Preface

We present the first volume of these studies on the 20th of March of the year 2000, on the occasion of the bicentenary of Alessandro Volta's invention of the battery. We believe that few scientific results had a similar impact on the development of science and technology. The beginning of the new millennium is certainly marked by a new perception of the role of science, not only by the public but also by its practitioners. On one side, in the general public the appreciation of the cognitive aspect of science, traditionally its most valued asset, is often overcome by the fear of its performative power. On the other, among scientists and namely among physicists, there are increasing doubts about the willingness of today's society to keep sponsoring *big science* and about the possibility of achieving the unification promised by the *standard model* at the end of last century. The reductionist programme is challenged by a view that stresses the relevance of "emerging properties"[1] at different levels of scientific analysis and the gathering of inquiries around the "disciplinary matrix"[2] structure.

A new situation in the development of science? Not really.

Already two hundred years ago Alessandro Volta, professor of experimental physics at the University of Pavia, had challenged with success the *standard model*[3] of his time: the largely French mathematical view based on forces acting with some inverse power of the distance between particles and fluids. No surprise that his letter communicating the invention of the battery, despite being written in French, was sent to a British journal. It was the result of a lifelong effort to interpret electrical phenomena in an original framework. Volta's scientific instruments immediately acquired international recognition; the same did not happen for his theoretical views, which identified analogous patterns in a number of disciplines: physics, chemistry,

[1] Cf. P. ANDERSON, "Historical Overview of the Twentieth Century in Physics", in *Twentieth Century Physics*, 3 vols., L.M. BROWN, A. PAIS, Sir B. PIPPARD, eds., (Bristol-Philadelphia-New York, 1995), III, pp. 2017-32.

[2] Cf. J. ZIMAN, "Some Reflections on Physics as a Social Institution", ibid., pp. 2041-59.

[3] Cf. J.L. HEILBRON, *Weighing Imponderables and Other Quantitative Science around 1800*, suppl. of *Historical Studies in the Physical Sciences*, 24:1 (1993).

thermology, gas theory, meteorology, physiology. The quantifying spirit of the age did not prevent a fruitful non standard conceptualisation.

Which was Volta's conceptual framework? How did his ideas originate? How exactly did they develop? What was the interplay between his theoretical views and his numerous experimental inventions? We do indeed hope that the new studies on *Volta and his Times* that we present here will provide increasingly detailed answers. Historians can benefit today from some new tools that the History of Science Group gathering around the *Pavia Project Physics* has made available: namely the reconstruction of Volta's *Gabinetto di Fisica*, with more than one hundred original instruments, the digitalisation, offering up to date research tools, of the complete set of the seven volumes of the *Edizione Nazionale delle Opere*, of the five volumes of the *Epistolario*, the *Aggiunte* and the two impressive volumes of the *Indici*. All this will make the historian's task easier and stimulate a renewed analysis of the manuscripts. The general public will be able to find out about this intellectual adventure of two centuries ago through the website dedicated to Volta's life and work. The website,[4] which offers a multimedia catalogue of the Cabinet, is about to include the complete works together with the present studies; hopefully it will also provide a focus point for the community of historians researching on *Volta and his Times*, a community which is small but enthusiastic and active.

In December 1998 a workshop held at Pavia University launched this venture: we owe a great many thanks to the colleagues and friends who gathered here, for their contributions and cooperation, thanks which of course are also addressed to our sponsors.

The contributions in this volume provide insights into general aspects of Volta's scientific work, the context in which it flourished and some of the debates it raised.

Overcoming a series of established anachronisms, JOHN L. HEILBRON takes a wide perspective on Volta's manifold researches. This leads him to the conclusion that substantial analogies existed among central areas of Volta's scientific work. Heilbron's analysis highlights in particular Volta's qualitative and quantitative use of analogies in areas as diverse as static electricity, the evaporation of liquids and the working of the pile.

KEITH HUTCHISON's paper deals with a fundamental transformation undergone by European physics in the course of Volta's lifetime, namely the shift from a "mechanical" world-view, based on inert matter acting by direct contact, to a new "dynamical" view, based on active matter exercising actions at-a-distance. Hutchison's discussion offers a general framework for understanding the grounds on which Volta worked out a dynamical and non-mechanical representation of the natural world.

[4] http://ppp.unipv.it/Volta

ELENA BRAMBILLA provides a detailed analysis of scientific education in Lombardy during the most fruitful years of Volta's research and teaching in Como and Pavia. The author emphasises the way the reforms promoted by the Austrian and French authorities changed the patterns of scientific education, with a special focus on the physical sciences within medical and engineering curricula. The question of the nature and degree of professionalisation of scientific teaching and research receives several interesting answers.

WALTER BERNARDI challenges the standard view that in the debate provoked by Galvani's research on animal electricity there was a split between a party of "biologists" led by Galvani and a party of "physicists" led by Volta. Exploiting new documental evidence, he reveals the complexity of the actual positions of a large number of Italian authors. Bernardi's main point is that several different controversies were originated by Galvani's discoveries with no such thing as today's division between biology and physics constraining the actors involved in the plot.

RODERICK W. HOME analyses Volta's strategy for building a scientific reputation outside the local environment of Italy. He focuses in particular on the connections Volta successfully managed to establish with British science, mainly through Priestley and Magellan. Priestley played a decisive role in drawing Volta's attention to the new important field of airs. The links with Magellan enabled Volta to receive up-to-date information on the latest developments in British science and to purchase a wide variety of scientific equipment in London, at that time the centre of the world's scientific instrument trade.

HELGE KRAGH discusses the long confrontation which took place during the nineteenth and the first half of the twentieth centuries between the contact and the chemical interpretations of Volta's pile. The author concentrates mainly on the nineteenth century, arguing that none of the great theoretical breakthroughs which occurred in this century had a decisive influence on the controversy. A series of interesting philosophical and historiographical conclusions are finally drawn by considering the features of the controversy and the way in which it continued well into the twentieth century.

Pavia, the 20th of March 2000

FABIO BEVILACQUA and LUCIO FREGONESE