odes to Apollo, while music played in the background. In his theatrical scenery for the cult of health, with related rituals, he displayed "the largest and most elegant medico-electrical apparatus in the world." (Graham, 1778; Porter, 1982)

Graham's use of electricity in his eccentric enterprise was multifaceted. Rather than actually using electrical machines to administer electricity to his patients, he exploited the fashion enjoyed by electricity as a further extravaganza for his healing centre; the "largest electrical apparatus in the world" was on display, rather than in use, in the Temple, where electrical vapors wrapped up the patients,

> gently pervading the whole system with a copious tide of that celestial fire, fully impregnated with the purest, most subtle, and balmiest parts of medicines, which are extracted by, and flow softly into the blood and nervous system, with the electric fluid, or restorative aetherial essences. (Graham, 1780, p. 29)

The actual practice of medical electricity was looked upon by Graham as an "ignorant and improper application of this awful element" in the "hands of ignorant and rash people," such as barbers, surgeons, tooth-drawers, apothecaries, or common mechanics "turned into electrical operators," who were sprouting "in almost every street in this great metropolis." (Graham, 1780, p. 29)

Graham's enterprise was short lived; he went bankrupt two years later. However, the ephemeral story of the Temple of Health highlights the wide variety of eighteenth-century electrical healers and the heterogeneity of their views on the role of electricity in the animal economy. Whereas Graham was not interested in the nature of the "electric fluid" and its action on the human frame, other eighteenth-century electrical practitioners asked important questions on the relationship between electricity and life. Some believed that the electric fluid was produced by the brain and that, being one and the same thing as the "nervous fluid," it circulated in the nerves. According to this theory, palsies were caused by obstructions of the nervous fluid that could be removed by electric shocks or, in other words, by forcing the electric fluid through the blocked vessels. Others maintained that electricity exerted only a mechanical action on the human frame, accelerating the natural motion of the vital fluids (Rowbottom & Susskind, 1984). In the last quarter of the eighteenth century experimental enquiries into the nature of muscular motion and on the electric organs of fish such as the torpedo or the gymnotus electricus opened up new fields of electrical researches that proved crucial to shaping the neurosciences in the following centuries (Piccolino, 2003; Piccolino & Bresadola, 2003). However, the success of medical electricity in the public domain is to be understood by taking into account the intersection of experimental philosophy, spectacle, and business that it represented. Eighteenth-century electricity was sensational and its therapeutic applications, independently of the theoretical convictions of electrical healers, highly attractive – and financially profitable.

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