

SPARKING CONTROVERSY:
JEAN ANTOINE NOLLET AND MEDICAL ELECTRICITY
SOUTH OF THE ALPS

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ABSTRACT

The paper considers a significant episode in the history of eighteenth-century electricity: the controversy over the “medicated tubes”. Invented by the Italian erudite Gianfrancesco Pivati, the tubes were said to produce instantaneous cures. Jean Antoine Nollet was one of the main actors of the controversy. In 1749, after touring Italy to see for himself the Italian tubes and their effects, he published a report, discrediting Pivati’s accounts. This study shows that the report, which has since been the main source for interpretations of the controversy, hides the key role of the Bologna *Istituto delle Scienze* in promoting Pivati’s invention. Relying on manuscript sources, I propose a change of perspective on the controversy that illuminates the world of Italian experimental philosophy during the Enlightenment and its place in the Republic of Letters. I also analyze the reasons for Nollet’s silence over the involvement of the *Istituto delle Scienze* in the controversy and the relevance of medical electricity in the wider context of contemporary electrical experimental philosophy.

Keywords: Bologna Institute of Sciences, 18th Century Electricity, Jean Antoine Nollet.

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Affected by an inveterate form of arthritis that did not allow him to move his hands, bend his knees or even walk without support, in the Spring of 1747 the 75-year-old Bishop Donadoni of Sebenico resolved to try the *intonacature*, or “medicated tubes”, a medical remedy invented by the Paduan erudite and amateur electrician Gianfrancesco Pivati (1689-1764). Accompanied by a few clerics, who helped him aboard the gondola, the Bishop visited Pivati in his Venetian villa, animated by the hope of finding some relief for his vexatious disorder. After examining the old man, Pivati prepared the “medicated tube”: he filled a glass cylinder with an anti-apopleptic, placed two corks at the extremities so as to seal the tube, rubbed its glass surface with a leather skin and, by bringing the tube near to the Bishop’s body, extracted sparks from the suffering parts. All of a sudden

the Bishop freely opened both his hands, clenched them, and found he had so much strength that, having taken one of the clerics by the arm, he held him so tightly that the latter had to beg to be released [...] he clapped his hands together [...] struck the ground with his feet [...] and cried that he did not know whether he was dreaming or awake [...]. Upon leaving, he got into his boat almost as if he were a vigorous boy, still extolling the prodigy that he had seen effected in himself to all and sundry.¹

The report of the Bishop’s cure, published in Pivati’s *On Medical Electricity. Letter by Gio. Francesco Pivati to Francesco Maria Zanotti, Secretary of the Institute for Sciences of Bologna* (Lucca, 1747), quickly went the rounds of the Republic of Letters, and throughout Europe electricians feverishly engaged in the attempt to reproduce the instantaneous cures performed by the medicated tubes. In the aftermath of Pivati’s publication, two Italian physicians, Giambattista Bianchi in Turin, and Giuseppe Veratti in Bologna, produced further evidence in support of the medicated tubes. Following Pivati’s directions, they replaced the glass piece of their electrical machine with a glass cylinder lined with a healing substance, chosen according to the disorder to be treated (Fig. 1). In line with Pivati’s

¹ “[...] apre liberamente ambedue le mani, le strigne in pugno, ed ha forza tale, che preso nel braccio uno di quei religiosi, questi fu costretto ben subito a pregarlo, che lo lasciasse, perché lo stringeva con troppa forza [...] batteva le mani l’una con l’altra [...] pestava co’ piedi la terra [...] e protestava che non capiva se sognasse, o fosse desto. Nel partirsi [...] entrò nella sua barca quasi come un giovane vigoroso, sempre decantando, come mi fu riferito, presso tutti il prodigio, dic’egli, che in se stesso ha veduto”. GIANFRANCESCO PIVATI, *Della Elettricità Medica Lettera del Chiarissimo Signore Gio. Francesco Pivati Accademico dell’Accademia delle Scienze di Bologna al Celebre Signore Francesco Maria Zanotti Segretario della stessa Accademia* (Lucca, 1747), pp. 38-40. Translations from the original Italian or French, unless otherwise indicated, are mine.

claims, they reported that, upon operating the electric machine, the healing virtue of the medicament evaporated through the sealed glass and almost instantaneously cured their patients. They also tried out other versions of the experiment, with Bianchi's electric purges proving especially popular.

While in Italy the prodigious effects of the tubes crowned Pivati as the "inventor of medical electricity",² beyond the Alps the electricians who engaged in the replication of the experiments could only report endless failures. Aware of the unsuccessful trials of his non-Italian colleagues, and after two years of fruitless attempts, in 1749 Jean Antoine Nollet (1700-1770) decided to see the Italian experiments for himself, in order "to study attentively the Circumstances" of what appeared to him as a "new Wonder more difficult to be explained than any other".³ He left Paris on 27 April 1749 and during the following nine months he toured the peninsula, meeting the healers and patients of the allegedly miraculous cures. On his return, he wrote a report, published in the *Mémoires de l'Académie Royale des Sciences*, and in the *Philosophical Transactions of the Royal Society*, in which he firmly discredited the efficacy of the medicated tubes. In his lengthy account, he described in detail his encounters with Bianchi, Pivati and Veratti, remarking that only in Turin was he able to eye-witness the medical electrical experiments. For several days he watched Bianchi administer electric purges to a variety of people (including himself) even though, after screening their testimonies according to their status and their "love of the marvellous", he had to conclude that none of Bianchi's patients had been purged by electricity.⁴ Conversely, when he met Pivati in Venice his desire to see him perform remained unsatisfied. Because of the heat and the presence of too many people, Pivati declined Nollet's request to see the experiments. With vague excuses, Pivati, whom in private Nollet regarded as a "charlatan and an ignoramus who does not deserve any credit",⁵ eluded the scrutiny of his controversial claims. However, that very same night, and in the presence

² FRANCESCO GRISELINI, *Lettera di Francesco Griselini al Padre D. Angelo Calogera, intorno l'Elettricità, e alcune esperienze della medesima* (Venezia, 1747), p. 32.

³ JEAN ANTOINE NOLLET, "Extract of a Letter from the Abbé Nollet, F.R.S. etc. to Charles Duke of Richmond, F.R.S. accompanying an Examination of certain Phaenomena in Electricity", *Philosophical Transactions of the Royal Society of London*, 1749-1750, 46: 368-397, p. 374.

⁴ Nollet's report in the original French (which includes other aspects of his journey south of the Alps) is: "Expériences et observations en différens endroits d'Italie", *Mémoires de l'Académie des Sciences de Paris pour l'année 1749*, 1753, pp. 444-488.

⁵ "C'est un ignorant et un charlatan qui ne mérite aucune croyance", Nollet to Jallabert (1 november 1749), in ISAAC BENGUIGUI, *Théories électriques du XVIII^e siècle: correspondance entre l'Abbé Nollet (1700-1770) et le physicien genevois Jean Jallabert (1712-1768)* (Genève: Georg, 1984), p. 180.

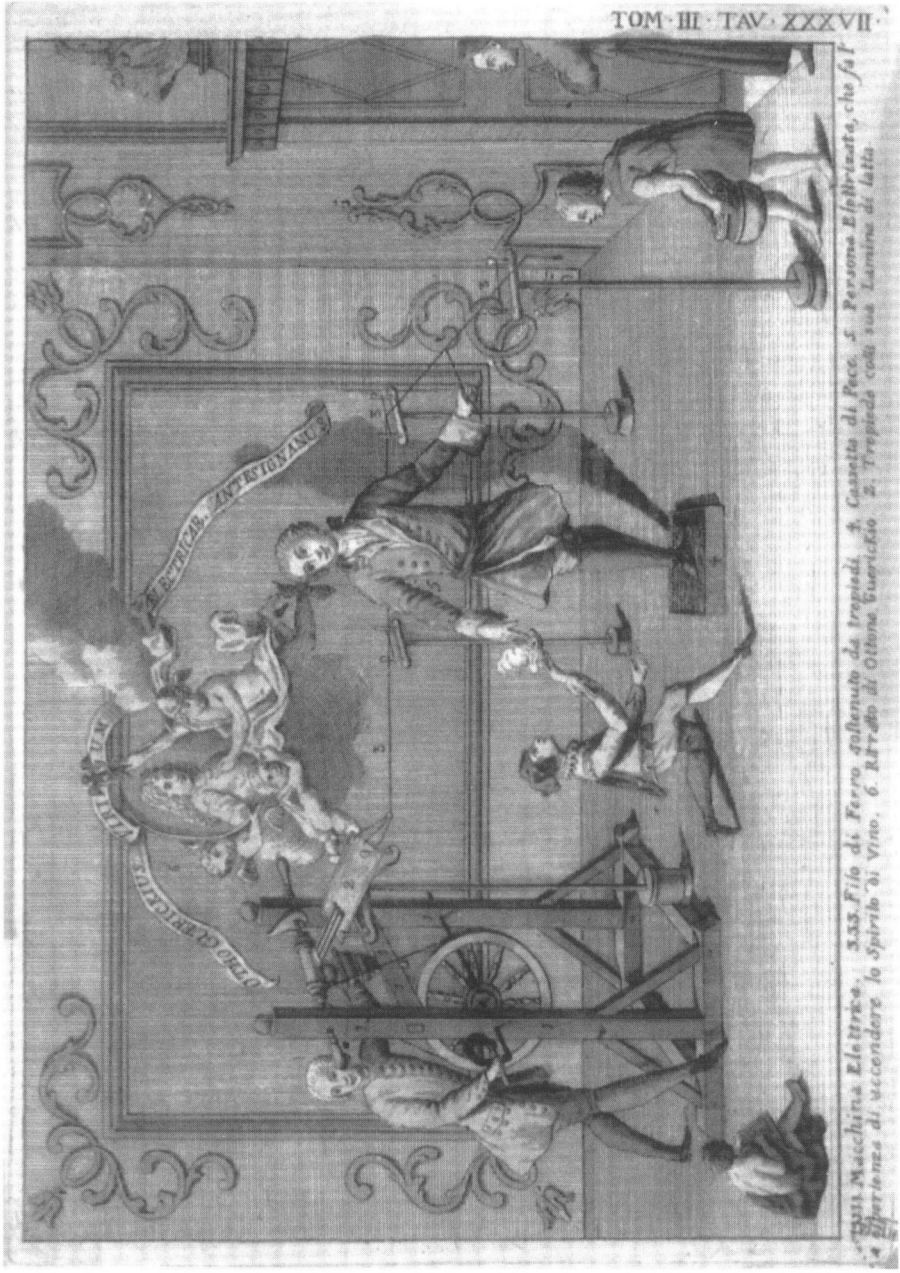


Fig. 1. Pivati's electrical machine. From Gianfrancesco Pivati, *Dizionario Scientifico e curioso sacro-profano* (Venezia, 1746-1751), hand-colored plate.

of “a large Company, among which there were People of Distinction”, he admitted that the Bishop of Sebenico “was not cured”, and that “since the Electrization, he had been as he was before”.⁶

Nollet’s report presented itself as an impartial source for the history of the controversy, and it was received as such by the international community of natural philosophers. Almost twenty years after its publication, Joseph Priestley reminded the readers of his *History and Present State of Electricity* (London, 1767) of the medicated tubes and of Nollet’s journey to Italy. Echoing Nollet’s report, Priestley warned against the “love of the marvellous” that led philosophers away from their disinterested search for truth, and used the episode as a didactic example of erroneous methods in experimental philosophy.⁷ If Priestley’s uncritical reliance on Nollet’s report was consistent with his whiggish account of the history of electricity, more recent interpretations of the controversy, despite having a completely different agenda, have still taken Nollet’s published version as their main primary source.⁸ This paper proposes a change of perspective, based on a different selection of historical sources. I treat Nollet’s account as the final product of the controversy, rather than as the starting point for its analysis, and I delve into the processes leading to the published version of Nollet’s encounters with the Italian electricians. In doing so, I focus on the dynamics that made it possible for a virtually unknown Paduan erudite to stir up a controversy which had such a resonance as to stimulate one of most reputed philosophers of the time to set off for the fatiguing enterprise of crossing the Alps. The change of perspective will place the Italian context in the foreground and will cast light on the individual and corporate interests behind the promotion of the medicated tubes in Italy and abroad. The analysis of Nollet’s interactions with such interests will highlight the role played by academic diplomacy in the experimental culture of the time, and it will help make sense of a startling, particularly because deliberate, omission in Nollet’s account of the controversy: the involvement of the Bologna Institute of Sciences. Recent studies have attracted historians’ attention to the central role that this institution played in the Italian scientific

⁶ NOLLET, “Extract” (cit. note 3), p. 385.

⁷ JOSEPH PRIESTLEY, *History and Present State of Electricity* (London, 1767), p. 156.

⁸ See SIMON SCHAFFER, “Self-evidence”, in *Questions of Evidence: Proof, Practice and Persuasion across the Disciplines*, edited by James Chandler, Arnold J. Davidson and Harry Harootunian (Chicago: Chicago University Press, 1994), especially pp. 68-78. See also LISSA ROBERTS, “Heterogeneous Purposes and the Protocols of Experiment, or How Tracing the History of Amber Can Shed Light on Medical Electricity”, in *Electric Bodies. Episodes in the history of medical electricity. Bologna Studies in the History of Science*, vol. 9, edited by Paola Bertucci and Giuliano Pancaldi (Bologna: CIS, University of Bologna, 2001), esp. pp. 17-20, 38-41.

scene during the eighteenth century.⁹ This paper illuminates its relevance in the perception of the foreign and Italian actors of the controversy, and the expectations that the Institute's members had of the new field of electrical research. I argue that the Institute's desire to recover its past prestige, which was one of the motive forces behind the making of Laura Bassi's career (a salaried member of the Institute's Academy of Sciences and the first woman to hold a university readership), helped create opportunities for improvised but enterprising inventors to make their way into the academic world.¹⁰ The choice of their research proposals was part of the strategies they employed to carve out their careers: the combination of tradition and innovation represented by electrical medicine proved particularly effective in exciting the Institute's desire of international prestige.

The microcosm of the interactions between Nollet and some of the most illustrious members of the Bologna Institute of Sciences highlights the complexity of Enlightenment cultural geography. It is commonly held that the Anglo-French axis constituted the center of the Enlightened Republic of Letters, and it can hardly be doubted that the Bologna Institute of Sciences was peripheral with respect to contemporary similar institutions in France and England, such as the Royal Society of London and the Académie des Sciences in Paris. Yet, as we shall see, Nollet's active attempts to gain the favors of the Institute's members questions the one-way relationship between center and periphery.

EXPERIMENTAL PHILOSOPHY AS A PUBLISHING VENTURE

As it has been repeatedly emphasized, the essence of the Enlightenment, especially seen from the periphery, was the Republic of Letters. For citizens of this virtual republic the most effective means of participation was publication. The role of the "public sphere" and its related financial aspects were clear to Pivati when he moved his first steps in experi-

⁹ On the Bologna Institute of Sciences: *Anatomie Accademiche*, edited by Annarita Angelini and Walter Tega, 3 vols. (Bologna: Il Mulino, 1987), MARTA CAVAZZA, *Settecento Inquieto. Alle origini dell'Istituto delle Scienze di Bologna* (Bologna: Il Mulino, 1990). On its role in the promotion of scientific careers: ID., "The Institute of Science of Bologna and the Royal Society in the Eighteenth Century", *Notes and Records of the Royal Society*, 2002, 56: 3-25; PAULA FINDLEN, "Science as a Career in Enlightenment Italy. The Strategies of Laura Bassi", *Isis*, 1993, 84: 440-469.

¹⁰ On this aspect of Bassi's career, CAVAZZA, "Between Modesty and Spectacle: Women and Science in Eighteenth-Century Italy", in *Italy's Eighteenth Century. Gender and Culture in the Age of Grand Tour*, edited by Paula Findlen, Catherine M. Sama and Wendy Roworth (Stanford: Stanford University Press, 2005, forthcoming); and FINDLEN, "Science as a Career" (cit. note 9).

mental philosophy.¹¹ When he published his *Medical Electricity*, he was working as a secular censor (*revisore*) for the Venetian Republic, and he was also the superintendent of the Venetian press (*Sovrintendente alle Stampe*), a position reintroduced in 1730 after a gap of almost a century. This role gave him concrete opportunities to become acquainted with the publishing world. In the first half of the eighteenth century, thanks to the increasing demand from a growing reading public, and the investments of an heterogeneous group of “capitalists” who funded the printing industry, the Venetian publishing trade was thriving.¹² In 1725, the Reformers of the University of Padua (*Riformatori dello Studio di Padova*), a board of magistrates that legislated on various academic matters, including the book trade, acknowledged that the press was one of the “principal arts that add prestige and bring advantage to the Dominant”.¹³ In the following years they responded to the Senate’s desire to revitalize the cultural life of the Republic through a more active commitment to the monitoring of the publishing trade. Prior to 1730, the year they reintroduced the position of superintendent, the Reformers intervened only on request in matters concerning the printing trade. The superintendent, on the contrary, embodied the renewed interest of the Republic in the publishing world: he had to inspect typographies, check that all the printing processes were carried out according to Venetian law, and voice the needs or felt needs of the typographers. As the superintendent of the press, Pivati was familiar with the world of typographers, booksellers and publishers. In particular, he was aware of the increasing popularity of dictionaries, ranging from collections of sacred or profane histories to the art of dressing one’s hair, which in the 1740s were successfully feeding the curiosity of a public willing to spend money on culture. The Venetian Senate awarded privileges to protect

¹¹ For a recent analysis of the relationship between center and periphery in the Enlightened Republic of Letters see the introduction and the essays by Findlen, Roberts, Koerner, Clark, in *The Sciences in Enlightened Europe*, edited by William Clark and Jan Golinski, Simon Schaffer (Chicago: Chicago University Press, 1999). For the “public sphere” see JÜRGEN HABERMAS, *The Structural Transformation of the Public Sphere. An Inquiry into the Category of Bourgeois Society* (Cambridge: Polity, 1989).

¹² On the Venetian publishing trade, see MARIO INFELISE, *L’editoria veneziana nel ’700* (Milano: Franco Angeli, 1991); MARINO BERENGO (ed.), *Giornali veneziani del Settecento* (Milano: Feltrinelli, 1962); ID., *La società veneta alla fine del Settecento: ricerche storiche* (Firenze: Sansoni, 1956); BRENDAN DOOLEY, *Science, Politics and Society in Eighteenth-Century Italy. The Giornale de’ letterati and its World* (New York: Garland, 1991).

¹³ “[...] fra l’arti principali che accrescono splendore et utile alla Dominante”, Archivio di Stato, Venice, *Riformatori*, f. 10, cc. 157-163, quoted in INFELISE, *Editoria* (cit. note 12), p. 41. On the attempts to cultural reform in the Venetian Republic, see DOOLEY, “Il patriziato veneziano e l’attività accademica”, in *Storia della cultura veneta*, 10 vols., Vol. V: *Il Settecento I*, edited by Girolamo Arnaldi and Manlio Pastore Stocchi (Vicenza: Neri Pozzi, 1985).

the typographers who ventured into the publication of such expensive works.¹⁴ In 1744 the Venetian publisher Stefano Monti, prompted by the investment of a group of capitalists, decided to commission the compilation of a dictionary of commerce based on the translation of those by Jacques Savary and Noël Chomel.¹⁵ Monti's choice fell on Pivati, who could count on the collaboration of authoritative contemporary men of letters – among them, Ludovico Muratori – and, no less important, on a group of translators. However, the joint venture of publisher and investors did not prove successful. The project ended the following year, with only three volumes published, but Pivati realized that he could turn the disastrous situation to his own advantage. In his role as a censor, he read both foreign and Italian literature, including the memoirs of the German, British and French scientific academies. At a time when intellectual property was feebly protected, and translators could easily pass themselves off as authors, Pivati did not waste the advantages of his position.¹⁶ Given Monti's opposition to continuing the work, he persuaded another Venetian publisher, Gasparo Baseggio, to entrust him with the compilation of a new kind of dictionary that would combine sacred history with the new scientific discoveries made in the most important European academies. It would take into account the ecclesiastical concern with religious orthodoxy together with public enthusiasm for philosophical experiments.¹⁷ Pivati's place in Venetian society, a world of patricians easily seduced by the marvels of experimental philosophy, made him realize that he could profit from the on-going commodification of culture. His insistence on experimental philosophy was not new. If his claim to a "natural inclination" for natural history and physics is to be viewed with due caution, his *Reflections on the present state of the University of Padua* (*Riflessioni sopra lo stato presente dello Studio di Padova*), a plan to reorganize the university system that he presented to the Reformers in 1738, reflects Pivati's active involvement in the renovation of Venetian culture.¹⁸

¹⁴ INFELISE, *Editoria* (cit. note 12), p. 51.

¹⁵ JACQUES SAVARY, *Dictionnaire universel de commerce* (Paris, 1723), NOËL CHOMEL, *Dictionnaire Oeconomique* (Lyon, 1709).

¹⁶ See ADRIAN JOHNS, "The Ambivalence of Authorship in Early Modern Natural Philosophy", in *Scientific Authorship. Credit and Intellectual Property in Science*, edited by M. Biagioli and P. Galison (New York: Routledge, 2003), p. 76.

¹⁷ The official publisher of Pivati's dictionary was Sebastiano Milocco. On the vicissitudes of the dictionary and on Pivati's work as a polygraph, see INFELISE, "Enciclopedia e pubblico a Venezia a metà Settecento: G.F. Pivati e i suoi dizionari", *Studi Settecenteschi*, 1996, 16: 161-190, also SILVANO GAROFALO, *L'enciclopedismo italiano: Gianfrancesco Pivati* (Ravenna: Longo, 1980).

¹⁸ PIVATI, *Lettera* (cit. note 1), p. xi. Biblioteca Marciana, Venezia. Cod. Marc. It. X. 324; Cod. Marc. It. IV. 592.

In the *Reflections* Pivati urged a reduction in the number of university chairs to increase the proportion of lectures in the sciences, and proposed the creation of a professorship in experimental philosophy, “the most useful, and the most necessary to be created”.¹⁹ The title of his *New Scientific and Curious Sacred-Profane Dictionary* (Venice, 1746-1751) reflected the agenda of its compiler, as well as his ambition.²⁰ Pivati’s work aroused the sarcasm of the secretary of the Duke of Modena in Venice, Pietro Ercole Gherardi, who had refused to get involved in Monti’s original project. He confided to Muratori:

I am told that he [Pivati] will take bits of information here and there from Furetière’s, Martinière’s, Savary’s, Chomel’s, Moreri’s, and with all the pieces sewn together he will make his Swindler’s clothes.²¹

This judgment, however, was not shared by the special committee of the University of Padua – of which both the anatomist Giambattista Morgagni and the professor of experimental philosophy Giovanni Poleni were members – who defended the originality of Pivati’s dictionary from Monti’s accusations of plagiarism.²² During the five years Pivati was working on it, he wove and consolidated connections with Venetian aristocrats, physicians, lawyers, members of the clergy and the academic world, who subscribed to the dictionary. But its troubled life induced him to seek the patronage of scientific institutions beyond Venetian borders.

The liaison between the Bologna Institute of Sciences and Pivati began on 13 August 1746, when Pivati sent two copies of the first volume as a gift to the Institute’s Secretary, Francesco Maria Zanotti – one for Zanotti himself, and one for the Institute. Pivati sent an accompanying letter in which he introduced himself and his project, referring also to his connection with Morgagni and Poleni at the University of Padua. He asked Zanotti to act as a “mediator and valorous patron” for the encyclopedic project.²³ Present-

¹⁹ PIETRO DEL NEGRO, “L’Università”, in *Storia della cultura veneta: il Settecento I* (cit. note 13), pp. 64-65.

²⁰ PIVATI, *Nuovo Dizionario Scientifico e Curioso Sacro-Profano* (Venezia, 1746-1751).

²¹ “Questi [Pivati], a quel che mi vien detto, prenderà dal Furetière, dal Martinière, dal Savary, dal Chomel, dal Moreri ora una notizia ed ora un’altra, e con molti pezzi degli scrittori suddetti cuciti insieme, farà l’abito suo di Trufaldino, ovvero volterà nella padella la frittata”. Gherardi to Muratori (23 October 1745), in *Edizione nazionale del carteggio di L.A. Muratori*, 20 vols., Vol. 20: *Carteggio con Pietro E. Gherardi*, edited by Guido Pugliese (Firenze: Olschki, 1982), p. 277.

²² See INFELISE, *Editoria* (cit. note 12), pp. 58-59.

²³ Archivio dell’Accademia delle Scienze di Bologna (hereafter AASB), “Antica Accademia”, Tit. III, *Lettere Ricevute*: Pivati to Zanotti, 13 August 1746.

ing the compilation of the dictionary as a scientific enterprise, he invited Zanotti to keep him updated with the recent discoveries or inventions of the members of the Institute so that he could mention them in his work, whose “worth comes by others, while the faults are mine”.²⁴ Letter and presents had the desired effect, and Pivati was elected a member of the Institute a few months later, on December 1, 1746.

SCENTED SPARKS, GENTLE PURGES

It was while he was working on the compilation of his scientific dictionary that the idea of the medicated tubes occurred to Pivati. As in the case of other learned men and women of the time, electricity was his leisure activity, and he probably did not exaggerate overmuch when he said he performed electrical experiments every day.²⁵ The correspondence of *letterati* testifies to the general curiosity about electrical experiments in the various states south of the Alps: electrical *soirées* became occasions for frequent gatherings of “society”, and the *letterati* were most willing to share the exhilarating situations that electrical experiments could offer. Each participant could experience upon his or her own body the wonders of electricity: in the darkened salons electrified ladies and gentlemen could “spark from [their] face, nose, arms, hands and feet”, or “light with one finger the extinguished candle, or the brandy, make bare swords glitter and their points gleam, attract and repel golden leaves in the shape of vague fountains, electrify water, fire and soil”.²⁶ New electrical experiments from beyond the Alps were soon replicated in Italy. Towards the end of 1746, Gherardi reported that he had tried the novel “phenomenon of the pulse”, the experiment thought out by the German professor Georg Matthias Bose, which seemed to indicate that electricity produced a measurable physiological effect. Upon electrification, Gherardi found his pulse rate rise from 65 to 76 per minute, and in Padua Pivati’s nephew tried the same experiment, with similar results.²⁷ Pivati was familiar with the repertoire of electrical experi-

²⁴ *Ibid.*

²⁵ PIVATI, *Lettera* (cit. note 1), p. xiv.

²⁶ “[...] scintillare dalla faccia, naso, lingua, braccia, mani e gambe, di accendere col dito la candela ammorzata, l’acquavita, di far lampeggiare la spada nuda e dalla sua punta farne uscire la fiamma, d’attraere e ripulsare [sic] le foglie d’oro a foggia di vaga fontana, di elettrizzar l’acqua e il fuoco, e la terra da fiori”: Gherardi to Muratori, 24 December 1746, in *Carteggio Muratori-Gherardi* (cit. note 21), p. 348.

²⁷ *Ibid.*, p. 349.

ments, and with the numerous publications on electricity that had appeared in Europe in the previous years. In his dictionary, in the entry for electricity, he demonstrated his acquaintance with the “classical” works on the subject, paying tribute to the members of the *Accademia del Cimento*, while also quoting Hauksbee, Gray and Dufay, and the more recent experiments by Bose, Krüger, Kratzenstein and Nollet.²⁸

Pivati was aware that, in parallel with the numerous society occasions that electricity made possible, at the University of Padua Poleni and Morgagni were working to “see whether such beautiful [electrical] discoveries can be made advantageous to pyrotechnics or, what is to be mostly hoped for, to medicine”.²⁹ Pivati’s familiarity with the proceedings of European literary academies made him realize that switching from experiments that “can satisfy one’s curiosity” to the therapeutic uses of “electric fire” would place him among the pioneers of the most promising application of the new science: medical electricity.³⁰ Between 1746 and 1747, Pivati engaged in systematic experimental activity, consisting in extracting sparks from all sorts of substances, from minerals to metals and plants. He suggested that electric sparks varied according to the composition of the substance from which they were extracted, and that they could be used in chemical analysis:

I observed, for example, that when I electrified the flowers of a potted plant, as I touched the pot itself, the soil, the leaves, the flowers, all emitted different light and caused different sensations, according to whether the plant abounded more of salts, sulphur, oils, etc.³¹

With his emphasis on chemical analysis he could not fail to attract the attention of the members of the Bologna Institute of Sciences, whose interest in chemistry dated back to the Institute’s foundation, in 1711. The founder of the Institute, General Luigi Ferdinando Marsili, in his plan for an institution modeled upon the Royal Society and the Académie Royale des Sciences, pointed out that the study of the “nature of the fluids”, pertaining to the domain of chemical research, was “neither practiced nor known” in Bologna. He remarked that the neglect of such subjects had rendered

²⁸ PIVATI, *Nuovo Dizionario* (cit. note 20), pp. 499-503.

²⁹ “[...] per vedere se così belle scoperte ridurre si possano di nuovo vantaggio o alla pirotecnia, o a quello ch’è più da sperarsi, alla Medicina”. *Ibid.*, p. 503.

³⁰ “Ho procurato di osservare in primo luogo il mirabile, cioè quello che può bastare alla curiosità; indi sono passato al fisico, e da questo finalmente al medico”. PIVATI, *Lettera* (cit. note 1), p. XIV.

³¹ “Osservai, per esempio, che elettrizzando un vaso di fiori, al toccare il vaso stesso, la terra, le foglie, i fiori, tutto tramanda luce e cagiona sensazione differente, secondo che la pianta abbonda più di sali, di zolfo, di olio & c.”. *Ibid.*

local medical research sterile, especially when compared with the “glorious memory” of the Bolognese physician Marcello Malpighi, whose work was the last to excite the “applause of foreign nations”.³² Marsili’s alarm resulted in the creation of a chemistry lectureship at the Institute (1714), and more than twenty years later, in 1737, in the creation of the first university chair of chemistry south of the Alps, to be held by Jacopo Bartolomeo Beccari.³³ A former pupil of the anatomist Giambattista Morgagni, Beccari played a prominent role in setting the agenda for the experimental activity of the Institute of Sciences. Apart from his work on gluten, which made him internationally known, Beccari was also interested in the physico-chemical properties of phosphorescent and electrical lights. His long-lasting, if unsystematic, interest in electricity (his first work on electricity dated back to 1703),³⁴ prompted his enthusiastic response to Pivati’s experiments.³⁵

The medicated tubes originated in Pivati’s electrical experiments on plants. In the course of one of these experiments, he drew a continuous flux of little sparks from a flower and directed the electric stream to his nostrils. He claimed that he could thus smell the “very gentle odorous effluvium of the flower, mixed with a nitrous smell, which for a few hours caused [...] an obstruction of the vessels in that part of my nose”.³⁶ This result suggested to him that the electric effluvia could draw out odorous substances, and that they could even carry into the human body the healing virtues of medicaments. So Pivati filled the usual glass cylinders of electrical machines with specific medicines, in the belief that they would reach the affected parts of the body without being ingested by the patient. The mere possibility of such an innovative electric treatment was enthusiastically welcomed by Morgagni, Beccari and Zanotti, who exchanged infor-

³² LUIGI FERDINANDO MARSILI, *Parallelo dello Stato Moderno della Università di Bologna con l'altre al di là de' Monti* (mss. 1709), published in *Anatomie Accademiche*, 3 vols., Vol. III: AN-NARITA ANGELINI (ed.), *L'Istituto delle Scienze e l'Accademia* (Bologna: Il Mulino, 1987), pp. 463-521: 468.

³³ On the relationships between the Institute for Sciences and the University of Bologna, see ANGELINI, *Istituto delle Scienze* (cit. note 32), and CAVAZZA, *Settecento Inquieto* (cit. note 9).

³⁴ JACOPO BARTOLOMEO BECCARI, *De vi attractiva*, manuscript kept in AASB, Tit. IV, Sez. I, MMAnA.

³⁵ On Beccari, about whom very little has been written, see the entry by M. CRESPI, A. GAU-
DIANO in the *Dizionario Biografico degli Italiani* (Roma: Istituto dell'Enciclopedia Italiana, 1960-).
He was elected a Fellow of the Royal Society of London in 1728.

³⁶ “Ho voluto farmi entrare cotesta fiammella [una scintilla non istantanea che parte dal fiore] in una delle narici, e sentij un gentilissimo effluvio odoroso del fiore, unito ad un odore di nitro, e per qualche ora mi cagionò una specie di raffreddore, o per meglio dire di otturamento de' vasi in quella parte del naso”. PIVATI, *Lettera* (cit. note 1), p. XVI.

mation on “our friend’s” activities.³⁷ Stimulated by their support, Pivati addressed the medical community at large, sensitizing physicians to what the new electrical treatment could offer. He meant the use of electricity to be a supplementary tool in the hands of medical professionals:

I flattered myself more, because I conceived of an effect that often proves impossible to the medical art, that is to introduce in the innermost parts of the human body a topic medicament that could either, by hitting, remove obstructions from blocked vessels, or could consolidate, cleanse, balm, & c., the parts that the medical art cannot reach by means of ingestion & c.³⁸

His results, however, were not intended to challenge the medical establishment. To make this point clear, he styled himself an amateur “in the dark as to the dose of the medicaments to be placed inside the tube, a matter for which only experience could be our guide”.³⁹ This implicit appeal to the medical world met with success, even outside Bologna. Giambattista Bianchi, head physician in Turin, professor of anatomy at the University, and member of the Bologna Institute of Sciences since 1722, initiated a correspondence with Pivati about the medicated tubes and the transmission of odors by electricity. Bianchi experimented on a variation of the theme of Pivati’s tubes. An updated Monsieur Purgon, he specialized in electric purges. Instead of placing medical substances inside the glass cylinders, Bianchi asked his patients, standing on insulated stools, to hold a purgative substance in their hands, while he extracted sparks from their body. This way, according to Bianchi, the electric effluvia would diffuse the purgatives into the air and so into the patients’ body, promptly causing a discharge. The possibility that those who needed purgatives could now “purge themselves without having to swallow any medicine that so often cause unpleasant stomach-aches or pains in the bowels” proved particularly successful.⁴⁰ The news of Pivati’s and Bianchi’s cures spread all over Italy, and numerous

³⁷ Morgagni to Zanotti, 3 November 1747, in *Carteggio tra Giambattista Morgagni e Francesco M. Zanotti*, edited by Gino Rocchi (Bologna, 1875), p. 349.

³⁸ “Mi sono lusingato di più, perché mi sono ideato un effetto sovente impossibile all’arte medica, ch’è quello d’introdurre nelle parti più interne del corpo umano un medicamento topico, il quale, o urtando disgombrar possa qualche impedimento ne’ canali, o scorrendo arrivi a consolidare, detergere, imbalsamare, o altro, qualche parte, a cui non è permesso all’arte di giungere per sola ingestione etc.”. PIVATI, *Lettera* (cit. note 1), p. XXV.

³⁹ “[...] il male si è, che sono all’oscuro per la dose delle materie, e per la dose, dirò così, della medicatura; e la sola sperienza in questo ci può servire di maestra”: *Ibid.*, p. XLIX.

⁴⁰ “Piacemi grandemente quella maniera di purgarsi senza prendere per bocca medicamento alcuno, che suole spesso indurre spiacevoli sconcerti di stomaco, o d’intestino”. Flaminio Scarselli to Laura Bassi (26 February 1749), in *Lettere inedite alla celebre Laura Bassi* (Bologna: Cenerelli, 1885), p. 119.

electricians engaged in the replication of the experiments with “simple” and medicated tubes. In March 1747 the Marquis Sale in Vicenza treated his noctambulous servant with an electrical machine built according to Pivati’s directions. The instantaneous cure, after the many unsuccessful treatments that had been tried on his already “famous” servant, became quickly widely known.⁴¹ In the eyes of many an academician, the successful combination of experimental philosophy and medical practice threw new light on the science of electricity: the possibility of medical applications of electricity immediately upgraded the status of electrical experiments from salon entertainment to frontline research.

PROMOTING THE MEDICATED TUBES

When he received from Pivati the description of the prodigious cures performed with “medicated tubes”, the secretary of the Bologna Institute of Sciences could not contain his enthusiasm.

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.⁴²

The conviction that under the aegis of the Institute one of its members had made an important discovery that would leave a mark on the practice of medicine informed Zanotti’s reception of Pivati’s experiments. Notwithstanding his awareness that further experiments were needed to assess the reliability of the medicated tubes, Zanotti arranged for Pivati’s letter to be published in Bologna, though with the false indication of Lucca.⁴³ According to the anonymous publisher, most probably Zanotti himself, thanks to the medicated tubes, electricity had now “acquired a new merit [...], i.e.

⁴¹ Bibliothèque Municipale de Nîmes, mss. 2321: Marquis Sale to Ludovico Bianconi, 12 March 1747. I am grateful to Ivano Dal Prete for making this material available to me. See also LUDOVICO BIANCONI, *Lettre sur l’électricité écrite par Mr. Bianconi, Conseiller et premier Medecin de S.A.S. Monseign. le Landgrave de Hesse-Darmstadt, Prince et Eveque d’Ausburg, à Monsieur le Comte Algarotti, Chevalier de l’Ordre du Merite, et Chambellan de S.M. le Roi de Prusse, etc. etc.* (Amsterdam, 1748).

⁴² “Quelle nouveauté dans nos expériences sur l’électricité! Quelle justesse! Quel succès! [...] Nous les appuiez de manière, que nous ne semblez pas les hazarder, et quant a moy, je croy, que nous avez surpassé tous en fait d’électricité”. Bibliothèque Publique Universitaire (hereafter BPUG), Genève, Collection Jallabert, Correspondance, SH 242, ff. 186 (Zanotti to Jallabert, 1 July 1748). I am grateful to Marc Ratcliff for making this material available to me.

⁴³ *Ibid.*, f. 186bis.

that of causing a wonderful progress in Medicine, and of offering a prompt and easy remedy to many disorders". For this reason it had been turned into "a new science", which required immediate publicity.⁴⁴ The members of the Institute saw the success of Pivati's tubes as an opportunity to give new lustre to Italian science internationally. Zanotti proclaimed to Francesco Algarotti that "if the facts are true, the Venetian has surpassed all your English, French and German people".⁴⁵ Exploiting their network of foreign correspondents, the members of the Institute engaged in the promotion of the medicated tubes abroad. Writing to Nollet, Zanotti boasted of the success of Pivati's work, that "made Italy electric",⁴⁶ while Beccari sent a report on Pivati's new method of applying electricity to Réaumur who, in early 1748, read it to the *Académie des Sciences* in Paris.⁴⁷ Zanotti also wrote to Jallabert about the "amazing" cure of the Bishop of Sebenico and notified the *Académie des Sciences* of the publication of Pivati's *Medical Electricity*.⁴⁸

Although Zanotti was aware that further experiments were needed to confirm Pivati's discoveries, he censured any opposition to the medicated tubes. Through his position as Secretary of the Institute, he had absolute control over the public image of the Institute as popularized by its periodical publication, the *De Bononiensi Scientiarum et Artium Instituti atque Academiae Commentarii*. The Secretary had the authority to select the memoirs to publish and was the author of their prefatory commentaries.⁴⁹ Zanotti exerted his powers in the public presentation of the Institute's reception of Pivati's discoveries. The first report on Pivati's experiments was read at the Institute by the medical lecturer Goffredo Bonzi,⁵⁰ who per-

⁴⁴ "Elettricità, quantunque sia stata già trattata da altri, tuttavia si può dir nuova, uscendo ora fuori con un pregio, che ella non aveva ancora avuto, e ciò è di recare un meraviglioso accrescimento alla Medicina, e porgere un pronto e facil rimedio a moltissimi incomodi della salute". PRIVATI, *Lettera* (cit. note 1), p. VI.

⁴⁵ "Se i fatti son veri, il veneziano ha superato tutti cotesti vostri inglesi, francesi e tedeschi": in FRANCESCO ALGAROTTI, *Opere* (Venezia, 1794), vol. XII, p. 259.

⁴⁶ AASB, "Antica Accademia", *Minute scritte durante il segretariato Zanotti*, MZ, Tit. III, n. 235: 2 March 1749.

⁴⁷ Archives de l'Académie des Sciences, Paris (hereafter AASP), *Procès Verbaux*, Tome 67 (1748), ff. 26-27.

⁴⁸ Zanotti to Jallabert, 1 July 1748, BPUG, *Collection Jallabert*, Correspondance, SH 242, ff. 185-187; AASP, *Procès Verbaux*, Tome 67, September 1748, f. 425.

⁴⁹ Although on paper the selection had to be made by a special committee, *de facto* the Secretary was the one who decided, as in AASB, Tit. IV, *Lezioni e carte diverse*, fasc. XI, *Notizie e giudizi sulle dissertazioni*.

⁵⁰ Bonzi's dissertation, which has not survived, was entitled *Sopra la medicatura elettrica* and was read at the Academy on 7 December 1747, as in AASB, *Registro Atti*, published in *Istituto delle*

formed experiments with glass tubes sent especially by Pivati from Venice. Bonzi firmly opposed Pivati's conclusions: he denied that electricity could make odorous substances evaporate through sealed glass cylinders and rejected the efficacy of the medicated tubes in the treatment of diseases. Zanotti labeled Bonzi as one of those who "are naturally inclined to despise new inventions", and in his commentary he did not mention Bonzi's results at all, bypassing any reference to his experiments and refusing to publish his memoir.⁵¹ Conversely he boasted of Pivati's discoveries, which "being a novelty, excited the whole of Italy".⁵²

Convinced as he was that the "science of physicians" needed the "curiosity of a physicist" in order to clarify the effects of the application of electricity to the human body, and sweep away the fear that electricity could be noxious,⁵³ Zanotti involved Giuseppe Veratti in the controversial question. Veratti, whose marriage to Laura Bassi in 1739 had caused more than one academician to raise his eyebrows, was lecturer in anatomy at the University and a member of the Institute.⁵⁴ Although a physician, his activities in experimental physics were well known to the members of the Institute and especially to Zanotti, who publicly praised Veratti's prudence over advancing new hypotheses.⁵⁵ In the (occasional) presence of Zanotti and Beccari, Veratti engaged in experimenting on the effects of the "electric fluid" on various diseases, and on the efficacy of the medicated tubes. The coinciding of Veratti's personal interest in consolidating his career with those of the Institute in promoting its public image, led to a new publication sponsored by the Institute and dedicated to the Bologna Senate: Veratti's *Physico-Medical Observations on Medical Electricity* (*Osservazioni fisico-mediche intorno alla elettricità*, Bologna, 1748). Given Zanotti's enthusiastic support for the medicated tubes, it was not easy for Veratti to voice his perplexities. In compliance with the Institute's general support for the medicated tubes, he expressed moderate approval of Pivati's experiments,

Scienze (cit. note 32), p. 337. References to the contents of the dissertation are in Zanotti's letter to Morgagni, dated 12 December 1747, in *Carteggio Morgagni-Zanotti* (cit. note 37), pp. 349-351.

⁵¹ Zanotti to Morgagni (12 December 1747), in *Carteggio Morgagni-Zanotti* (cit. note 37), p. 351.

⁵² "[...] cum rei novitatem Italiam universam commovisset": "De electricitate medica", *De Bononiensi Scientiarum et Artium Instituti atque Academiae Commentarii* (hereafter *Commentarii*), 1755, III, pp. 83-87: 85.

⁵³ "Grande accrescimento avrebbe dato alla scienza de' medici la curiosità di un fisico": Zanotti to Morgagni, 5 September 1747, in *Carteggio Morgagni-Zanotti* (cit. note 37), p. 343.

⁵⁴ On the Bassi-Veratti marriage, see BEATE CERANSKI, *Und Sie fürchtet sich vor niemanden. Über die Physikerin Laura Bassi (1711-1778)* (Frankfurt-New York: Campus Verlag, 1996), especially pp. 89-95; also FINDLEN, "Science as a Career" (cit. note 9).

⁵⁵ "De interitu animalium in aere interclusorum", *Commentarii*, 1745, II, vol. 1, pp. 340-347.

but also – conveniently – emphasized that lack of time had not allowed him to repeat the experiments to his own satisfaction. Yet it was not the cautious attitude that Zanotti valued so much that induced Veratti to be diplomatic concerning his doubts about the medicated tubes. If on the one hand he played up his modesty and declared that he had been “compelled” to publish the results of his experiments by the “repeated incitements and authoritative advice of wise persons”, on the other hand he worried about priority no less than Zanotti.⁵⁶ It can hardly be doubted that Laura Bassi passed on to him the recommendation of the Bolognese ambassador at the papal court, Flaminio Scarselli, to hurry along the publication of the experimental results. According to Scarselli “the subject is so fascinating, that it arouses philosophers’ and physicians’ curiosity and diligence, so any delay brings with it the danger of being anticipated”.⁵⁷

Veratti’s book was promoted by the Institute in Italy and abroad. The French translation of the work was published in Geneva in 1750. The interest of the Institute in making Veratti’s work known in the rest of Europe coincided with the private interests of the Bassi-Veratti duo who, in 1749, would open a laboratory in their house with a view to offering private tuition to paying students. Making the Institute’s support of medical electricity her own, Bassi engaged in an intensive promotion of her husband’s book, sending Scarselli several copies to be distributed to Cardinals, other philosophers and booksellers in Southern Italy and, most importantly, to the Pope.⁵⁸

However, in Italy there was still no unanimous consensus about the electric cures. Scipione Maffei, a Veronese antiquary and historian who performed electrical experiments and owned an expensive electrical machine, explained to Zanotti that, in Venice, Pivati’s “stories are believed either false, or greatly altered”. Even the most famous and authoritative of Pivati’s cures did not withstand the scrutiny of his colleagues.

I am told that, an acquaintance of Bishop Donadoni from Sebenico having met him by chance in Venice, with nothing else than a smile accompanied by a shake of

⁵⁶ “[...] da replicati impulsi, ed autorevoli consigli di più persone sagge fui costretto a pubblicare queste poche osservazioni da me fatte intorno alla Elettricità”: GIUSEPPE VERATTI, *Osservazioni Fisco-Mediche intorno all’Elettricità dedicate all’Illustrissimo, ed eccelso Senato di Bologna* (Bologna, 1748), p. 1.

⁵⁷ “La materia quanto è bella, altrettanto lusinga la curiosità, e la diligenza de’ Filosofi, e de’ Medici, onde il ritardo porta pericolo di essere prevenuto”. Scarselli to Bassi (30 November 1748), in *Lettere inedite* (cit. note 40), p. 115.

⁵⁸ For Bassi’s strategies and her correspondence with Scarselli, see FINDLEN, “Science as a Career” (cit. note 9). On the physics cabinet of Laura Bassi and Giuseppe Veratti, see CAVAZZA, “Laura Bassi e il suo Gabinetto di Fisica Sperimentale: realtà e mito”, *Nuncius*, 1995, 10: 715-753.

his head did [the Bishop] reply to those who congratulated him for seeing him now free from the long-standing chiragra and podagra he had suffered from.⁵⁹

When Maffei visited Pivati to see the famous experiments, he found that “his machine is so imperfect, that he was able to show me nothing with it, not even a trivial thing, for an entire morning”.⁶⁰ In the literary world, the reputation of Pivati’s experiments went hand in hand with that of his work as a literary hack:

If the translation of the *Scientific Dictionary* is such an unfortunate muddle, so the accounts of the cures extolled in the well known letters [*letteruzze*] on medical electricity by Pivati and Grisellini will be found peradventure, as impostures and visions of prejudiced imagination.⁶¹

Writing in 1747, Gherardi was probably unaware of the coinciding of Pivati’s personal agenda and that of Zanotti on behalf of the Institute of Sciences. Hence, he mentioned Bonzi’s experiments with the tubes sent by Pivati from Venice, explaining to Muratori that in Bologna they “produced the effect that incense produces upon the deceased”.⁶²

Meanwhile, however, Pivati’s fortunes had continued their upturn. In the various Italian states, he was commonly regarded as the first to have conceived of the medical applications of electricity and, at the beginning of 1749, he obtained a privilege from the Venetian Senate for his *Physical Reflections on Medical Electricity* (*Riflessioni fisiche sulla medicina elettrica*, Venezia, 1749), an ambitious work heralding his priority in the invention of “medical electricity”.⁶³ From the rest of Europe, other reports of successful cures

⁵⁹ “Mi vien detto che, incontrato casualmente a Venezia il vescovo Donadoni di Sebenico da un suo conoscente, non con altro se non che con un sorriso accompagnato da qualche crollamento di capo rispose a chi si congratulava di vederlo oramai libero della lunga podagra e chiragra patita”. Gherardi to Muratori, 18 November 1747, in *Carteggio Muratori-Gherardi* (cit. note 21), p. 405.

⁶⁰ “La sua macchina è così imperfetta, che con essa nulla, né pur di triviale potè egli farmi vedere in tutta una mattina”. Maffei to Zanotti (14 February 1749), in SCIPIONE MAFFEI, *Epistolario: 1700-1755*, 2 vols. (Milano: Giuffrè, 1955), Vol. 2, p. 1239.

⁶¹ “Se lo traslatamento del Dizionario scientifico riesce uno spiacevole guazzabuglio, si scopriranno per avventura, per imposture e visioni di fantasia pregiudicata, i racconti delle guarigioni decantate nelle consapute due letteruzze di Pivati e Grisellini intorno l’elettricità medica”. Gherardi to Muratori (18 November 1747), in *Carteggio Muratori-Gherardi* (cit. note 21), p. 405. Maffei’s electrical machine is mentioned in a letter (dated 16 april 1747) by Maffei to Giovanni Poleni, in MAFFEI, *Epistolario* (cit. note 60), p. 1178.

⁶² “[...] gli elettrici tubi intonacati spediti all’Accademia bolognese han fatto l’effetto che ai defunti produce l’incenso”: Gherardi to Muratori (18 November 1747), in PUGLIESE, *Carteggio Muratori-Gherardi* (cit. note 21), p. 405.

⁶³ In GRISELINI, *Lettera intorno l’Elettricità* (cit. note 2) there are references to Pivati as the “inventor of medical electricity”, see pp. 32 and 61.

performed with the medicated tubes demonstrated to Pivati's Italian audience that he had achieved international fame. Most importantly, at Leipzig, the professor of experimental physics Johann Heinrich Winkler communicated to an audience of over four hundred people, including state officials, the results of Pivati's experiments that he had successfully replicated.⁶⁴

PUBLIC DISPUTES AND NOLLET'S CAREER

If in Italy Winkler's report consolidated Pivati's public persona as the inventor of medical electricity, in Paris it caused some piqued reactions:

If he [Winkler] does not mean to deceive other people, I believe he does not fear too much of deceiving himself.⁶⁵

Writing to his friend Jallabert a month before his Italian tour, Nollet could not hide his feelings about the medicated tubes or the transmission of odors by electricity.⁶⁶ His irritated impatience resulted from the numerous controversies over the healing properties of electricity in which he had been involved since 1746, when Musschenbroek's experiments with the Leyden jar became the electric news of the moment. Nollet was the first to test the idea "that naturally offers itself to the mind", whether electric shocks administered to patients could restore movement to paralyzed limbs. In 1746, together with the physician Morand and the surgeon de la Sone, he applied electric shocks to the treatment of paralytic patients. He deemed the results, however, "too doubtful to be worth announcing": while the patients seemed to feel some pain, and in the course of the following nights even some itching in the electrified parts of their body, assessment of the healing effects of such treatment remained inconclusive.⁶⁷

Although Nollet's initial attitude to medical electricity was far from enthusiastic, his experiments on paralytic patients aroused the heated reaction of Antoine Louis, a Parisian surgeon, whose work on paralysis had

⁶⁴ "An Account of Professor Winkler's Experiments relating to Odours passing through electrised Globes and Tubes", *Philosophical Transactions of the Royal Society*, 1751, 47: 231-241.

⁶⁵ "S'il [Winkler] n'a pas dessein de tromper les autres, je crois qu'il ne craint point assez de tromper luy même". Nollet to Jallabert (22 March 1749), in *Correspondence Nollet-Jallabert* (cit. note 5), p. 173.

⁶⁶ Nollet to Jallabert (January 1749), *ibid.*, pp. 166-169.

⁶⁷ "[...] trop douteux pour mériter qu'on l'annonce": NOLLET, "Sur quelques nouveaux phénomènes d'électricité"; *Id.*, "Observations sur quelques nouveaux phénomènes d'Electricité", *Mémoires de l'Académie des Sciences de Paris pour l'année 1746*, 1751: 1-23, p. 19.

gained him membership in the Académie Royale de Chirurgie (22 August 1747).⁶⁸ In his *Observations on Electricity* (*Observations sur l'électricité*, Paris, 1747), Louis made public the results of his own experiments, claiming that electricity had dangerous secondary effects, and warning those who entertained themselves with electrical experiments about the potential dangers of such a practice. Instead of being put off by the objections against his trials with medical electricity, Nollet took the opportunity to present his experimental skills and philosophical competence as indispensable tools in the assessment of controversial claims. Faced with Louis's attack on using electricity on paralytic patients, he communicated to the members of the Académie des Sciences Jallabert's success in the treatment of a case of paralysis by electricity.⁶⁹ All the rumors provoked by the medical applications of electricity made Nollet realize that, apart from his own perplexities, medical electricity had consistently added to the appeal of electrical experiments. On returning his thanks to Jallabert for his news on the paralytic patient, he acknowledged with undisguised pleasure that it was "because of you [Jallabert] that electricity has begun to sell really quickly".⁷⁰

Financial concerns and a craving for prestige were key features in Nollet's philosophical enterprise. In the early years of his activities, thanks also to the patronage of his former tutor Réaumur, his authority as an experimental philosopher grew through his ability in instrument-making and his success as a communicator of natural philosophy. His expensive physics cabinets were bought by academic institutions and by wealthy and famous contemporaries such as Voltaire who, paying 10,000 *livres* for a whole cabinet, confessed that "the Abbé Nollet is ruining me".⁷¹ The upper class's fascination with electricity and with popular natural philosophy created a demand that Nollet satisfied meticulously.⁷² In 1744 he was invited to re-

⁶⁸ ANTOINE LOUIS, *Observations sur l'électricité* (Paris, 1747), p. xx.

⁶⁹ AASP, *Procès Verbaux*, Tome 67 (1748), ff. 43-44 (3 February 1748).

⁷⁰ "[...] c'est pour vous que l'électricité a commencé à se vendre véritablement vite": Nollet to Jallabert (17 March 1748), in *Correspondence Nollet-Jallabert* (cit. note 5), p. 161.

⁷¹ Quoted in JEAN FRANÇOIS GAUVIN, "An Eighteenth-Century Entrepreneur", *Bulletin of the Scientific Instrument Society*, 1998, 57: 21-25, p. 23. Nollet sold a cabinet of physics to the Académie in Bordeaux; see GRANDJEAN DE FOUCHY, "Eloge de M. L'Abbé Nollet", *Histoire de l'Académie pour l'année 1770, 1773*: 121-136, p. 125. On Nollet see the essays in *The Art of Teaching Physics. The Eighteenth-Century Demonstration Apparatus of Jean Antoine Nollet*, edited by Lewis Pyenson and Jean-François Gauvin (Sillery, Quebec: Les éditions du Septentrion, 2002).

⁷² On the public culture of science in the French and British contexts see: JAN GOLINSKI, *Science as Public Culture. Chemistry and Enlightenment in Britain* (Cambridge: Cambridge Univ. Press, 1992); SIMON SCHAFFER, "Natural philosophy and public spectacle in the eighteenth century", *History of Science* (1983), 21: 1-43; LARRY STEWART, *The Rise of Public Science. Rhetoric*,

side in Versailles in order to lecture to the Dauphin de France three times a week. He took with him all his instruments, and performed experiments for the Royal Family and other courtiers at Versailles:

The Queen and my ladies saw my experiments with pleasure, and several times; all this need was worth a very good piece of gold, some books [...] 4000# of gratification and an annual pension of 1000# from the coffers of Mr. Le Dauphin.⁷³

In 1739, after his appointment as *adjoint mécanicien* at the Paris Académie des Sciences, the King of Piedmont employed him as private tutor to his son, having him as a guest for six months at the Royal Palace, in Turin. Nollet thus made contact with the professors of the University, where he sold a whole Physics cabinet, paid for by the King. Ten years later, when he went back to Italy, he was pleased to see all the instruments still in good order.⁷⁴ When, at the end of 1746, after three years at Versailles, he went back to his affairs, he shifted his attention from instrument-making to the ordering of electrical experimental philosophy.⁷⁵ His first publication in the field, the *Essay on the electricity of bodies* (*Essai sur l'électricité des corps*, Paris, 1746), set out the first systematic theory of electricity, the “*système Nollet*”.⁷⁶ In presenting his philosophical claims to the general reading public he took advantage of the prestige he enjoyed among the upper classes. The aristocratic spectators of his public demonstrations acted as authoritative witnesses for his claims concerning the operations of nature and, as such, they acted also as favorable judges in the “tribunal in which I shall never be condemned, all the times that the majority of votes prevails; for, what

Technology and Natural Philosophy in Newtonian Britain, 1660-1750 (Cambridge: Cambridge Univ. Press, 1992); GEOFFREY SUTTON, *Science for a Polite Society. Gender, Culture and the Demonstration of Enlightenment* (Boulder: Westview Press, 1995).

⁷³ “La Reine et mes dames ont vu mes expériences avec plaisir et un grand nombre de fois, toute cette besogne m’a valu une assez belle boete d’or, quelques livres [...] 4000# de gratification et une pension annuelle de 1000# sur la cassette de Mr. Le Dauphin”. Nollet to Jallabert (June 1744), in *Correspondence Nollet-Jallabert* (cit. note 5), pp. 115-117.

⁷⁴ Bibliothèque Municipale de Soisson, Soisson. NOLLET, *Journal du Voyage de Piedmont et d’Italie*, mss. 150, f. 11 (14 May 1749).

⁷⁵ Nollet to Jallabert (4 december 1746), in *Correspondence Nollet-Jallabert* (cit. note 5), p. 145 and p. 147.

⁷⁶ On Nollet’s electrical theory, see JOHN HEILBRON, *Electricity in the 17th and 18th Century. A Study of Early Modern Physics* (Berkeley and Los Angeles: University of California Press, 1979, revised edition: Dover Books, 1999), pp. 280-289. On Nollet’s career from craftsman to savant, see ANTHONY TURNER, “Sciences, Arts and Improvement. Jean Antoine Nollet, from Craftsman to Savant” and GAUVIN, “Eighteenth-Century Entrepreneur. Excerpts from the Correspondence between Jean Antoine Nollet, Etienne-François Dutour, and Jean Jallabert, 1739-1768”, in *The Art of Teaching Physics* (cit. note 71), pp. 29-47 and pp. 47-69.

I claim here, I demonstrated during my public Lectures before over six hundred people”⁷⁷

Meanwhile, however, electrical practitioners with little experience were advancing new theories of electricity, publishing descriptions of their experiments in the popular press. Nollet worried about the loss of credibility investing the science of electricity as a result of their claims, and pointed to the lack of expertise of improvised electricians. “Too fertile with wonders” when handled by the non-experts, electricity was engendering a “certain contempt towards Physics”.⁷⁸ With a view to containing the multiplication of uncontrolled theories over the nature of electric matter, in 1748 Nollet proposed to the members of the Académie des Sciences the appointment of a special committee devoted to a “general revision” of all electrical experiments, which would provide accredited references for physicists wishing to perfect electrical theories, and useful tools for amateurs wishing to understand the science of electricity. His project was accepted, including his proposal to carry out all the trials in his house and with his instruments. Nollet was a member of the committee.⁷⁹

As the electrical novelty of the time, medical electricity was part of Nollet’s ordering program for experimental philosophy. Requiring skills in the performance of electrical experiments as well as medical knowledge, medical electricity identified a domain of practice with blurred borders, often left unguarded by both physicists and physicians, while often frequented by improvised electricians.⁸⁰ The conflicting results of the various trials on medical electricity performed in different parts of Europe called for evaluations that would have to comply with electricians’ as well as physicians’ expectations. In early 1748, when he received Jallabert’s report on the cure of a case of paralysis, Nollet sought permission from the Minister of War, Le Comte d’Argenson, to resume his trials on the effects of electricity, this time on three paralytic soldiers at the Hôpital des Invalides. Through the Minister’s intercession, Nollet obtained the collaboration of the physician M. Munier and the head surgeon, M. Bouquot. One of the

⁷⁷ “[...] c’est un tribunal où je ne serai point condamné sin l’on va à la pluralité des voix; & ce que j’avance ici, je l’ai fait voir dans mes Leçons publiques, à plus de six cens témoins”: NOLLET, *Recherches sur les causes particulières des phénomènes électriques* (Paris, 1749), p. 14.

⁷⁸ *Ibid.*, p. 342.

⁷⁹ AASP, *Procès Verbaux*, Tome 67 (1748), ff. 486-487. On the Académie des Sciences and its role in forging the image of French intellectuals, see ROGER HAHN, *The Anatomy of a Scientific Institution: The Paris Academy of Sciences, 1666-1803* (Berkeley, Los Angeles, London: University of California Press, 1971).

⁸⁰ See ROBERTS (cit. note 8).

rooms of the hospital was allotted to the experiments: following Jallabert's directions, Nollet and his collaborators had the patients placed on an insulated stool and connected them to an electrical machine.⁸¹ For two hours in the morning and between two and three hours in the afternoons, the operator extracted sparks from the paralyzed limbs. After fifty days of these trials, Nollet, Morand and Bouquot concluded that the effects of electricity were only transient and that only involuntary movements could be induced in the paralyzed limbs.⁸²

The experiments at the Hôpital des Invalides became for Nollet an opportunity to present himself as an expert arbiter in the assessment of controversial statements on the healing effects of electricity. When, three weeks after the beginning of his trials, the minister of war and a "great number of people of distinction" assembled in order to see his medical electrical experiments, he expressed his hope of seeing more encouraging results in the future, even though experimental evidence had not pointed to any lastingly positive effects of electricity upon paralyzed limbs. Nonetheless, he started his public performance by reading aloud Jallabert's report on the cure of a paralytic patient by electricity.⁸³

PHILOSOPHICAL NEGOTIATIONS

As an envoy of the French Court and representative of the *Académie Royale des Sciences*, Nollet actively interacted with the world of Italian scholars, in both academic and aristocratic contexts.⁸⁴ By showing his willingness to perform controversial experiments together with his rivals, he consolidated his public image as a charming demonstrator ready to engage in the controversial issues of modern philosophy, while also enhancing the aura of disinterestedness which would render his judgment acceptable even to his rivals. As a literary strategy, that of the philosophical duel was familiar to Nollet. In his *Recherches sur les causes particulières des phénomènes électriques* (Paris, 1749), published a few months before his jour-

⁸¹ Nollet to Jallabert (17 March 1748), in *Correspondence Nollet-Jallabert* (cit. note 5), pp. 160-163.

⁸² MORAND & NOLLET, "Expériences de l'Electricité appliqué a des Paralitiques", *Mémoires de l'Académie des Sciences de Paris pour l'année 1749, 1753*: 29-38.

⁸³ Nollet to Jallabert (1 May 1748), in *Correspondence Nollet-Jallabert* (cit. note 4), p. 165.

⁸⁴ On these aspects of Nollet's tour, see PAOLA BERTUCCI, "Back from Wonderland: Jean Antoine Nollet's Italian Tour", in *Curiosity and Wonder from the Renaissance to the Enlightenment*, edited by Robert Evans and Alexander Marr (Aldeshot: Ashgate, 2005).

ney to Italy, he staged four fictional dialogues with four authors who had criticized his work. The argumentative style of the *Recherches* appealed to the reviewer for the *Journal des Trévoux*, who praised the “feelings which should be taken as an example for all literary disputes”:

One can arm oneself for truth, one can fight up to a certain point; but after the battle, one must behave like our Warriors during armistice: they look at each other, they warn each other, they think highly of each other, they say to each other: take your seat, with a friendly welcome, at a homely treat [*Iam nunc sociorum absuescite mensis*] (Aeneid, VIII, 174).⁸⁵

The role model of the disinterested philosopher, armed with reason, fighting in the name of truth, was amply displayed by Nollet during his journey south of the Alps. In Italy, where a quite considerable portion of the academic world looked to Pivati's medical electricity with hopeful interest, this attitude won him a number of allies. Both supporters and opponents of Pivati's tubes accepted Nollet as an authoritative arbiter. Virtual witnessing having failed, Pivati's (and his followers') experiments needed Nollet's presence for their reliability to gain credit beyond the Alps.⁸⁶ The Italian electricians were aware of the opportunity Nollet's visit could provide in terms of international prestige:

[Bianchi] wants us to make a parade, because once this very distinguished physicist is convinced (and it seems, from what he saw at Bianchi's, that he is going to be persuaded), all of France and England will be with us.⁸⁷

However, Nollet too was interested in gaining the favors of the philosophical community south of the Alps. In spite of what his published report suggests, Nollet's Italian tour did not aim to debunk alleged marvels by stigmatizing the Italian “love of the marvellous”. In fact, just as the Italians placed their expectations of international recognition in Nollet's ap-

⁸⁵ [anon.], “Article XLIII. *Essai sur l'Electricité des Corps*, par M. l'Abbé Nollet”, *Journal des Trévoux*, 1751, II: 864-875, pp. 874-875, original Latin in the text. For the quotation from Virgil's *Aeneid* I have used John Dryden's translation. The original in French reads: “On peut s'armer pour la vérité; on peut combattre jusqu'à un certain point; mais après la bataille, il faut faire comme nos Guerriers durant l'Armistice; ils se voyent, ils se préviennent, ils s'estiment, ils se disent mutuellement: Jam Sociorum assuescite mensis (Aeneid, VIII, 174)”.

⁸⁶ For the concept of “virtual witnessing” see STEVEN SHAPIN and SIMON SCHAFFER, *Leviathan and the Air-pump. Hobbes, Boyle and the Experimental Life* (Princeton: Princeton University Press, 1989), chapter 2.

⁸⁷ “[...] vuole che mettiamo sulla parata, perché convinto sia (come pare da quello che ha veduto dal Sig. Bianchi cominci a persuadersi) questo distintissimo fisico, verrà con noi tutta la Francia, e l'Inghilterra”. BCAB, *Collezione. Autografi*, Pivati to Veratti (July 1749), f. 15001.

proval, Nollet took full advantage of the opportunities that his tour through the cultural capitals of the Italian peninsula offered to establish strong ties with experimental philosophy's experts and amateurs. As I have shown elsewhere, throughout his career his relationship with the culture of curiosity and wonder unfolded along a double register: if it is unquestionable that he made his own the contemporary rhetoric that berated the "love of the marvellous" as synonym of plebeian credulity and superstition, his involvement in the public culture of science, and especially his mastery of the "wonders" of electricity, played a crucial role in molding his career; during his Italian tour it facilitated his admission to the numerous courts and scientific societies south of the Alps. In order to present himself as an impartial arbiter, and maintain the credibility that his counterparts accorded to him, he ought to show no prejudice against the "Italian prodigies" and conceal his conviction that the "Italian facts are at least exaggerated".⁸⁸

Before leaving Paris a number of Italian experimenters with whom he corresponded had informed him of their own unsuccessful attempts to make odors pass through sealed glass tubes.⁸⁹ After his first unsuccessful trials with the medicated tubes, Nollet wrote to Bianchi, who he had met during his first stay in Turin ten years earlier, asking his opinion of Pivati's cures. Bianchi's reply, with its descriptions of electric treatment of paralyzes, sciaticas, and tumors, plus numerous electric purges, all performed according to Pivati's directions, made Nollet realize that Pivati was not an isolated amateur. Bianchi also informed Nollet of the experiments that Veratti was carrying out in Bologna, and of the electric purge that he had successfully supplied to his valet.⁹⁰ Yet Nollet also knew that in Italy there was no unanimous consensus on the efficacy of medicated tubes, and that even the most persuasive instance of their usefulness (the healing of the Bishop of Sebenico performed by Pivati) had proved to have only a transient effect.

A year before his journey he sought the help of Jallabert, a member of the Institute, to compensate for one crucial difference, concerning their relationship to the Institute, between Bianchi, Pivati and Veratti, on the one hand, and Nollet himself, on the other: membership. "I am not a member of the Institute of Bologna, and you cannot doubt that I should be very

⁸⁸ "[...] nous sommes tous disposés à croire que les faites d'Italie sont pour le moins exagérés". Nollet to Jallabert (22 March 1749), in *Correspondence Nollet-Jallabert* (cit. note 5), p. 174. See also BERTUCCI "Back from Wonderland" (cit. note 84).

⁸⁹ AASP, *Procès Verbaux*, Tome 67 (1748), ff. 18-26.

⁹⁰ *Ibid.*, ff. 15-18.

flattered to be one”,⁹¹ he wrote to Jallabert in May 1748. The implicit invitation to sponsor his candidature resulted in Jallabert’s proposal to Zanotti, and Nollet’s prompt election, a few months later. Nollet’s maneuvers were dictated not only by personal ambition, but also by the new policy of the Paris Académie des Sciences, which at the time was particularly keen on enlarging its network of foreign correspondents, and the public for its *Mémoires*. Nollet’s journey through the various Italian states proved a success in this respect. During the nine months he spent in the most important cultural capitals of the peninsula, Nollet acted as an able merchant of the intellectual commodities produced by the Académie. He found seven new foreign correspondents, and arranged for the *Mémoires* to be received systematically by the scientific institutions of the peninsula, from North to South.⁹²

His priorities as a representative of the Académie des Sciences informed the strategies he adopted in his interaction with the members of the Institute of Sciences. Once in Bologna, he was extremely careful not to give the impression of being there to judge the Institute’s research activities. If, in his published report, he declared that “one of the most pressing [Motives which made me undertake the Journey to Italy] was, the Desire of seeing succeed, in the Hands of those who had already said they had, these Phaenomena in Electricity”,⁹³ in his private correspondence with Zanotti, the secretary of the Institute of Sciences, he asserted that “electricity was, I assure you, the least of the reasons that brought me to Bologna”.⁹⁴ For their part the members of the Institute, and especially Zanotti, welcomed him as a representative of a prestigious foreign institution and as a prestigious foreign member of the Institute of Sciences. On his arrival in Bologna, the vice-legate arranged for him to have a coach and a lackey for the whole period of his stay, while Laura Bassi and Giuseppe Veratti invited him to their home. They discussed the question of medicated tubes, but in contrast to his confrontation with Pivati in Venice, Nollet’s visit to Bologna did not take on the aspect of a philosophical duel. Instead of throwing down the glove and publicly staging his disagreement over the efficacy of medicated tubes, during his encounters with Bassi and Veratti Nollet presented himself as a champion of polite conversation. He kept silent, for example, about what the Cardinal delle Lance had told him months

⁹¹ “[...] je ne suis pas de l’Institut de Boulogne et vous ne pourriez pas doutés que je ne fusse très flatté d’en être”. Nollet to Jallabert, 1 May 1748, in *Correspondence Nollet-Jallabert* (cit. note 5), p. 165.

⁹² See BERTUCCI, “Back from Wonderland” (cit. note 84).

⁹³ NOLLET, “Extract” (cit. note 3), p. 374.

⁹⁴ BCAB, *Lettere di vari a Zanotti* (Nollet to Zanotti, 29 October 1749), B 160, f. 38.

earlier in Turin. The Cardinal had visited Veratti in Bologna to see him perform electrical experiments upon a young girl, but the latter had failed to reproduce the announced effects. Veratti's explanation of the failure – "Monsignore, it is because we could not electrify her in your presence as she should be electrified" – sounded to Nollet such an admission of quackery that it prompted him to underline the text of Veratti's reply in his diary, but the gossip never reached the press.⁹⁵

Nollet's *savoir faire* gained the sympathy of Bassi and Veratti. After his visit, Bassi praised his amiability and fine manners; in the following years she exchanged various letters with him, and he addressed to her one of his *Letters on Electricity* (*Lettres sur l'Électricité*, Paris, 1753). He also obtained Zanotti's agreement to act as a foreign correspondent from Bologna for the *Académie*, and he arranged for the *Mémoires* to be regularly received by the Institute.⁹⁶ On his way back to Paris, writing to Zanotti, Nollet acknowledged the friendship and cordiality that the members of the Institute showed to him, "rare qualities among men who pursue the same career".⁹⁷ The good relations Nollet was able to build up with the Institute were also good references for his encounter with the pope, who gave him a private audience, wishing to hear all about his visit to Bologna.⁹⁸

The visit marked an unexpected turning point in the controversy. The pope had a personal interest in hearing the opinions of such a respected philosopher about the discoveries that the Bolognese institution, which he patronized, sponsored so actively. In fact, the pope was considerably dissatisfied with the Institute's hasty support of a subject as controversial as medical electricity. A few years later he would reveal his annoyance over the electric craze of the time:

in every meeting with Princes's Ministers, in every correspondence from this or the other side of the Alps, we are electrified, and we feel no other effect but our blood become hot, our head obstructed, and our temperament bilious.⁹⁹

⁹⁵ NOLLET, *Journal* (cit. note 64), f. 16 (underlined in the manuscript), also quoted in HEILBRON, *Electricity* (cit. note 76), p. 354.

⁹⁶ BCAB, *Lettere di vari a Zanotti* (Nollet to Zanotti, 11 May 1750), B 160, f. 45. ASP, *Procès Verbaux*, Tome 69 (1750), 27 March 1750, f. 187.

⁹⁷ "[...] qualites rares parmi les hommes qui se trouvent dans la meme carrière": BCAB, *Lettere di vari a Zanotti* (Nollet to Zanotti, 6 September 1749), B 160, f. 37.

⁹⁸ NOLLET, *Journal* (cit. note 74), f. 149v.

⁹⁹ [...] "in ogni udienza de' Ministri di Principi, in ogni Posta che venga o di qua, o di là da monti, noi siamo elettrizzati, e non proviamo altro effetto, che quello di sentirci acceso il sangue, ingombrata la testa, e mossa la bile", in FRANZ XAVER KRAUS, *Briefe Benedictus XIV an den Canonicus Pier Francesco Peggi in Bologna* (Freiburg, Tübingen: J.C. Mohr, 1884), p. 119. I am grateful to Marta Cavazza for attracting my attention to this quote.

When Nollet was in Rome, Pozzi, the physician to the pope, revealed to him that, like other people, the pope was furious that Veratti's work had been published at all.¹⁰⁰ The pope's attitude to medical electricity tipped the balance of the controversy in Nollet's favor, but it also obliged him to be cautious in the literary rendering of his encounters with the Italian electricians. While his lack of sympathy for the medicated tubes strengthened Nollet's own views, the pope's patronage of the Institute of Sciences, combined with the interests of the Académie des Sciences to maintain good relations with the Institute, suggested some circumspection over the ways in which the Institute's involvement with the medicated tubes should be made public. Nollet's belligerent attitude became smoother soon after his meeting with the pope. When he wrote to Jallabert that he feared "there is nothing but imagination to purge here", he also recommended him not to publicize his views until his return, as, he wrote, in Bologna the "spirits are divided"¹⁰¹ and the members of the Institute themselves "regret having moved forward so much", and "they have resolved to be much more circumspect in the future".¹⁰²

In May 1750, back in Paris, Nollet sent Zanotti an extract of the report he was going to submit to the Académie des Sciences, in which he described his visit to Bologna and his discussions with Veratti about the medicated tubes. He professed himself willing to make all the changes that Veratti might suggest, even though he had already sent his report to the Royal Society of London, where it had been read two months earlier, on 29 March 1750.¹⁰³ There was nothing potentially offensive in that section of the report: Veratti was portrayed as a "learned, wise, and candid Man" whose cures "are not such as give me Difficulty to believe them".¹⁰⁴ Nonetheless, Veratti did find a number of inaccuracies in Nollet's report and, a few days later, he prepared a draft with the corrections to be sent to Paris.¹⁰⁵ The corrections were never incorporated in Nollet's final version of the report, but there is no evidence that he ever received the letter. Yet whether Nollet ever read it or not, Veratti's letter did not arrive in time: the

¹⁰⁰ Nollet to Jallabert (22 August 1749), in *Correspondence Nollet-Jallabert* (cit. note 5), pp. 177-178.

¹⁰¹ *Ibid.*

¹⁰² "[...] de s'être tant avancé et que à l'avenir on se propose d'être bien plus circonspect". *Ibid.*, p. 179.

¹⁰³ BCAB, *Lettere di vari a Zanotti* (11 May 1750), B 160, f. 45. Royal Society Library, London, *Journal Book*, 1750, ff. 278-286.

¹⁰⁴ NOLLET, "Extract" (cit. note 2), p. 390.

¹⁰⁵ BCAB, *Mss Laura Bassi*, Cart. 1, fasc. 2, uncatalogued.

Royal Society would publish the version that Nollet had sent to London before asking Veratti's opinions of the report. Probably Nollet deliberately ignored Veratti's corrections, or the letter never reached him, possibly because of an act of censorship – or self-censorship – imposed upon Veratti. Were it possible to support with more documentary evidence either of the options, I could conclude by highlighting, respectively, Nollet's awareness of having won the philosophical duel, or the discreet surrender of the members of the Institute. Either way, however, it would appear that, soon after Nollet's visit, the Institute had to negotiate the cost of the "armistice", in order to "take a seat at a homely treat".¹⁰⁶ It was a two-way negotiation, in which both Nollet and the Institute had something to gain: while the Institute's members worried about their international reputation, Nollet had an interest in maintaining good relations with the Institute and its patron, Benedict XIV. Silence over the Institute's support of medicated tubes appeared as a viable compromise to both parties. Upon receiving Nollet's extract, Zanotti prepared a formal letter in which he made it clear that the attitude of the Institute towards medical electricity had changed:

here almost no one talks about electricity, whether medical, or of any other kind. The World gets tired of lengthy discussions of the same subject.¹⁰⁷

The compromise was also acceptable to Nollet; in his publication, he could boast of his victory over the supporters of medicated tubes without offending the Institute, or its powerful patron. No mention of Bianchi's or Pivati's relationship to the Bologna Institute of Sciences would therefore appear in the report, the final act of a long series of negotiations between personal and collective interests, individual and institutional craving for prestige.

CONCLUSION

In miniature, the micro-history of the medicated tubes encapsulates significant features of Enlightenment experimental philosophy. Questions of authority and impartiality, tensions emerging from an absence of shared

¹⁰⁶ See quotation from Virgil in n. 81 above.

¹⁰⁷ "[...] qui non si parla quasi più della elettricità, o sia medica, o sia di qualsivoglia genere. Il Mondo si stanca di parlar lungamente della medesima cosa". AASB, "Antica Accademia", Tit. III, *Minute scritte durante il segretariato Zanotti: Lettera scritta in nome dell'Accademia al Sig. abate Nollet*, 19 December 1750. In a letter to Veratti dated 10 July 1751, Pivati lamented the latter's slight interest in the medicated tubes: BCAB, *Collezione autografi*, LVI, f. 15004.

norms for replication and testimony, the entanglement of experimental philosophy with local contingencies, all came into play during the controversy. At a time when natural philosophers were engaged in setting the standards according to which experimental results should be credited and knowledge of the natural world secured, the controversy over the medicated tubes acquired a distinctive pedagogical value that prevented it from being quickly forgotten. Nollet continued to refer to the episode in his later books, and two decades after his Italian tour, Joseph Priestley resumed the controversy in his *History and Present State of Electricity*. Given Priestley's view of a linear scientific progress, and his use of history to illuminate what he regarded as the "rise and progress" of natural experimental philosophy, his recourse to an episode that was no longer on everyone's lips is strong evidence of his conviction that his readers would nevertheless draw a lesson from it.¹⁰⁸

I made a rule to myself, and I think I have constantly adhered to it, to take no notice of the mistakes, misapprehension, and altercations of electricians; except so far as, I apprehended, a knowledge of them might be useful to their successors. All the disputes which have no way contributed to the discovery of truth, I would gladly consign to eternal oblivion.¹⁰⁹

In line with a new contemporary understanding of history as a means to intellectual enlightenment, Priestley's account of philosophical controversies served the purpose of codifying proper experimental practice.¹¹⁰ Mistakes and altercations, in his history, were not to be understood as revealing anything other than the difference between "right" and "wrong" procedures. Nollet himself, with his repeated narrations of philosophical duels which he regularly won, also mastered this educational approach. The constellation of interactions between the parties involved in philosophical disputes was completely erased in such accounts. The actors themselves, however, were aware of other dynamics that were essential in crediting discoveries, building up careers, and arbitrating, or sparking, controversies.

Academic institutions were pivotal in these respects. Thrilled by Pivati's surprising discoveries, and aware that the results of one individual alone would not gain the attention that he had hoped for the medicated tubes, Zanotti acted on behalf of the Bologna Institute of Sciences in the promotion of Pivati's invention abroad. The interactions between the

¹⁰⁸ PRIESTLEY, *History* (cit. note 7), p. I.

¹⁰⁹ *Ibid.*, p. X.

¹¹⁰ On history writing in the Enlightenment, see ROY PORTER, *Enlightenment. Britain and the Creation of the Modern World* (London: The Penguin Press, 2000), chapter 10.

members of the Bologna Institute and those of the Académie des Sciences allowed Pivati's experimental results to be received as objects worth further investigation rather than as the fanciful assertions of a charlatan. The mediation of the Bologna Institute guaranteed that the certification of Pivati's claims had already taken place, so he did not need to continue to negotiate his authority. The Institute would operate on his behalf, bestowing its own authority on the medicated tubes. In return, the "appellation d'origine contrôlée" awarded by the Institute to the new invention would enhance its own prestige and demonstrate to its patron Benedict XIV that his substantial investments in the Institute had been fruitful. Success abroad would help achieve local objectives. Membership in institutions of acknowledged reputation, such as academies or universities, conferred upon individuals the additional credit due to the institutions to which they belonged. The announcements of the effects of the medicated tubes by the Institute of Sciences carried more authority than those by Pivati, Bianchi and Veratti as individual practitioners. It was after reading that medical electricity "excited the minds of the most learned Italian men", that Henry Baker warned the Fellows of the Royal Society of London that the subject, "romantic as it may seem, should not be absolutely condemned without a fair Tryal".¹¹¹ Similarly, it was Winkler's support of Pivati's tubes, in a prestigious institutional context and before government representatives, that inflamed Nollet. However, this universe of relationships was entirely removed in the published account of the controversy, which crowned Nollet as a disinterested arbiter while it also constructed a sort of "role model" for the experimental philosopher. The more Nollet's battle became disentangled, at least at the literary level, from the local context in which it took place, the more significance it acquired at the global level as a normative example of proper experimental conduct.¹¹² Previous analyses of the controversy have interpreted Nollet's tour as an "exercise on the political geography of calibration", or as the moment in which the "protocols of experimental philosophy" were extended to medical electricity.¹¹³ While such analyses underline processes that undoubtedly characterized the codification of electrical experimental philosophy in the years of the controversy, they examine it from the point of view of-

¹¹¹ HENRY BAKER, "A Letter from Mr. Henry Baker F.R.S., to the President, concerning several Medical Experiments of Electricity", *Philosophical Transactions of the Royal Society*, 1748, 45: 270-275, p. 275.

¹¹² On the disembodiment of science, see SCHAFFER, "Self-evidence" (cit. note 8).

¹¹³ See *ibid.*; ROBERTS, "Heterogeneous purposes" (cit. note 8).

ferred by the winner of the “philosophical duel”, bypassing the significance of the interactions between Nollet and those he subsequently portrayed as his rivals. This study has proposed a change of perspective that, while highlighting the Italian context, has emphasized the reciprocity between Nollet and the philosophical community south of the Alps. Such reciprocity was characterized by their participation in the same culture, rather than by conflicting approaches to the investigation of the natural world.

Recent studies on the Grand Tour have begun to examine the locals’ reactions to travelers’ accounts and have pointed out that those who were “traveled to” responded critically to such accounts. The analysis of such critical responses highlights their emergence from the same cultural framework as the one in which travel writers moved. Cultural assumptions and aspirations of both travelers and those who were traveled to were strikingly similar.¹¹⁴ With their comments on the cultural as well as natural landscapes of the places they described, travel diaries drew the map of the Enlightenment, marking its centers and peripheries; yet the periphery did not passively accept such a definition and it produced critical reactions to what was often perceived as biased judgment: “Why is it that even the most ENLIGHTENED foreigners when confronted with their own knowledge and evidence maintain constantly the same national prejudices which they acquired in the milk of their wet-nurses?”¹¹⁵ Similarly, if in his published account, Nollet blamed the Italians’ heated imagination and their love of the marvelous, the “Italians” did not really match his picture, even in Nollet’s own understanding. I have shown that prior to and during his tour, Nollet created the conditions that would help him be welcomed by the members of the Institute of Sciences as one of their own, rather than as a prejudiced foreigner who wanted to discredit their work. During his Italian tour Nollet looked more for consensus than for conflict. Whereas in presenting his trials with the medicated tubes to a reading public he insisted on the actual performances of the experiments and fashioned himself as a disinterested philosopher fighting in the name of truth, his tour through the cultural capitals of the peninsula was characterized by his active attempts to weave relationships with local experimental philosophers, both professional and amateur. In fact, I would argue that the controversy was more a literary phenomenon than Nollet’s actual preoccupation while he toured the Ita-

¹¹⁴ This point has been raised by Melissa Calaresu in her “Looking for Virgil’s Tomb: The End of the Grand Tour and the Cosmopolitan Ideal in Europe”, in *Voyages and Visions. Towards a Cultural History of Travel*, edited by Jás Elsner and Joan-Paul Rubiés (London: Reaction Books, 1999), pp. 138-161.

¹¹⁵ PIETRO NAPOLI-SIGNORELLI, *Vicende*, V, p. 494, quoted in Calaresu (cit. note 114), p. 155.

lian peninsula. Beyond his rhetoric on the Italians' "love of the marvelous", this analysis has shown that the interactions between Nollet and the Italians unfolded according to shared protocols that characterized citizenship in the Republic of Letters. In spite of the philosophical duel which saw Nollet opposed to Pivati, the strategies that they adopted in order to carve out careers for themselves shared strikingly similar features. One common element was the public culture of science that sustained their careers. As has been convincingly argued, eighteenth-century science was geared to the demands for public learning that emerged from the increasing commodification of culture.¹¹⁶ Inventions, whether of new instruments or of new machines, could bring fame and secure lifelong income, and authorship too could significantly contribute to build up one's reputation.¹¹⁷ Both Nollet and Pivati profited from the opportunities provided by the heterogeneous demands for experimental philosophy that were expressed by the social context in which they operated, and they both saw in the "wonderful" science of electricity the key to access higher status and recognition. A brief clarification on words is essential at this point. In his *The Ambiguous Frog* Marcello Pera has put together an entertaining miscellanea of quotations from mid-eighteenth-century texts, convincingly showing the actors' emphasis on the "marvelous", or "wonderful" character of electric science in general, boosted by the medical applications of electricity.¹¹⁸ If his galloping sequence of quotations effectively challenges the "anti-marvelous" ethos of the Enlightenment recently proposed by Lorraine Daston and Katherine Park in their *Wonders and the Order of Nature*, Pera's main argument ignores the role played by the social milieu that fed on such "wonderful" experiments, while he also restates disciplinary borders between physics and medicine that this essay, as well as other studies, have shown to be too blurred to be relied upon.¹¹⁹ The "youngest daughter of the sciences", as electricity came to be regarded in the eighteenth century, was extremely popular thanks to the sense of wonder that it never failed to excite and it was also a field of experimental research where lack of accepted standards made the scrutiny of any claim to

¹¹⁶ See note 72.

¹¹⁷ LILLIANE HILAIRE-PÉREZ, *L'invention technique au siècle des Lumières* (Paris: Albin Michel, 2000), STEWART, *The Rise of Public Science* (cit. note 72).

¹¹⁸ MARCELLO PERA, *La rana ambigua. Alle origini della controversia sull'elettricità animale* (Torino: Einaudi, 1986; Engl. Transl.: Princeton, 1992), chapter 1.

¹¹⁹ LORRAINE DASTON and KATHERINE PARK, *Wonders and the Order of Nature: 1150-1750* (Zone books: New York, 2001; trad. it. Carocci, 2001), chapter 8. For a different interpretation focused on Nollet's travel to Italy, see BERTUCCI, "Back from Wonderland" (cit. note 84).

expertise less severe.¹²⁰ Hence it appealed to amateurs, like Pivati, seeking to make a name for themselves, or aspiring philosophers, like Nollet, with ambitions to systematize and set the standards for future research.

The very subject of the controversy, the medical applications of electricity, is worth a few more words.¹²¹ Around the mid 1740s, when a group of electricians fostered the idea that the visible physiological responses of the human body to the passage of the “electric fluid” might lead to innovative healing therapies, electrical practice began to stimulate the investigative curiosity of physicians, apothecaries, physiologists and others, who had not regarded electrical research as pertaining to their field of interest or expertise. They envisaged a golden future for the medical applications of electricity, at various levels. The “new and noble field of electrical discoveries” seemed to promise innovative healing treatments, and so it perfectly conjugated electrical practice with useful science, a theme that was dear to Enlightened philosophers.¹²² Situated at the intersection between medicine, physics and chemistry, medical electricity also posed challenging questions about the relation between electric fluid and animal life that engaged both the cautious, like Nollet, and the enthusiastic, like Zanotti. It soon became a controversial field of experimental inquiry that could reserve surprises of both philosophical and practical kinds. It did so, for example, a few decades later, again in Bologna, when Luigi Galvani performed the experiments that would spark off another controversy (on animal electricity), which would lead to the invention of the Voltaic battery.¹²³ Medical electricity offered profitable opportunities also to instrument makers, who devised new instruments permitting the administration of the electric fluid for medical purposes.¹²⁴ Yet it remained a controversial practice throughout the century.

However controversial, medical electricity survived the changing vicissitudes of electrical theory and its metamorphoses into electromagnetism in

¹²⁰ *Monthly Review*, 1767, 37, p. 94.

¹²¹ On the history of the medical applications of electricity, see MARGARETH ROWBOTTOM and CHARLES SUSSKIND, *Electricity and Medicine. History of their Interaction* (San Francisco: San Francisco press, 1984), also *Electric Bodies* (cit. note 8).

¹²² PRIESTLEY, *History* (cit. note 7), p. 145.

¹²³ See GIULIANO PANCALDI, *Volta. Science and Culture in the Age of Enlightenment* (Princeton: Princeton University Press, 2003), esp. chapter 6; also PERA, *La rana ambigua* (cit. note 118); MARCO PICCOLINO and MARCO BRESADOLA, *Rane, Torpedini e Scintille. Galvani, Volta, e l'elettricità animale* (Turin: Boringhieri, 2003).

¹²⁴ The first patent in the class of electricity was awarded to Edward Nairne's medical electrical machine in 1782; see BERTUCCI, “A Philosophical Business. Edward Nairne and the Patent Medical Electrical Machine (1782)”, *History of Technology*, 2001, 23: 41-58.

the following century, always serving the “heterogeneous purposes” of its ambitious practitioners, taking advantage of its lack of clear disciplinary borders. Sometimes such heterogeneous purposes coincided, as in the case of the Bologna Institute’s desire to enhance its international reputation, and Pivati’s and Veratti’s attempts to obtain local fame; other times they collided, as in the case of Nollet’s efforts to subsume electrical practice under the aegis of experimental philosophy, and Pivati’s reliance on the subjective judgments of his “patients”. It is such heterogeneity that this paper has brought to light, with a view to highlight the negotiations that led to the published version of the controversy over the medicated tubes. And in doing so, it has also cast light over the vibrant, though at times unsuccessful, world of Enlightenment science south of the Alps and on its actors’ aspirations to participate actively in the Republic of Letters. Although for profoundly different reasons, in the end I have to agree with Priestley and Nollet: the controversy over the medicated tubes was indeed a marvelous story.