4-1965

MARCELIN BERTHELOT: A Study of a Scientist's Public Role

Reino Virtanen
University of Nebraska-Lincoln

Reino Virtanen

MARCELIN BERTHELOT

A Study of a Scientist's Public Role

new series no. 31
University of Nebraska Studies
april 1965

Reino Virtanen

MARCELIN BERTHELOT

A Study of a Scientist's Public Role

university of nebraska studies : new series no. 31

published by the university
at lincoln : april 1965

The University of Nebraska

The Board of Regents

RICHARD E. ADKINS — VAL PETERSON, *president*

J. G. ELLIOTT — JOSEPH SOSHNIK, *corporation secretary*

B. N. GREENBERG, M.D.

CLARENCE E. SWANSON

J. LEROY WELSH

The Chancellor

CLIFFORD M. HARDIN

Marcelin Berthelot

A Study of a Scientist's Public Role

THE FRENCH chemist Marcelin Berthelot won great recognition during his lifetime, but since his death in 1907 he has become little more than a name for the world at large. He was a representative man—representing his time so completely that there remained little for the future to exploit. A man whose manifold accomplishments were so appropriate to the stage then reached by scientific development that nothing was left over—no loose ends, no undigested ideas, no potentialities unrealized. After Claude Bernard and Louis Pasteur, no scientist in France could challenge his eminence until the turn of the century, when other leading figures emerged, Poincaré, Becquerel, the Curies, clearly marking the end of a period that could be called the period of Berthelot. His lifespan extended into the new century and he lived through most of those relatively peaceful years preceding the First World War. Thus in his optimism of progress through science, he was spared the blow of this cataclysm. His adversaries could have found material here for a shattering refutation of his creed.

For it is as a leading and sometimes vulnerable exemplar of "scientism" that, outside of chemistry, he is chiefly remembered. Yet while he lived how many reasons there were to expect that his fame would prove lasting! The outstanding figure of organic chemistry, the learned historian of alchemy, the prominent statesman, the intellectual partner of Ernest Renan—what more did one need to guarantee a place in history? But the author of several weighty treatises and nearly a thousand research articles was later to be called a brake on scientific progress. The estimable Minister of Education afterwards was an ineffective Minister of Foreign Affairs. The monuments erected by the historian of chemistry have lost some of their authority and much of their grandeur. The principal spokesman for science was almost laughed out of court for one careless remark, culled by people who read no further from the Preface of

his *Origines de l'alchimie*: "Le monde est aujourd'hui sans mystère."[1] This was in the 1890's, when the cry "bankruptcy of science" was resounding through the land. Nevertheless his prestige remained great. He was Perpetual Secretary of the Academy of Science. He entered the French Academy in 1901. (Some thought he had been there all the time.) Upon his death his body joined those of so many illustrious Frenchmen in the Panthéon. An American writer in 1904 had called him "the greatest experimental genius since Faraday."[2]

It is significant that he was proposed for the Nobel Prize in chemistry repeatedly, yet was never chosen.[3] It is also significant that Charles Richet's call, in 1927, for a biography on the scale of Vallery-Radot's *Pasteur* was doomed to go unanswered. He made the suggestion in his preface to Emile Perrin's brochure marking the Berthelot centenary.[4] Certainly the somewhat longer study by Augustin Boutaric, of the same year, was no answer to Richet's appeal.[5] It cannot be expected that there will ever be a Vallery-Radot to recount Berthelot's life. It was too undramatic and even-flowing to attract such a biographer. Historians of science will undoubtedly one day provide that full and critical treatment of his scientific career which his many achievements deserve. In the meantime, there is something to be learned from a review of his many-sided role, not from the standpoint of a specialist in chemistry—which the present writer is not—but in the broader perspective of general "intellectual history" or of the history of ideas.

Berthelot the Scientist and Historian of Chemistry. The work that won him fame and had the widest bearing on general thought was that on organic synthesis. Although Friedrich Wöhler had achieved as early as 1828 the synthesis of urea out of inorganic materials, the belief still prevailed decades later that a mysterious vital force was necessary to produce organic compounds. As Berzelius realized, the synthesis of urea did not constitute a breakthrough into the heart-land of the organic. It was left to Berthelot, more than to any other man, to bring to a culmination the task begun by Wöhler. Berthelot relates the history of this advance in the introduction to his *Chimie organique fondée sur la synthèse*, (1860), in which the contributions of Chevreul, Gay-Lussac, Berzelius, Liebig, Wöhler and many others, are presented as steps on the way to his own work.[6]

Today we are witness to what seem to us even more spectacular discoveries along this line, with the researches on nucleic acid and protein molecules. The amazement we feel is akin to the reactions

of Berthelot's contemporaries in the case of the organic compounds. He was the first to use the term *synthesis*. By 1853 he had already created some animal fats and alcohols. The synthesis of acetylene and of benzene followed. Ten years of investigation are set forth in systematic form in the two volumes of his *Chimie organique fondée sur la synthèse*, divided into "books" on the synthesis of hydrocarbons, alcohols and sugars, with a book on methods including a discussion of ferments and isomers. The treatise established his reputation, despite some criticism from the veterans Chevreul and J.-B. Biot who opined that he should have contented himself with presenting his experimental results and left theory alone. Sensitive himself to the resistance of tradition, Renan noted a parallel between their objections and those of old-school orientalists against his own linguistic theories.[7]

With this work, Berthelot gained the admiration of one celebrated outsider. The historian Jules Michelet was delighted to be able to understand the introduction and the conclusion of the treatise: "Je vous ai non pas lu, mais bu comme une éponge!" The chemist charmed everybody at the Michelets'. Mme Michelet found him full of life.[8] It was an exhilarating time for chemistry, and for Berthelot, who described his science lyrically in these words: "La chimie crée son objet. Cette faculté créatrice, semblable à celle de l'art lui-même, la distingue essentiellement des sciences naturelles et historiques."[9] In his opening lecture at the Collège de France in 1864, he conveyed to his audience something of the drama. Synthesis had already produced hundreds of new substances and might one day lead to the creation of new elements![10] He did not realize, to be sure, that this creation, when accomplished, would demonstrate how far off the track he was in this respect. It was not chemistry, but physics, that would achieve this feat. And with his skepticism about the real existence of atoms, Berthelot could not possibly have foreseen how transmutation would be brought about.

Not everyone was pleased with his appointment to the Collège de France. Louis Pasteur wrote in protest to Chevreul, J.-B. Dumas and Claude Bernard, who with others had signed the petition for the chair. He referred unkindly to Berthelot's book: "On nous avait fait pressentir, il y a peu d'années, une révolution de la science par l'apparition de ces deux volumes énormes de *Chimie organique fondée sur la synthèse*. Jamais ouvrage a-t-il été plus vite oublié!" The wish was father to the thought, for Pasteur could not abide the mechanistic tendencies of Berthelot's work. But he went further, denouncing the appointment as "une des manifestations de cette

école, impatiente et dangereuse, personnifiée dans les noms de MM. Renan, Taine, Littré, etc. C'est M. Renan qui a fait la chose et qui a eu l'habileté de la faire signer par les membres de l'Académie des sciences."[11] Fifteen years later, Pasteur's antagonism against Berthelot will again come violently to the surface, and doubtless with more justification, when, upon the death of Claude Bernard, Berthelot publishes Bernard's notes on enzymes, which run counter to Pasteur's view that fermentation can take place only in the presence of life. It seemed to Pasteur a disingenuous attempt on the part of Berthelot to exploit Bernard's name on the morrow of his death against the vitalist position that Pasteur was defending.[12]

Although Pasteur did not use the label "positivist" in his accusation against that "dangerous school of Renan, Taine and Littré," it is obviously what he meant. As fate would have it, the illustrious bacteriologist succeeded in 1882 to Emile Littré's *fauteuil* in the French Academy. And it was Renan himself who made the reception speech, and gently corrected Pasteur's rather unsympathetic discourse on his predecessor.[13] Renan's shafts of irony passed between the uprighteousness and the downrighteousness of the famous scientist without leaving a mark on him. As for Berthelot's opinion of Pasteur, it was less than enthusiastic. He once expressed, at a time when Pasteur's fame was at a peak, his mental reservations on the finality of some of the microbiologist's work.[14] It would perhaps be wrong to dramatize these differences very much. Pasteur's notion of a positivist conspiracy was largely based on hasty inferences. But we can understand his suspicion of the Berthelot who wrote, in his long chapter on fermentation: "Bannir la vie de toutes les explications relatives à la chimie organique, tel est le but de nos études." Berthelot admitted that the chemist cannot make a leaf, a fruit, a muscle, or an organ. He implicitly left that task to the physiologist. But what chemistry cannot do as far as the organization of living things is concerned, it can undertake, said Berthelot, in the fabrication of the substances they contain.[15]

The decade of the sixties, opening with Berthelot's treatise, would see appear in succession Renan's *Life of Jesus*, Taine's *History of English Literature* and Claude Bernard's *Introduction to the Study of Experimental Medicine*. It might well be called the "positivist decade," except that Renan, Bernard and Berthelot explicitly separated themselves from the school of Auguste Comte.[16] Of our group, only Renan and Berthelot were close personal friends. But the scientists Bernard and Berthelot were frequently associated in the public mind. The attraction felt by Renan for their fields of

study is expressed in his essay of 1863, "Les Sciences de la nature et les sciences historiques (Lettre à M. Marcellin Berthelot)": "chaque fois que je cause avec vous, avec Claude Bernard, je regrette de n'avoir qu'une vie, et je me demande si, en m'attachant à la science historique . . . , j'ai pris la meilleure part."[17] In the course of the essay, Renan makes the fanciful prediction that in the very remote future, ages from now, the chemists and the physiologists would become masters of the Universe and of Life:

> Qui sait si, étant maître du secret de la matière, un chimiste prédestiné ne transformera pas toute chose? Qui sait si, maître du secret de la vie, un biologiste omniscient n'en modifiera pas les conditions, si un jour les espèces naturelles ne passeront pas pour des restes d'un monde vieilli, incommode, dont on gardera curieusement les restes dans des musées.[18]

Reminiscent of this dizzy forecast is the witticism which the Goncourt brothers entered in their *Journal* in 1869, reporting a café conversation:

> On disait que Berthelot avait prédit que dans cent ans de science physique et chimique, l'homme saurait ce que c'est que l'atome et qu'avec cette science, il pourrait à son gré modifier, éteindre, rallumer le soleil comme une lampe Carcel. Claude Bernard de son côté aurait annoncé qu'avec cent ans de science physiologique, on pourrait faire la loi organique, la création humaine en concurrence avec le Créateur.
>
> Nous n'avons fait aucune objection, mais nous croyons bien qu'en ce moment-là de la science le vieux bon Dieu à barbe blanche, arrivera sur la terre, avec son trousseau de cléfs, et dira à l'humanité, ainsi qu'on dit au Salon, à cinq heures: "Messieurs, on ferme!"[19]

The passage is merely suggestive of the public image of the scientist at the time. Neither man said anything of the sort, we can be sure. To take only Berthelot: he did not even believe in the *atom*, as a real entity.

While the synthesis of organic out of inorganic substances was exerting its effect in the realm of general ideas, Berthelot was embarking on new investigations, on explosives and in thermochemistry. His researches on flames and gaseous explosions led eventually to the invention of the bomb calorimeter. He never took out a patent on any of his discoveries. His public-spiritedness was shown also in his efforts to help his country during the Franco-Prussian War. But the General Staff was too hide-bound to take full advantage of his fertile mind and his technical ability. Napoleon Bonaparte had had his scientific brain trust, and used it. Napoleon the Third had his, but apparently did not know how to profit from it.

Berthelot could make little headway with his proposals for weapon development and for greater use of artillery. His discouragement is reflected in a number of entries in the Goncourt *Journal*.[20]

By the nature of the subject, Berthelot's investigations in thermochemistry caused few or no reverberations outside the walls of the laboratories and the lecture-rooms devoted to this science. Within these walls the theory he evolved was to be controversial in more ways than one. This was his principle of "maximum work" which he conceived to be a fundamental law of thermochemistry. According to this "law," every chemical reaction occurring without the addition of energy from outside will yield those substances whose formation involves the maximum evolution of heat. Its announcement in 1873 drew from the Danish chemist Julius Thomsen the charge that Berthelot had failed to make acknowledgment of his own contributions. Berthelot replied vigorously. But soon afterwards the question of priority between the two became one of secondary importance compared to the question of its theoretical validity. It was reduced to the status of a useful approximation, that could be strictly true only at a temperature of absolute zero! That formidable enemy of positivism, Pierre Duhem, took special delight in making fun of Berthelot's principle: "Pour échapper aux prises de l'expérience, le troisième principe de la thermochimie a pris une foule de formes; mais pour ne point être étranglé par la logique serrée de Sainte-Claire Deville, il a été contraint de s'évanouir en une ridicule tautologie: 'Toute réaction qui n'absorbe pas de chaleur en dégage.' "[21]

The stubbornness which Berthelot showed in defending this theory was manifested also in another connection, of more interest to the layman. We have already referred to his skepticism in regard to the atomic theory. He is like Sainte-Claire Deville in his aversion for granting meaningful reality to the atom. The question was a matter of contention between them on the one side and the leading French atomist of the time, Adolphe Wurtz, on the other. A high point in the controversy came in 1877 in the forum of the French Academy of Sciences. Sainte-Claire Deville started it off with an attack on Avogadro's Law: "simple hypothèse." It continued with Wurtz's reply and Berthelot's rebuttal, followed by further exchanges on the choice between writing chemical formulae in terms of "equivalences" or of atomic weights. At one point Berthelot called the combination of an element with itself a "mystical conception," for he retained the old idea that only unlikes could combine. What was involved here was the existence of molecules of a

single element formed of more than one atom. At another point Berthelot asked triumphantly: "Who has ever seen a gas molecule or an atom?" For Wurtz, the notation in equivalents based on volumes of vapor was an anachronism, even a retreat, and he was right.[22] Berthelot persisted in using this obsolete system, when everyone else was writing in terms of atomic weights. Not until 1890 did he finally yield, according to one report in the very middle of a lecture and without the slightest warning.[23]

The historian of chemistry, F. J. Moore, relates the following anecdote: "When a friend once told Berthelot that he need not take the atoms so seriously, that using them as aids to thought need imply no belief in their objective existence, he replied with a trace of bitterness, 'Wurtz has seen them!' "[24] His reaction is somewhat reminiscent of Claude Bernard's feeling about microbes: "Today the experimental spirit is being impoverished and frittered away with nonsense about the infinitely little which has no meaning. That is what is commonly called: 'Chercher la petite bête.' "[25] But while Bernard's negative stand on this point did not adversely affect his work as a physiologist, Berthelot's resistance to the concepts of the atom and molecular structure put him out of step with advances in his own field, notably in the case of stereochemistry. Now when people thought of benzene, they thought of Kekulé with his benzene ring, rather than of Berthelot who synthesized the substance from acetylene.

Berthelot's conservatism has been remarked on by many scientific writers, and even by some who were not scientists, such as Georges Sorel and Julien Benda. The latter was to assert that Sainte-Claire Deville and Berthelot prevented for forty years the teaching of the atomic theory.[26] This is a somewhat sweeping exaggeration, as the example of Professor Wurtz indicates. But there is some truth in the charge. The biologist Maurice Caullery writes that the opposition of Berthelot and Sainte-Claire Deville prevented the teaching of the theory in the lower schools until 1890. Caullery's generation was brought up on the old equivalents. In the Ecole Normale in 1887, the teachers were wont to refer sarcastically to the atomic theory. Caullery compares Berthelot's distrust of hypotheses with the spirit of Comte's positive philosophy, and sees therein a factor of sterility.[27] A French historian of science, R. Taton, draws another lesson: "Experience shows that it is always dangerous to confer too much power of criticism upon even the most eminent scientists, for there are some who, with age, turn theories into unassailable dogma against which they allow no criticism. And if their

powers are too wide, some of them may reduce their young adversaries to utter silence and thus brake the progress of science. Jean-Baptiste Dumas and Marcelin Berthelot were two eminent scientists who for a time enforced a scientific dogmatism against which it was very difficult to struggle."[28] One thing is clear: Berthelot was no longer riding the crest of the wave in science when he took up its defence against the Ferdinand Brunetières raising the cry "bankruptcy of science" toward the end of the century. This made it easier for his opponents to argue that he represented, not the future, but the past.

In another sense, he had increasingly turned his attention to the past, though this was not a sign that he belonged there. His activity in laboratory and agricultural experiment station continued without let-up. But now he also studied the antecedents of his science. His vast technical knowledge gave him an insight which few scholars could possess into the practices and processes involved in alchemy. A somewhat earlier historian of chemistry and alchemy, Hermann Kopp, was to be sure also an eminent research chemist. But after Berthelot, such a combination would be difficult, if not impossible. Berthelot's *Origines de l'Alchimie* is a contribution to the subject which can still interest both the specialist and the general reader. Later scholars like Edmund von Lippmann and, to an extent, Lynn Thorndike had perforce to leave the average reader out of their reckoning. Their erudite compilations, correcting Berthelot's occasional errors and filling in the gaps, could with their bewildering detail appeal only to the expert.

The other publications of Berthelot, such as the *Collection des anciens Alchimistes Grecs* and his studies of mediæval alchemy are still indispensable even for those scholars who do not always agree with his views. Thorndike considers his books on the beginnings of alchemy essential, while finding his mediæval work inadequate because based on too few manuscripts. Berthelot's dominant concern was not antiquarian. His interest in alchemy grew out of his interest in chemistry. Curiously enough, it is precisely for this that he has recently been taken to task. It is alleged that he overstressed those parts of alchemy from which chemistry was to be born, while pruning off the mystical and irrational elements in which a psychologist like C. G. Jung finds such deep if confusing significance.[29]

Perhaps his severest critic is still Von Lippmann. If a reader of the little books by Boutaric and Perrin thinks them too eulogistic, he can find a strong antidote, perhaps too strong, in Von Lippmann's remarks in his *Entstehung und Ausbreitung der Alchimie*,

published, incidentally, in Berlin in 1918. According to the German writer, Berthelot's authority as historian was accepted because of his excellent style and most people's ignorance of the field. We cannot stop for every particular in the indictment. It is almost a litany of belittlement: presumption, vainglory, conceit, failure to credit earlier scholars or even his own collaborators—so much for the historian. Not content with this portrait, Von Lippmann pursues his victim into the laboratory: Berthelot exaggerated his own role in organic synthesis, slighting Wöhler; and in his quarrel with Thomsen laid unwarranted claim to the title of creator of thermochemistry.[30] Thorndike, who for his part calls "pretentious" Berthelot's volumes on the Middle Ages, declares that Von Lippmann's book is still based largely on Berthelot's publications.[31]

Von Lippmann is right about Berthelot's style. For its clarity and elegance of expression, *Les Origines de l'Alchimie* is not too unworthy of the great tradition of French scientific and scholarly writing established by Descartes and Pascal, carried on by Voltaire and the Encyclopedists, and continued by Berthelot's friend Renan. There is just one blemish, that unlucky sentence with which the preface opens, and which almost everyone took for an indication of cocksure scientism. "Le monde est aujourd'hui sans mystère." The fortunes of this phrase will be discussed in connection with the "Bankruptcy of science" polemic. Restored to the context of the book, the remark can be better understood in the way the author intended. The work deals with a subject whose very spirit is the spirit of mystery. Alchemy would eventually lead to chemistry, through the gradual elimination of the occult features. In the first pages, the author describes the mystic origins of alchemy, its association with fallen angels and the appeal to divine or diabolical forces. This is the sense in which he uses the word *mystère*, with its connotations of sacrosanct and miraculous.

The very title is an indication that Berthelot shared one of the main preoccupations of his time. *Les Origines de l'Alchimie* is a counterpart of Renan's *Origines du Christianisme* and, to a lesser degree, of Taine's *Origines de la France contemporaine*. Berthelot follows a methodical plan, discussing first the sources, then the individual alchemists, the technical processes and facts, and finally the theories. (A glance at the documentation shows that Von Lippmann's charge of miserly acknowledgment of previous contributions is not quite fair. The German scholar lists 33 works he alleges Berthelot slighted, yet two thirds of them are mentioned in this book alone.[32]) The rise of alchemy began early in the Christian era, but

the sources include ancient Egyptian metallurgy, Babylonian and Hebrew tradition, and Greek speculative philosophy, as transformed by the Alexandrian Greeks and the Gnostics.

Interesting if all too brief is the chapter on the mystic origins, in which Berthelot touches on the Promethean aspect of science which makes it seem impious or sacrilegious to mystical souls like Tertullian, because it induces men to seek to rival the Gods. Many of the alchemists accepted this implication, if scientists do not. Berthelot links the notion with the myth of the Tree of Knowledge, and with similar themes revived by modern poets like Alfred de Vigny, Lamartine and Leconte de Lisle, in works like *Eloa, La Chute d'un Ange,* and *Qaïn.*[33]

The part of the book having the most bearing on general thought is that which sets forth the theories of the alchemists. The author traces in the one direction their affiliations with Ionian, Pythagorean and especially Platonic speculations on matter, in the other direction their resemblances to modern hypotheses. Ideas presented by Plato in the *Timæus* form part of the edifice of alchemical doctrine, and the *materia prima* is a cornerstone. Transmutation was presumed to be possible if substances could be reduced to this primary "element." Berthelot explains that alchemy developed into a rational, or at least rationalized system, in which the mystical or magical powers imagined during earlier times and still attributed to it by a superstitious public, no longer played an essential role. It suffered not so much from an excess of fancy perhaps, as from an excess of *a priori* reasoning. Qualities were thought of as entities, processes were conceived to be substances.[34]

Alchemical ways of thought survived into the last half of the Eighteenth Century, when Lavoisier and others finally established the fixity of elementary substances and the basic difference between these and the compounds formed from them. The evidence proved that transmutation was not possible at the level where the alchemists operated. This evidence was, however, not *a priori,* but experimental. The supposed substances of phlogiston and caloric were late reincarnations of the ancient element of fire. In the new chemistry this "element" became a process, a phenomenon.[35]

Berthelot's exposition here of these points does not differ much from generally accepted accounts of the "chemical revolution," although he shows an inclination to soft-pedal the contributions of Lavoisier's English contemporaries. This tendency is more evident in his book *Lavoisier: La Révolution Chimique.* Though Berthelot refers to the experimental work of the British chemists, one may

fairly say that Berthelot was too disposed, like his rival Wurtz, to regard chemistry as a French science. The British chemist, Sir Edward Thorpe, saw in the book an attempt to arrogate in favor of Lavoisier most of the honor for the chemical revolution, to the prejudice of Cavendish and Priestley. There is some justice in the complaint, for Berthelot did write: "Les conceptions qui ont fondé la chimie moderne sont dues à un seul homme Lavoisier."[36] But the credits have since been equitably allotted between Lavoisier on the one side and the English chemists on the other. The question need not concern us here. Something more to our purpose, in Berthelot's comparison of alchemical and modern theories of matter, is his tendentious treatment of the atomic theory, which he links in some of its aspects with the ideas of the alchemists. He discerns the not entirely ethereal ghost of *materia prima* haunting the hypotheses of the modern atomic school, and warns against falling into a "mystical enthusiasm." He finds analogies with the Pythagoreans "alors qu'ils prétendaient enchaîner dans un même système les propriétés-réelles des êtres et les propriétés mystérieuses des nombres."[37]

This closing chapter of *Les Origines de l'Alchimie* is less a tightly reasoned exposition than a series of reflections on the state of chemistry during the eighties and its possible implications for a modern quest for the Philosopher's Stone. The reader notes that Berthelot has changed somewhat since his debate with Wurtz in 1877. He has apparently become more conciliatory, for now he writes: "les corps simples sont caractérisés chacun par un nombre fondamental, que l'on appelle son *équivalent* ou son *poids atomique*."[38] From denial of the atom, he has moved to suspension of judgment, entertaining almost indulgently various possibilities. There is indeed in his comments something like the elusive quality that his friend Renan displayed in dealing with religion.

The concept of families of elements codified in what is called the Periodic Table of Mendeléeff suggests to Berthelot some analogies with the isomers and polymers he had discovered in organic chemistry. Nickel and cobalt, for example, with almost the same atomic weight, might be compared to isomers.[39] Such analogies might imply the possibility of transmuting elements. But these analogies break down if, following William Prout, one tries to argue from them that elements are all multiples of one fundamental unit: hydrogen. For many atomic weights end in fractions and cannot be thus reduced.[40] The discovery of isotopes a few decades later would have been a revelation to Berthelot. Yet from the standpoint of his time, he was not far wrong in questioning the possibility of trans-

mutation of the elements. This would be possible only when a totally new departure, which he naturally could not well conceive, was made along lines different from chemical synthesis. Nevertheless, we cannot affirm that he would have been completely at sea in this new world. One of his objections to the atom involved the notion that this particle was indestructible, as understood by the atomists, and that nothing could happen inside it. "Les forces physiques, aussi bien que les forces chimiques, ne sauraient faire éprouver à cet atome que des mouvements d'ensemble, sans possibilité de vibrations internes. . . . Il en résulte encore qu'il ne peut y avoir dans l'intérieur d'un atome individuel aucune réserve d'énergie immanente. Telles sont les conséquences rigoureuses de la théorie atomique."[41] Thus it was the atom of Democritus and Dalton that he rejected, and not necessarily some more dynamic concept. In other passages, he comes even closer to modern views, as in the following: "Dans la philosophie scientifique de nos jours, la permanence apparente de la matière tend à être remplacée par la permanence de la masse et de l'énergie." He is not impressed by the concept of the ether, then recently bruited about. It is like the mercury of the alchemical philosophers, a symbol and a fiction. "Déjà l'atome des chimistes, l'éther des physiciens semblent disparaître à leur tour, par suite des conceptions nouvelles qui tentent de tout expliquer par les seuls phénomènes du mouvement."[42]

If ever men succeed in transmuting elements, he writes, the discovery will lead to new laws, and our present theories will probably appear as chimerical to these men as the theories of the alchemists appear to us.[43] Such a pronouncement, coming at the end of *Les Origines de l'Alchimie*, may sound like foresight, but it expresses even more clearly Berthelot's skepticism about hypotheses in general. His friend Renan might have said with Berthelot: "La plupart des hommes ne supportent pas de demeurer dans le doute et l'ignorance: ils ont besoin de se forger des croyances, des systèmes absolus, en science comme en morale."[44] A mischievous critic might mention here Berthelot's own "Principle of Maximum Work." For the inclination toward dogmatism is not the sole explanation of why men hold fast to theories. There is also self-pride.

Berthelot and Renan. No study of Berthelot's role during his time can dispense with an account of his life-long friendship with Renan. What brought them together late in 1845 was their common enthusiasm for science and their belief that it would light the way for the future of mankind. Renan tried without success to interest

Berthelot in his own field of philology. The Hebrew Bible Berthelot acquired was to remain unopened.[45] Renan's sister Henriette and Berthelot, said Renan, were virtually the only people he confided in during that period. It is interesting to learn that Renan had misgivings about his young friend's experiments with explosives. On one occasion, the experimenter sustained a grave injury to his eye. Renan might well have feared that Berthelot's future was a doubtful one. In December 1848, Renan wrote: "Après s'être blessé plusieurs fois, et malgré mes supplications (car je connaissais sa maladresse), il s'obstina à continuer."[46] By dint of practice, Berthelot's dexterity must later have vastly improved.

Their friendship was somewhat unusual. Renan once commented on how the *solitaires* of Port Royal could spend their lives together and address each other as Monsieur to the day of their death. Such, in a way, were Renan and Berthelot. No doubt this was truer of Renan's feelings than of his friend's. The fact that Renan was four years older probably helped to establish the formality in their relationship. We have reason to think that the younger man was put off by Renan's reserve. On Renan's side, these remarks from the *Souvenirs d'enfance et de jeunesse* are significant: "Dans la suite de la vie, une telle liaison a pu par moments cesser de nous être nécessaire. Elle reprend toute sa vivacité chaque fois que la figure de ce monde, qui change sans cesse, amène quelque tournant nouveau sur lequel nous avons à nous interroger."[47] Renan had none of that feeling expressed by Montaigne to explain his friendship with Etienne de la Boétie: "Parce c'était lui; parce que c'était moy."

Contemporaries frequently saw Renan and Berthelot together at gatherings like the dinners at the Restaurant Magny and the Brébant, as well as elsewhere. One aspect of their relationship was noted by Marie-Louise Pailleron. Her mother told her that Renan was the dominant member of the duet: "Lorsqu'Ernest Renan discutait avec Berthelot, dont le caractère nerveux était si différent de celui de son interlocuteur, Renan lui imposait doucement sa loi; ma mère disait: 'Il le faisait taire.' "[48] Taine's comparison of the two shows how impressions may vary. It is Renan whom Taine finds *nerveux*. "Renan est bien différent de Berthelot qui se tient tranquille comme un bœuf patient de labour, mâchonnant son idée, appuyant dessus. C'est l'inspiration en contraste avec la méditation. . . . L'un fermente lentement, obscurément, l'autre fait explosion." There is a third term in the comparison: Taine himself—first implicitly as when he writes: "Aucun d'eux ne va en avant méthodiquement, passant du connu à l'inconnu." Then explicitly: he describes Renan as "flottant

. . . un sceptique qui, à l'endroit où son scepticisme fait un trou, le bouche avec son mysticisme. Berthelot a ri et m'a appelé homme à casier, à étiquettes, quand j'ai dit à Renan que c'était là sa définition. Des trois je suis le plus positiviste, le moins mystique." This encounter took place in the early sixties, when Renan was bringing out his *Vie de Jésus*. According to Taine, both he and Berthelot charged Renan with replacing a legend with a romance and spoiling the solid parts with a mixture of hypotheses, thus making his book vulnerable to attacks from the clerical camp. But Renan turned a deaf ear to this criticism, saying that the others were not artists, and that a merely positive and factual treatise would not make Jesus come alive.[49]

Once considered very important, Berthelot's influence on Renan has in our day come to be regarded as almost negligible. Some of Renan's adversaries blamed Berthelot for anything they did not like in his friend. Thus we find the atheist Jules Soury telling Maurice Barrès: "Renan, il était perverti par Berthelot qui sait Béranger par cœur." The political reactionary Soury must have had in mind the political liberal rather than the free-thinker. Abbé Deschamps, who claimed to know Renan, asserted that Berthelot was responsible for Renan's apostasy.[50] A reaction to such glib assumptions was in order. Berthelot's role has been virtually reduced to that of a fellow traveler who provided Renan with scientific information which he could readily have obtained elsewhere. Berthelot served at most as a counterpoise to balance Renan's tendency to concentrate entirely on philology.[51]

An examination of Renan's *Cahiers de jeunesse* of 1846 makes Berthelot's role in this regard seem less crucial than had been once imagined. The *Cahiers* are disappointing if one seeks there a clear echo of the young men's conversations. There is one pertinent entry, related to Renan's later remark that Berthelot had shown him how physics is prior to chemistry. Renan wrote in 1846: "Quel esprit, par exemple, peut être complet sans l'étude de la physique? Peut-on sans cela avoir une idée complète des *lois* de la nature?"[52] But in the section written before they ever met, we see how Renan's mind teemed with speculations on science, nourished by Laplace and Humboldt, as well as by his teachers at school. His meditations led him straight from Leibniz's monads to the atoms of physics. Laplace's nebular hypothesis inspired him as, almost simultaneously, it was inspiring Poe, in his cosmological notions.[53] The *Cahiers* reveal that Renan professed independent if wayward ideas in Berthelot's own domain, for example: "Ma théorie de la polarisa-

tion des forces de la monade explique merveilleusement l'affinité chimique: il est facilement explicable que des monades polarisées suivant une figure analogue s'attachent." He makes other incursions into Berthelot's field: "Il y a 60 corps simples, disent les chimistes, cela est bon relativement. . . . Je jurerais qu'il n'y a qu'*un* corps simple."[54] We recall that Berthelot's crotchet was to disbelieve in the atom. Renan not only believes in it; he swears by Prout's hypothesis, it would seem! At any rate, it is evident that Renan did not come entirely unprepared to those eagerly pursued conversations.

Yet can we lightly dismiss Renan's repeated declarations of their mutual indebtedness? No doubt these statements are so tenuous in content as to discourage any attempt to define it with any precision. An example is Renan's tribute in *Souvenirs d'enfance et de jeunesse*:

> Notre amitié consista en ce que nous apprenions mutuellement, en une sorte de commune fermentation. . . . Ce que nous avions vu à deux nous paraissait certain. Quand nous entrâmes en rapports, il me restait un attachement tendre pour le christianisme: Berthelot tenait aussi de son père un reste de croyances chrétiennes. Quelques mois suffirent pour reléguer ces vestiges de foi dans la partie de nos âmes consacrée aux souvenirs . . . La claire vue scientifique d'un univers où n'agit d'une façon appréciable aucune volonté libre supérieure à l'homme devint, depuis les premiers mois de 1846, l'ancre inébranlable sur laquelle nous n'avons jamais chassé.[55]

The passage is a fabric of allusion, in the style which Renan cultivated, to the delight, the despair, or the distaste of his various readers, in so much of his writing. Obviously, neither had retained a great deal of religious faith for the other to undermine. On the other hand, we have all experienced in our youth the seminal effect of conversations with "kindred spirits," without being able to measure exactly the results of such communion.

Quite as tantalizing is Renan's dedication to Berthelot of his *Dialogues et Fragments philosophiques*: "Plus d'une fois, en retrouvant dans ces pages certaines idées dont nous avons mille fois causé ensemble, je me suis demandé si elles étaient de vous ou de moi, tant nos pensées se sont depuis trente ans entrelacées. . . ." It would be, he says, like trying to divide the limbs of a child between father and mother. He carries the image even further: "Tantôt l'embryon de l'idée est de vous et le développement m'appartient; tantôt le germe est venu de moi, et c'est vous qui l'avez fécondé." But he does not identify these brain-children, except to say: "Tout ce que j'ai pu dire de bon sur l'ensemble de l'univers, je veux qu'on le regarde

comme vous appartenant. D'un autre côté, je réclame une part dans la formation de votre esprit philosophique."[56] In order to understand what Renan meant, the best approach is by way of the essays they addressed to each other in 1863.

Renan started the exchange with his "Letter to Marcellin Berthelot on the Natural and the Historical Sciences." Making use of a scale somewhat different from Comte's hierarchy of the sciences, Renan projects the perspective of history back through the ages, from man's prehistory through the "geological, planetary, and solar periods" to a "molecular period" when chemistry started, and farther still to an "atomic period," the reign of pure mechanics, when the universe began.[57] Then, turning his sights toward the future, he envisions the supreme end and goal of the world with the universal triumph of Mind, when God will be complete.[58] It is the same vision later developed in his *Dialogues.* Comparing this essay with Berthelot's reply, it will surprise no one that Renan is a bolder and more adventurous thinker than his friend. Berthelot's title is significant as it stresses a distinction not too clearly made by Renan: "La Science idéale et la science positive." The science of the ideal must be based on positive sciences, but it will lack the certainty of the latter and will therefore vary according to the individual differences between thinkers. Berthelot's own philosophy of the ideal, while resembling Renan's, is less original.[59] The two letters are not so much a genuine exchange of views in which one tries to influence the other, as a device for setting forth virtually the same basic philosophy with differing emphases. Addressed to the general public of the *Revue des Deux-Mondes,* they complement each other, one stressing the historical view, the other expounding the method which science must follow.

The role which Berthelot came to play as a spokesman for free thought has led many to forget the idealistic character of his philosophy. Parts of this essay are reminiscent of Victor Cousin's trinity of the Good, the True and the Beautiful.[60] The idealist Edme Caro found it possible to welcome Berthelot as a possible ally against the positivists and the materialists. The distinction between "positive" and "ideal science" left the road open, Caro felt, for what he called metaphysics and by which he meant idealism.[61] Berthelot certainly did not intend to take this road. What he meant by "ideal" was not the eternal order of Platonic ideas, but the expanding sphere of human hopes and aspirations whose center must always remain scientific fact established by experiment and observation. The ideal for Berthelot was not, like Plato's, "truer than phenomena." This

substance of things hoped for, evidence of things not seen, could only be founded on positive science, which excludes the supernatural. Man's need for the ideal is itself a fact based on observation, not on *a priori* reasoning. This is a truth of human experience, like the sense of good and evil, and like the belief in free will that no reasoning can shake.[62] Pascal's reasons of the heart? No, it is Kant's practical reason which Berthelot invokes. In fact, Berthelot is, as he will remain, a rather faithful disciple of Kant. In this he differs somewhat from Renan, whose wider knowledge of philosophy includes Fichte and Hegel as well.

Renan uses natural science as a springboard for launching into vast cosmological speculations. Berthelot insists on the humbler example of the burning torch, from which a series of Whys leads to the molecular theory of heat, each successive step being based on observation and experiment.[63] A mild note of disagreement with Renan is discernible toward the end: "Vous avez exposé votre manière de comprendre le système général des choses. . . . Peut-être aussi composerai-je un jour mon *De natura rerum*, qui, malgré notre accord sur la méthode, différera sans doute à quelques égards du vôtre."[64] Berthelot, for his part, never did compose his *De natura rerum*.

Renan mentions his debt to Berthelot for some of the scientific foundation of his cosmology. He taught him, for one thing, that all energy comes from the sun.[65] This is of course a commonplace. Another point is more interesting. A concept he owes to Berthelot provides a basis for Renan's speculative cosmogony:

> C'est vous qui me le fîtes remarquer un jour: la physique mécanique est encore antérieure à la chimie, au moins d'une façon virtuelle. Par elle, nous sommes transportés dans un monde composé d'atomes purs, ou, pour mieux dire, de forces dénuées de toute qualité chimique. La mécanique seule régnait en cet état primitif où tout n'avait qu'un visage, où nulle individualité distincte n'existait. Y eut-il un âge du monde où la matière exista ainsi sans qualité intrinsèque, sans autre détermination que la quantité de sa masse? Certes il ne faut pas l'affirmer. Je ne puis cependant m'empêcher de concevoir la gravitation comme quelque chose d'antérieur aux réactions chimiques.[66]

The priority given to physics over chemistry suggests Comte's ladder of the sciences, but the notion really goes beyond Comte. Indeed, we might say, it takes us into those remote regions of heady speculation where Edgar Allan Poe had ventured in his *Eureka*. Wiser than Poe, Renan recognized the tenuousness of these ideas, and knew also that just beyond them there hovered the antinomies of

Immanuel Kant, shutting off any progress in that direction. The coincidence with Poe's *Eureka* is accented by the fact that Renan had already in 1846 entertained similar notions. The friendship between Renan and Berthelot had hardly begun at that time. So it is perhaps too much to say, in the words of one of Renan's biographers, that Berthelot opened to his friend's gaze "the magnificent certitudes of physical and natural science."[67] In this instance, instead of "certitudes," one might of course prefer one of the other titles of his *Dialogues*—"probabilités," or even "rêves."

Edmond de Goncourt claimed that he had heard all the challenging ideas of the *Dialogues* from the lips of Berthelot: "C'est long et oiseux, les *Dialogues* de Renan. . . . Et d'autant plus que toutes les hypothèses qui ont le chapeau sur l'oreille ne sont pas du philosophe, mais sont des éructations de Berthelot après le champagne de Magny."[68] Possibly Goncourt had heard Berthelot relaying at dinner thoughts which had originally come up in conversations between the chemist and Renan. But certainly most of the striking speculations in the *Dialogues* bear the unmistakable signature of the "philosopher" and not that of the chemist. The concept of the cosmos gradually evolving toward consciousness, of God *in fieri* and not *in esse*, of a universe that through the extension of reason will ultimately become one divine unity, impelled by a sort of *élan vital* or *spirituel*—all this clearly belongs to Renan.[69]

For Berthelot, metaphysics was virtually a closed book. It was for Renan a book of mostly blank pages, but sometimes he would open it and discover a few leaves still faintly marked with the letter of his lost faith and also tinted with its spirit. It was a sort of illuminated manuscript, almost completely faded, in which he would occasionally inscribe a new word, if not restore an old hue. On the occasion of the *Dialogues*, he warned against identifying his speakers with any real persons.[70] A point like the following might suggest Renan had been talking to Berthelot: "L'atome de carbone qui forme la poussière de la voie lactée est identique à celui qui alimente nos fourneaux. . . ."[71] Even if we take a phrase like "L'ensemble de l'univers" which in his dedication Renan linked with Berthelot, and compare the various occurrences of the expression in the *Dialogues*, we find nothing tangible to support Goncourt's allegation.[72] This coincidence, like the titles of the dialogues, "Certitudes" and "Probabilités," which echo key phrases of Berthelot's essay of 1863, may be considered a token of their common interests, little more.[73]

That Renan continued to share some of Berthelot's interests is

seen in the *Drames philosophiques*, which follow the *Dialogues*. The reader thinks of Berthelot upon reading Lionardo's speech in *Caliban*: ". . . il n'y a de sérieux que la science; seule elle ne passe jamais de mode; car la science répond à une réalité: savoir, c'est pouvoir. Prospéro, qui aspire à posséder les forces de la nature, est le plus grand de nous."[74] This conception is carried out in the sequel *L'Eau de Jouvence*, in which Prospéro has become a chemist. An idea common to Berthelot and Renan is stated by Prospéro: "C'est la science qui fait le progrès social, et non le progrès qui fait la science."[75] It is reported that Renan had asked Berthelot for information on the process of distillation while he was writing the play.[76] But there are no technical details given, nor, of course, should we expect any. An amusing note is struck when Prospéro reveals his invention and an onlooker exclaims: "L'imprudent! il montre son procédé à tous, sans avoir pris de brevet d'invention."[77] It is just what Renan might have heard certain people say about Berthelot. As for what the invention is, we may dismiss it here in a few words. Prospéro's elixir does not really restore youth, nor confer immortality.[78] Each finds in it only what his own soul contains. And it acts differently on each. For Prospéro, whose course is run, it provides euthanasia.[79] Obviously neither the figure of Prospéro nor the contradictory symbolism of the *eau de jouvence* has anything to do with Berthelot. Renan's ideas are his own, just as they are in the later *Examen de conscience philosophique*.[80] Unlike Renan, Berthelot was never a devotee of thought for thought's sake.

In our discussion of the two men, their political ideas have, for the sake of clarity, been left aside. In order now to compare their political attitudes, we must go back again to the beginning of their friendship. Renan's *L'Avenir de la science* reflects the liberal hopes harbored by both young men about 1848. There is relatively little about the natural and physical sciences in the book. Renan explains this fact as due to his lack of competence in the area.[81] Had Berthelot had any direct part in writing it, it would surely have had more. Thus his share in the production could not have been great, especially in view of the difference in their ages. He was twenty-one, Renan was twenty-five. On the other hand, one might say that in 1890, when Renan finally published it, it was Berthelot, and not its author, who continued its spirit of liberal idealism and faith in progress. When Léon Blum reviewed Berthelot's *Science et Libre Pensée* in 1905, he found it touching that Berthelot's last book and Renan's first should be so much alike.[82]

The young Parisian scientist's heritage differed from the *breton*

background of Renan. Berthelot's father was the first republican Renan had ever seen.[83] Momentarily, Renan's sympathies were carried away by the liberal current. Disappointed by the turn of events in 1848, Renan resigned himself to the new order. Berthelot, for his part, joined his friend J.-J. Clamageran in demonstrating against the *coup d'état* of 1851.[84] Renan was to recall in 1876: "Après avoir amené le fatal écroulement de février, ceux qui nous devaient une libre patrie préparaient malgré nous la funeste solution de décembre. Puis quand nous fûmes résignés à suivre la France dans la voie où elle s'était engagée, tout croula de nouveau."[85] This telescoping of the years between 1851 and 1870 suggests that they put aside their political interests to throw themselves completely into their own work. But Renan did consider running for deputy when his course at the Collège de France was banned.[86] And Berthelot maintained close contacts with the liberal and republican opponents of the Empire, the Hérolds, the Clamagerans, and Emile Ollivier. He was disappointed by Ollivier's *volte-face*.[87] We might mention that Renan and Berthelot married during this period, both choosing their wives from Protestant families.

When France met disaster in the war with Prussia, the reactions of the two laid bare the gulf between their political philosophies. Not too hopefully, Berthelot lends his hand to the Republic. Renan, however, in *Réforme intellectuelle et morale*, advocates a monarchy. They express their patriotism in different ways. Listening to the dinner conversations through the ears of Edmond de Goncourt, one might well believe that Berthelot was the more patriotic, Renan the more defeatist, of the two. Goncourt reported that Renan had called the Germans a superior race and was apparently willing to live under Prussian domination. Henriette Psichari has denied Goncourt's allegations concerning her forbear.[88] As for Berthelot, on the other hand, there is no doubt about his indictment of the French military leadership for failing to use the explosives he was working on, and for their inability to plan a campaign like the Prussians.[89] We should add that during the Commune, when he heard that Berthelot was considering a post in England, Renan admonished him that they who had been nourished by France had no right to desert her now.[90] After the defeat of the Commune, Paris elected Berthelot Senator, though he had not filed, as a reward for his services on the Comité Scientifique de Défense.

Berthelot was more optimistic about the prospects of the Third Republic than his friend. But when Alsace-Lorraine was ceded to the conqueror, he sank into despair: "Cet abandon sera le signe de

notre déchéance totale. Aveugle qui ne le voit pas!" Incidentally, his premonition, if not realized then, was to become true after the greater *débâcle* of 1940: "Nous allons avoir, je le crains, les pires des tyrans, les prétoriens vaincus par l'étranger."[91] But by October 1872 he had regained his confidence. He advises Renan against his sympathy for those "spectres césariens qui ont perdu la France." In 1873 he concludes that it is impossible for the Count of Chambord to mount the throne and set up a clerical régime.[92] And in 1875, the year of the Constitution, he foresees a liberal and anticlerical trend in politics.[93] In 1879, he expects a violent struggle between clericalism and the Republic, but in 1880 he anticipates a republican success. He does not restrain a sardonic feeling of triumph: "la lutte est entamée depuis trente-cinq ans et c'est une nouvelle phase où les rôles sont renversés, mais où la surprise des gens qui nous ont persécutés . . . et leur indignation factice ressemblent à celles du voleur surpris par le volé. . . ."[94] Renan, however, fears the worst reaction since the Sixteenth Century. Berthelot sees no great danger: "Je suis moins pessimiste que vous."[95] After 1881, Berthelot, *sénateur inamovible*, becomes more closely associated with affairs of state, while Renan continues to remain aloof. Like Renan, however, Berthelot feels doubtful about the wisdom of Gambetta, now Prime Minister after the republican electoral victory.[96] In a few years, Berthelot will be presiding over committees and even become a Minister in the Goblet cabinet.

Toward the end of the decade, with General Boulanger on his black horse looming on the near horizon, Renan and Berthelot share a feeling of alarm. Berthelot is disturbed by the labor problem and the continued economic depression, repeatedly voicing his disenchantment with politics. Renan urges him to persuade his friends to unite and make mutual concessions in order to ward off the threat to parliamentary government posed by the Boulangist movement. He calls it a "terrible danger": "Ce serait la plus horrible aventure qu'on aurait vue depuis des siècles."[97] With the waning of Boulangism, Berthelot feels a renewal of confidence: "Quant à présent, je suis plus que jamais dans les besognes actives. . . . Il faut bien tâcher d'améliorer les choses humaines. Je serai dupe jusqu'au bout de ce désir de progrès, que vous reléguez si sagement parmi les illusions."[98] Renan had perhaps some reason to think of progress as an illusion, as he contemplated the actions of the anarchists in 1892: "Pauvre bonhomme Démos, que de sottises encore on lui fera faire!"[99]

The last letters exchanged by the two friends are darkened,

however, not by external events, but by the growing troubles of old age. Both are determined to work until the last.[100] Berthelot will out-live Renan by fifteen years, continuing to take an active part in public life. This review of their correspondence shows that if the intellectual aristocrat held himself aloof, unlike his friend, from the problems of the Republic, he did not refuse it his sympathy and good wishes. Without Berthelot, is it not likely that Renan's attitude, instead of being one of benevolent reserve, would have been closer to the hostile detachment of Hippolyte Taine?

Berthelot in Politics. Berthelot has been called an "idealogue of the Third Republic."[101] His voice was often heard on official and ceremonial occasions, inaugurating statues or commemorating anniversaries. Taken together, the themes he sounded would make a fairly complete program for the Radical Party of the nineties: anticlericalism, laicization and promotion of education, patriotism but not chauvinism, freedom for Alsace-Lorraine to choose her destiny, but not through *revanche*, social solidarity but not socialism.[102] In all this, he was the not very sonorous echo of the interests and aspirations of a large part of the middle class. Although a Senator from 1871 on, a Senator-for-life from 1881, a chairman of Senate commissions, and twice a minister, he made little impact on political events. One reason was that he was less positive in practice than he was in precept. Around 1880 he was momentarily attracted by Protestantism, but its inability to free itself from 16th century dogma made him doubt the future of Christianity.[103] The temper of his anticlericalism is shown in a magazine article of 1882, honoring Prefect Ferdinand Hérold upon his death after a lifetime of republican activity. He praises his efforts to laicize civil life in his prefecture. The Church and the State were still closely interlaced. Berthelot compares their association with the symbiosis of fungus and alga in the lichen: not too happy an analogy since it could easily be turned against his argument. The task was to separate them, without offending the feelings of sincerely religious people. The separation must be progressive and not abrupt. The excesses of the anticlerical press reminded Berthelot of the earlier excesses of Catholics against their adversaries. True free-thinkers must be fairer than their antagonists.[104]

In 1886, he presided over the Commission on laicization of primary education, and in December of that year he assumed the responsibility of carrying out the program as Minister of Public Instruction. He promoted bills on primary and higher education.

This was the period of what has been termed the first anticlerical campaign of the Third Republic. Berthelot took a leading part, perhaps without fully realizing the complexity of a situation in which more politically astute colleagues used the laicization program to divert attention from the need for social and economic reform.[105]

The most curious episode of his ministry concerned the maintenance of the ban on the play based on Zola's *Germinal* which Goblet had imposed when he was Education Minister. Berthelot's position seems odd for an advocate of freedom of thought. His action was one cause of the disaffection of his one-time admirer Edmond de Goncourt. The latter acidly notes Berthelot's unfairness to literature after literature had helped him to rise in politics. He now calls Berthelot a great mind but a poor minister—"un ministre Gavroche." "C'est prodigieux comme le pouvoir et les honneurs abêtissent certains hommes."[106] Although Goncourt's motives for disparaging Berthelot were doubtless mixed, we are disposed to agree with him upon reading the extraordinary speech on censorship which the Minister delivered before the Chamber of Deputies. Somewhat apologetic about upholding censorship, and insisting on his admiration for Zola and his novel, he dwells on the dangers to public morality that would ensue if the theaters were allowed complete liberty. The law that provides for punishment of violators of decency is ineffectual, because by the time it is invoked the damage has already been done. But the question of public morality is less important than other possible effects. A song at a *café-concert* might cause a drop of one franc at the Bourse! Or it might provoke international repercussions. The most incredible part of the speech was still to come. Berthelot reaches back into Athenian history to produce the example of Aristophanes' *Clouds.* Aristophanes was the enemy of the scientific spirit as Socrates was its noblest exemplar. *The Clouds* called for putting Socrates to death, and this is just what happened. Such is the danger of complete freedom for the theater! Was Berthelot suffering from political astigmatism, or was he fearful of the socialistic import of *Germinal*? It is a strange spectacle: the defender of censorship invoking the martyrdom of Socrates. Berthelot seems comically afraid of being made fun of by some *chansonnier*: ". . . quand l'un de vous sera devenu un type populaire, quand il sera l'objet d'un refrain qu'on répétera partout, il aura beau poursuivre les auteurs devant les tribunaux, il n'en sera pas moins stigmatisé pour toute sa vie!"[107] And well he might have been!

Berthelot's incumbency as Minister ended with the fall of the Goblet cabinet. The President of the Chamber Floquet apparently tried to include Berthelot in a new combination, with Lockroy and General Boulanger, but the Opportunists thwarted this plan.[108] The move indicates that Berthelot was still considered *ministrable*. He presided over the Commission on military service in 1888 and 1889, urging exemption from all but one year of the three-year stint, not only for university students but also for key-workers in the shops and factories. He was concerned with promoting the economic as well as the cultural and military strength of the nation.[109]

When he next joined a cabinet, it was in November 1895 under Léon Bourgeois. His invitation came, it is reported, because President Félix Faure and his premier-designate were not able at the moment to get Hanotaux. With a naïveté we have already noted in Berthelot, he accepted the call saying that although he lacked diplomatic experience he did have relations with many foreign scientific societies.[110] During his scant five months at the Quai d'Orsay, he found himself involved in several important matters for which neither his contacts with foreign scientists nor his recent polemics with Brunetière on the "bankruptcy of science" had prepared him. The Turkish atrocities against the Armenians were in full swing. The French Ambassador to the Sublime Porte, Paul Cambon, complained in private letters of the lack of leadership from Paris at a time when France could have been playing a decisive role. He felt that France was but the tail to the Russian kite. "It's as if we had entrusted the Foreign Ministry to the Russian Ambassador to Paris."[111] It was under Berthelot, however, that a French fleet was sent to the Aegean to express disapproval of the massacres. At least that was how he described it. But the problems in the Levant, including the question of Crete, were then beyond solution.[112]

He had also inherited the Madagascar problem, and had to present the French Government's policy to the Chambers in November. An American historian, Frederick L. Schuman, was not too kind to him when he described Berthelot's declaration as "in all probability . . . the most chaotic jumble of legalistic inconsistencies ever read in the Palais Bourbon." Was Madagascar to be a protectorate, a French colony, or what? Professor Schuman continued: "Madagascar thus became an unparalleled juristic monstrosity—not so much because of a chemist's ignorance of the fundamental legal concepts which he handled so cavalierly, as by his desire to placate all shades of opinion in the Chamber by a purposely ambiguous statement of the situation."[113] Berthelot was evidently a willing

servant of French colonial policy, rather than an initiator. This was shown again in January when he signed the Siam Treaty with Lord Salisbury.[114] It was a more complicated problem in international dynamics that was to compel his resignation early in the spring, and just when he did try to initiate something.

His difficulties arose because he was not whole-heartedly in accord with other men in government on basic points of policy involving the Franco-Russian Entente and the relations with England. This policy was less his own than it was that of Faure and Bourgeois, and indeed that of Gaston Hanotaux who had preceded him and, after Bourgeois's momentary stay, who would soon follow him at the Quai d'Orsay. He was unable to impose his authority on the professional politicians and diplomats who superciliously called him "the old chemist" and who continued consulting with Hanotaux instead of him although Hanotaux had ostensibly gone back to private life. We may add that domestic issues complicated his position. The Radical cabinet was pushing for an income tax, and was having troubles with the Senate.[115]

The issue which led to Berthelot's departure was the British request for funds from the Egyptian Debt Commission to finance a nominally Egyptian reconquest of the Sudan. Motivating the British plan was an Italian defeat in Abyssinia. Germany, Italy and Austria supported England while Russia and France joined in opposition. These powers were the members of the Debt Commission. The British Prime Minister, Lord Salisbury, tried to conciliate France by offering not to go beyond Khartum and to leave when order was restored. Encouraged by the success of the Siam negotiations, Berthelot was receptive; but the rest of the Cabinet, intent on maintaining a common front with the Tsar, refused the British overtures. Nevertheless Berthelot authorized the French envoy in London to receive Lord Salisbury's letter. The Russian Embassy in Paris protested. At the same time French public opinion was excited against Kitchener's advance up to Dongola, downstream from Khartum. A note highly critical of British actions was given to the French press, March 17, allegedly emanating from Berthelot and the French Foreign Office. This violation of diplomatic procedure aroused British indignation. Berthelot tried to argue that the note was not official. But a diplomatic *faux-pas* had been committed and was charged to Berthelot. It seems, in fact, that the good faith of Berthelot was abused by Léon Bourgeois, and that not Berthelot but others in the government had released the note and left the onus on the old chemist. His position had become untenable, and

after the Debt Commission voted four to two to support the Anglo-Egyptian expedition, Berthelot reluctantly resigned on March 28.[116]

On the surface, everything seemed to demonstrate his ineptitude. But there was another factor. The conservative press had not forgotten the Berthelot Banquet. In a *Figaro* article, Zola differed with the paper's attacks on the Minister. Berthelot had done no worse than many a mediocrity in the office: he was pilloried because he was of the intellectual élite. He was mocked at even by colleagues: "Que diable allait-il faire dans cette galère?" The *Revue Bleue* hailed his disaster as a refutation of Renan's forecast that scientists would one day govern the world in accordance with the laws of reason: "Pour un seul savant que nous avons eu au Quai D'Orsay, il paraît que déjà le monde est sens dessus dessous."[117] For his part, the German Kaiser gleefully indorsed in the margin of his Paris envoy's dispatch the deduction that chemical experiments are less dangerous than political.[118] Berthelot did look a little like Professor Obnubile in Anatole France's *Ile des Pingouins*. The time for what Albert Thibaudet would call the "République des professeurs" had not yet arrived.

In defense of Berthelot, it has been argued that had his advice been followed, the grave incident of Fashoda would have been avoided.[119] But it seems more likely that nothing France could have done would have reconciled the British to a French presence on the upper Nile. For Berthelot personally, one regrets that he had not, before taking office, had some service as ambassador somewhere. With such experience in his background, he might have been more readily accepted by the diplomats, and perhaps evaded the trap he fell into with the anti-British note. What seems clear is that he was more sinned against than sinning. How could he make any knight's moves when he was being used as a pawn?

Despite this unhappy episode, and despite his advancing age, he maintained official connections with the Third Republic. In meetings celebrating Anglo-French reconciliation in 1903 and the arbitration under the Hague Convention of a dangerous Russo-British incident in 1904, he urged compulsory arbitration of disputes and the extension of international agreements to Scandinavia and the United States, with the ulterior aim of disarmament and the ideal goal of universal peace.[120] His death itself was an official event. Aristide Briand, as Minister of Public Instruction, pronounced his eulogy at the national ceremony of burial in the Panthéon, stressing his role as the exponent of science, freedom of thought and tolerance. That he had become a national institution is indicated by the

protest uttered in the Chamber of Deputies by the nationalist Maurice Barrès against burying Zola between Victor Hugo and Berthelot: "Berthelot que l'austérité de sa vie aussi bien que la grandeur de ses découvertes recommande à notre respect?"[121]

Berthelot as Ambassador for Science in partibus. During the last years of the Second Empire, Berthelot was often seen and heard at the famous *dîners chez Magny* for which Friedrich Nietzsche so envied the literary world of Paris. The first of Goncourt's references to him dates from 1864 when he noticed his presence in this select group. The conversation concerned Hugo, then in exile: " 'Hugo est plein de barbarismes,' s'écrie un monsieur, un nouveau venu, qui a l'air et la tenue d'un ouvrier intelligent, mêlé à du cabotin. C'est un M. Berthelot, un fort chimiste, un bon Dieu en chambre, à ce qu'on me dit, qui décompose et recompose les corps simples. Puis il proclame *Notre Dame de Paris* stupide."[122] This maiden speech was perhaps not too auspicious. As late as 1882, in the midst of Hugo's apotheosis by the Third Republic, he will still maintain a negative attitude. Goncourt notes: "Hugo a des idées sur tout, dit quelqu'un. . . . —Des idées non! Des images seulement, répond Berthelot."[123] The Goncourts were fascinated by the tidbits of scientific fact and fancy tossed about by Berthelot in conversation. Edmond de Goncourt wrote in 1878 that he had met only three original minds, one obscure, the others Gavarni and Berthelot. "Les Renan et les Flaubert etc., à côté de ces hommes, ce n'est que de la menue monnaie." Eventually, of course, Berthelot, too, would fall out of favor with Goncourt. As we have noted, Goncourt was alienated by Berthelot's continuing the ban on the stage presentation of *Germinal*. He now calls the chemist: "rebelle à tout sentiment littéraire, hostile à toute espèce d'art." He seems delighted when Berthelot has to relinquish the ministerial post, and seeing him at dinner seated near his successor Spuller, he ogles Berthelot to catch signs of his discomfiture.[124]

Berthelot had known many other writers of the Second Empire. We have mentioned his friendship with a leading figure from an earlier generation, Michelet. Sainte-Beuve saw him quite often, invited him to the famous "Dîner du Vendredi-saint" with the Prince Napoleon, but the scientist did not receive the invitation in time to get there. He supported Sainte-Beuve in his battle for freedom of the press. George Sand asked the critic to arrange an introduction to Berthelot, yet, when as the only woman ever to share the Magny dinner she saw him there, she was disappointed.

He found nothing to say to her. On those occasions, it seems that everybody shone except the "grand savant."[125]

One of the stars at Magny's was Gustave Flaubert, another friend of Berthelot. Late in 1872, Flaubert begged Dr. Cloquet to recommend Berthelot to the Academy of Science. Berthelot was chosen a few months afterwards. Flaubert later wrote to Maupassant expressing his indignation at Catulle Mendès's attack on Renan and Berthelot. He read with interest the letter-articles on science by Renan and Berthelot, especially the former.[126]

It was through his connection with Renan that Berthelot came to know Taine. We remember their interesting three-way conversation on skepticism and on Renan's *Vie de Jésus*. Taine's nephew André Chevrillon recalls a vacation visit in Savoy in the 1880's. The Renans brought the Berthelot family to Annecy. In Chevrillon's memoir, we catch glimpses of Berthelot discussing the *ether* with Taine, of his simple, austere demeanor, of his turning every vacation walk into a field trip, of Mme Berthelot's cameo-like beauty, and of the four Berthelot boys, André, Daniel, Philippe and René, so promising in their different ways. Yet the relations between Taine and Berthelot could not have been close. In 1897, some years after Taine's death, the *Revue Blanche* invited Berthelot to comment on Taine's work as a part of a poll on Taine's influence. Berthelot's response was certainly noncommittal: "Taine était de mes amis. C'est un homme qui a joué un rôle trop considérable pour que je puisse l'apprécier ainsi d'une façon impromptue. Je vous prie donc d'excuser mon silence qui ne signifie ni dédain, ni négligence."[127] From his answer, one might hazard the inference that he cared little to discuss a writer whose last work, the *Origines de la France contemporaine*, went counter to his own views on the *philosophes* and on the Revolution.

To return to the ban on *Germinal*, another writer who lacked sympathy, at the time, for Berthelot was Anatole France. It is true that he showed no more sympathy for Zola. When Zola protested against the continued censorship, A. France taunted both of them:

> Nous ne sommes pas libres, et M. Zola en meurt. Mânes de Caton, tressaillez! M. Zola meurt pour la liberté! Mourra-t-il du moins, avant d'avoir enfoncé le poignard vengeur dans le cœur du tyran Berthelot? . . . Je me contenterai de remarquer que M. Zola, réclamant la liberté à l'heure qu'il est, n'a certainement pas le sens du ridicule.[128]

If Zola had reason to nurse a grudge against Berthelot, he would later come to admire the scientist, as we shall see. It does not

appear, despite Perrin's suggestion,[129] that Berthelot's criticism of the French General Staff, recorded by Goncourt, had much to do with inspiring Zola's *La Débâcle.* It is for other reasons that Zola will honor Berthelot. The scientist will become for Zola the advocate of progress through science, and thus a leading exponent of the modern spirit.

Zola's former associate in the Soirées de Médan, Joris-Karl Huysmans, thought of Berthelot in quite a different way. He imagined him as lending support to alchemy! Durtal, the *alter ego* of Huysmans in *Là-Bas,* considers that modern science is merely re-discovering the lost lore of the past:

> Quelle singulière science! ruminait Durtal . . . malgré les railleries de ce temps qui, en fait de découvertes, n'exhume que des choses déjà perdues, la philosophie hermétique n'est pas absolument vaine. Sous le nom d'isométrie, [sic] le maître de la chimie contemporaine, Dumas, reconnaît les théories des alchimistes exactes et Berthelot déclare que "nul ne peut affirmer que la fabrication des corps réputés simples soit impossible à priori."[130]

His reference to *isomérie,* to which Dumas who had died in 1884 could not well object, does not say much for Huysmans's knowledge of chemistry, even when buttressed by the quotation from the end of *Les Origines de l'alchimie.* As for the purely literary works of other contemporaries, aside from Zola, Berthelot's influence is of little moment. Perhaps we should record that the "positivist poetess" Mme Ackermann had been a careful reader of his essay on ideal and positive science. One might have expected Flaubert's Bouvard and Pécuchet, in their omnivorous cramming in science, to have studied Berthelot, except for the fact that their chemical researches, around 1848, necessarily antedated his publications. Still, their fascinated yet reluctant discovery that the same elements are found in organic as in inorganic bodies, and their puzzlement over equivalents and the atomic theory do seem to reflect Berthelot's time. With all his realist's care for avoiding anachronisms, Flaubert, writing in 1879–1880, could not completely forget what had been in the air since the appearance of *Chimie organique fondée sur la synthèse.*[131]

The *fin-de-siècle* has often been described as a period of retreat for positivism. Many young writers voiced their disenchantment with science. Pierre Lasserre wrote in 1891: "le genre de foi scientifique dont M. Renan rédigeait . . . la confession glorieuse, touche à présent à son déclin." Others echoed the cry of Pascal: "Humiliez-

vous, raison impuissante!" A future great like André Gide has André Walter say: "La raison devient impuissante . . . qu'elle ne vient pas, fallacieuse, . . . lever ses arguments troubles." Eugène Bosdeveix goes farther: "Les législateurs regretteront amèrement d'avoir laissé tomber en désuétude l'antique coutume 'de serrer entre des ais le crâne des enfants nouveaux-nés.' " While condemning the evil of "intellectualism," "cet agent de mort psychique qui est spécial à notre époque," Henri Bérenger would not go as far as Bosdeveix: "Il ne faut pas abolir l'intelligence, car elle est encore un précieux résidu de la vie. . . . Mais qu'elle ne prétende pas nous obséder par ses magies!"[132] A kindred spirit, Teodor de Wyzewa, wrote in the foreword to his *Contes chrétiens*: "nous devons détruire l'Intelligence, cette soi-disante faculté de savoir et de penser: car toute science est vaine, toute pensée est vaine, et c'est d'elles que naît toute la souffrance qui est dans le monde."[133] The irreverent editor of *La Revue Blanche*, Lucien Muhlfeld, reviewing the books of Bérenger and Wyzewa, recalled Voltaire's jibe at Rousseau: "On n'a jamais employé tant d'esprit à vouloir nous rendre bêtes." But Muhlfeld could not apply this compliment to either, for there was not enough "esprit" there.[134]

Teodor de Wyzewa claimed Anatole France as his master in disenchantment, but the latter a bit cruelly disowned this "disciple."[135] France's essay entitled "Mysticisme et science" is a discussion of the intellectual "crisis" which can serve as a summary of the main points involved: "Le plus clair est que la confiance dans la science, que nous avions si forte, est plus qu'à demi perdue." The writer still held to his belief in science, but acknowledged: "Il faut bien reconnaître que les choses ne vont pas aussi vite que nous pensions et que l'affaire n'est pas aussi simple qu'elle nous paraissait." Anatole France adds further: "M. Ernest Renan, notre maître, qui plus que tout autre a cru, a espéré en la science, avoue lui-même, sans renier sa foi, qu'il y avait quelque illusion à penser qu'une société pût aujourd'hui se fonder tout entière sur le rationalisme et sur l'expérience." Turning to the young generation, Anatole France observed: "La jeunesse actuelle cherche autre chose." It finds science inadequate, amoral, inhuman, and destructive of free will. "La génération nouvelle fait ainsi le procès à la science et la déclare déchue du droit de gouverner l'humanité. Que veut-elle mettre à la place des connaissances positives?" Anatole France was not much impressed by the answers offered to the last question.[136]

Having just published *L'Avenir de la science*, Renan still lived when France wrote the essay on mysticism and science. But after

1893, Berthelot alone survived of the group that had included Renan and Taine, and thus he found himself one of the main targets of the opposition. Mention has already been made of the unfortunate first sentence from the preface of his *Origines de L'Alchimie*: "Le monde est aujourd'hui sans mystère." Some six years after publication, this quotation, torn from its context, began its curious course through the polemics of the decade, from Edouard Rod to Paul Desjardins to Abbé Klein and Brunetière. In *La Vie littéraire*, Anatole France says just about what Berthelot meant: "Comme l'a dit M. Berthelot, il n'y a pas de domaine interdit à la discussion."[137] But by almost everyone else, the dictum was misunderstood, and endlessly quoted and misquoted as proof of the sophomoric superficiality of this outstanding leader of scientific thought. Paris has long been known as a place where, as they say: "Le ridicule tue," and thus all the cohorts of reaction, the witty and the unwitty, tried mercilessly to carry out the execution. The spirit of the attacks is illustrated by Rod's description of the positivist generation:

> qui se fit de la science une idée fausse, presque absurde, et la compromit pour avoir drop tenté d'élargir son domaine; qui, enfin, a résumé ses aspirations limitées et ses aveugles certitudes dans cette phrase stupéfiante, échappée à l'un de ses représentants les plus autorisés: "Le monde est aujourd'hui sans mystères." [sic][138]

A student of semantics might find some interest in the history of the phrase, which years later even a devotee of science like Remy de Gourmont would remember as follows: "Il y a dix ans, et plus peut-être, je lus cette phrase de M. Berthelot: 'La nature n'a plus de secrets pour nous.' Et j'avoue que, depuis dix ans, elle me hante. Je ne puis lire son nom sans que ce verset d'un monstrueux psaume ne me chante dans la tête."[139] *Habent sua fata . . .*

Directly countering the smug scientism ascribed to Berthelot was another phrase of wide circulation: "the bankruptcy of science." It occurs in many writings after 1883 when Paul Bourget introduced it in a dialogue on "Science and Poetry": "On n'ignore pas que la Science recèle un fond incurable de pessimisme et qu'une banqueroute est le dernier mot de cet immense espoir de notre génération—banqueroute dès aujourd'hui certaine pour ceux qui ont mesuré l'abîme de cette formule: l'Inconnaissable."[140] Herbert Spencer's Unknowable was reenforced by Pasteur's l'Infini, the theme of the discourse of Littré's successor in the French Academy. No doubt the resounding bank failures of this very time added to the resonance of the phrase, if they were not its inspiration. The crash of

the Union Générale occurred the year before Bourget's dialogue appeared. The economic depression which followed could not but accentuate a mood of pessimism, which, we recall, affected Berthelot himself. In the words of S. B. Clough: "This was the beginning of a long period of economic calm. Until 1893 business was to wallow in a slough of despondency." According to another economic historian, Henri Sée, recovery did not come until 1896.[141] The intellectual "crisis" cannot be understood apart from this background, yet, strangely enough, few of the students of the "idealist reaction" seem to have paid any attention to it. The coincidence of dates alone is striking enough, although it does not signify any mechanical connection, nor does economic determinism supply more than one factor in a complex problem. In any event, the word "bankruptcy" had become part of the vocabulary of general ideas. Years before applying it to science, Brunetière applied it to Zola's literary school, seeing in *La Terre* and in the *Manifeste des Cinq* of some self-styled former disciples of Zola the signs of "La Banqueroute du Naturalisme" (1887).[142]

Zola himself, in his novel *L'Œuvre*, written in 1885–1886, had one of his characters deplore the "faillite du siècle," but with a different slant: "Comment! on ne marche pas plus vite? La science ne nous a pas encore donné, en cent ans, la certitude absolue, le bonheur parfait? . . . C'est une faillite du siècle, le pessimisme tord les entrailles, le mysticisme embaume les cervelles. . . ."[143] In *Le Docteur Pascal* (1893), Zola vigorously combatted the notion that there could be a "bankruptcy of science." Dr. Pascal admonishes Clotilde against thinking of science as of some new apocalypse. In her religious crisis, Clotilde demands: "Toute la connaissance et tout le bonheur en un jour! . . . La science nous les a promis, et, si elle ne nous les donne pas, elle fait faillite." Dr. Pascal protests that she expects too much, that science has not promised happiness. Clotilde interrupts him: ". . . . Ouvre donc tes livres, là-haut . . . . ils en débordent, de promesses. A les lire, il semble qu'on marche à la conquête de la terre et du ciel. . . . Nous ne pouvons plus attendre. Puisque la science, trop lente, fait faillite, nous préférons nous rejeter en arrière, oui! dans les croyances d'autrefois, qui pendant des siècles, ont suffi au bonheur du monde." Dr. Pascal cries out in reproval: "Ah! c'est bien cela, nous en sommes bien à ce tournant de la fin du siècle, dans la fatigue. . . . Oui, c'est le retour offensif du mystère, c'est la réaction à cent ans d'enquête expérimentale. . . . Mais. . . . la marche en avant continuera." Later, having accepted Dr. Pascal's credo of the "progress of reason through science," this

crisis will be for Clotilde only a memory.[144] The whole exchange is of course anachronistic, for in the chronology of the novel the date is around 1872. And the dialogue is not convincing as an expression of human feeling. But it is significant as a statement of the opposing points of view. Zola had placed himself on record before the controversy came to a head.

A writer for *Le Temps* reported that "la faillite de la science" was a catchword in the mystic *cénacles* of the Latin Quarter.[145] It was Brunetière, however, who can be credited with effectively launching the phrase as a battle-slogan in the January first number of the *Revue des Deux-Mondes*.[146] This article was actually entitled "Après une Visite au Vatican" and some suspicious anticlericals including Georges Clemenceau immediately charged that it had been inspired by Pope Leo XIII.[147]

Brunetière had never been anticlerical, but he had been something of a positivist, a follower of Taine if not of Comte. He had even been influenced by Darwinism, borrowing the notion of evolution for some historical studies of French lyric poetry, pulpit oratory and drama. His mechanical attempt to apply natural selection to literary history was an example of scientism if there ever was one. Thus his vaguely scientific antecedents made his sympathetic report of his conversation with the Pontiff seem more spectacular, if not like the return of a prodigal son. It is true that he was gradually finding his way back to the Church. On the other hand, it appears that he did not give up his plan to publish further studies of the evolution of literary genres until April 1895 when he was parodied in a *revue* presented at the Centenary of the Ecole Normale Supérieure. The young Edouard Herriot gave a lampooning lecture on the occasion about a "novelist" in whom the critic recognized himself: "un romancier qui . . . après avoir cherché son inspiration dans les cénacles du positivisme, après s'être réclamé de la Science, cherche, en vain, d'ailleurs, à liquider les quelques actions qui lui en restaient sur le Marché et dans les couloirs du Vatican."[148] Obviously not everybody in the Latin Quarter belonged to the *cénacles* of mystics cited by the writer for *Le Temps*. A British journalist, Wickham Steed, who was then close to anticlerical French intellectuals like Charles Andler, Lucien Herr and Charles Seignobos, reported that Brunetière's "conversion was greeted with indignation by the Latin Quarter where the students prevented Brunetière from giving the lectures he was to deliver before an elegant audience in the Sorbonne."[149]

Defenders of Brunetière have correctly stated that he never pro-

claimed the *total* bankruptcy of science, but only some "faillites partielles." Moreover, it was only in the beginning of an article—actually it amounted to nearly one half—from which he went on to assert the legitimacy in their separate domains of science and religion, and to urge a sympathetic response to Leo XIII's overtures to the Republic.[150] Still, in forensic discussions it is not the qualifications that count, but rather the first impression and the general effect. And the general effect of the first part of his article was that of an anti-scientific manifesto. Referring to the changes since the 1860's in the "depths of contemporary thought," he asks: "Parlerons-nous à notre tour de la banqueroute de la science? Les savants s'indignent sur ce mot, et on en rit dans les laboratoires." Where or how has physics or chemistry failed? And suppose some rash person had made unjustified claims, how does that implicate science? "Ainsi raisonnent ceux qui ne veulent voir dans la 'banqueroute de la science' qu'une métaphore retentissante—et je ne puis dire qu'ils aient tout à fait tort. Mais ils n'ont pas non plus tout à fait raison." After this apparently conciliatory opening, he takes the offensive. He charges that exponents of science had indeed promised that social ills would be eliminated as, in Renan's phrase, mankind was organized along scientific lines. And yet misery has increased. Moreover, he goes on: "En fait, les sciences physiques ou naturelles nous avaient promis de supprimer 'le mystère.' " The allusion to Berthelot is obvious. Now science, contended Brunetière, not only had not explained the mystery of man's origin and destiny, but could never do so. Religion, on the other hand, does supply positive answers. In the terms of the metaphor, scientists had in fact failed to meet obligations they had presumptuously incurred. "La Science a perdu son prestige. . . ."[151]

Such attacks on the credit-standing of science provoked some serious replies as well as amused or indignant retorts. In *Le Figaro*, the playwright Alfred Capus made a humorous jab at a disciple of Brunetière whose electric light fails to work; "La science devient impuissante à éclairer les appartements. Quelle effroyable banqueroute!"[152] In his paper *La Justice*, Clemenceau declaimed that it is not science but religion that is bankrupt: "Voici qu'après les planètes, l'humanité, elle-même, échappe au pape et à son légat."[153] With a journalist's flair, Bernard Lazare organized a questionnaire in the republican *Echo de Paris*, soliciting replies from a number of scientists and scholars. Berthelot led off with a brief response, promising to return to the subject if interest continued. Other answers came from Théodule Ribot, Jules Soury, F. Pillon and V.

Brochard.[154] Charles Richet, editor of the *Revue scientifique*, offered a reasoned refutation of Brunetière, pointing out that scientists do not claim to answer the Why? of human destiny or the world, but only the How? of phenomena. Nevertheless many problems once thought insoluble have been and are being solved. The total of a thousand individual efforts by scientists applied to particular problems makes for civilization. Richet agrees with Brunetière that the Sermon on the Mount is of religious origin. But Richet felt that as Christianity developed, it left behind that lofty teaching. It is science that is bringing men back to the Sermon on the Mount. Science is on the march. Maybe religion will decide to march with it.[155] All these replies, and more, came in the one month of January.

Interest continued unabated, although Brunetière's defenders were a little slower in mobilizing than his opponents. The conservative politician Denys Cochin, who had once studied with Pasteur, gave his full indorsement to Brunetière, and even outdid him, deploring the indoctrination of students by positivists, the laicization of hospitals, the power of "secular prejudice." He affirmed his approval of science if only it stayed in its place, but the value of this concession was reduced by the argument he offered against Darwinism: He could detect no difference between the horses and camels pictured on Assyrian friezes and those of today![156] The Catholic philosopher Georges Fonsegrive, while agreeing that science had not failed in a *material* sense, asserted that its *moral* bankruptcy was complete and irreparable. Answering Berthelot's citation of religious crimes, he charged that the anarchist bombers and even downright criminals like Lebiez had come to act as they did because of their "liberation from all religious dogma."[157] From the other side, the Socialist Jean Jaurès warned in the Chamber of Deputies that there was a concerted effort to discredit public education at its very source, which was science itself. He did not confine himself to defending science: "On parle beaucoup depuis quelque temps de la banqueroute de la science et on nous adresse à un banquier qui, lui, ne fait jamais faillite, parce que ses traites, étant tirées sur l'invisible et l'invérifiable, ne sont jamais protestées."[158] It was Berthelot, however, who made the main rebuttal, in an article entitled "La Science et la Morale," published in the February issue of the *Revue de Paris*.

From the first page, Berthelot assumed a tone that was not calculated to conciliate the irascible Brunetière. He wrote: "Nous assistons en ce moment à un retour offensif du mysticisme contre la domination du monde qu'il a perdue, après l'avoir si longtemps

maintenue par le fer et le feu." Berthelot was confident that the attack would be turned back: "[la jeunesse] sait que la prétendue banqueroute de la science est une illusion de personnes étrangères à l'esprit scientifique." He felt obliged to explain his much-incriminated phrase about *mystery*: "Quelques observations d'abord au sujet d'une expression qui a donné lieu à de singuliers malentendus, le mot *mystère*. . . . Certes nous ne prétendons pas donner le dernier mot de l'univers."[159] Science does not claim to have penetrated the essence of things. Such promises are the intangible currency of theologians. Science does not close any horizon. And here he brings out his old distinction between positive and ideal science. Thirty years and more have passed without much change in his thinking. He uses almost the same words: "La science en effet se présente à nous sous un double point de vue: science positive qui est la base solide de toute application . . . et science idéale qui comprend nos espérances prochaines, nos imaginations, nos probabilités lointaines. Le lien commun entre les deux points de vue, c'est la méthode . . . observer d'abord les faits et provoquer le développement . . . par l'expérimentation."[160] The *science idéale* may, in its higher reaches, vary with the individual: "Chacun développera à son gré, suivant son inspiration individuelle suivant ses sentiments et ses facultés créatrices, les conséquences des imaginations et des symboles, à l'aide desquels il s'est figuré les faits et les lois. . . ." We are reminded of his skepticism regarding certain chemical theories. He continues in terms that echo his essay of 1863: "Chacun finit par édifier ainsi son système du monde; c'est un échafaudage appuyé à la base sur les faits, mais dont la solidité—je veux dire la certitude ou plutôt la probabilité—diminue à mesure qu'on monte plus haut." One cannot therefore reproach science for affirmations that it has not made, nor for hopes that it has not aroused.[161]

The last half of the article expounds the thesis suggested by the title. The basis of morality is in experience and knowledge, not in divine revelation. Man finds in his *conscience* the ideas of good and evil, of duty—the categorical imperative of Kant. The biological and related sciences reveal the natural source of morals in the social instincts. Berthelot's discussion is again reminiscent of his earlier essay. One difference is that he no longer uses the term God as synonym for the ideal as he had done, like Renan, in 1863. Another difference is that the ideal of the brotherhood of man, and the universal triumph of science assuring men the maximum of happiness and virtue, no longer seem to Berthelot as remote as they had seemed under the Second Empire.[162]

In a counter-rebuttal, Brunetière did not fail to seize on this latter example of Berthelot's over-optimism: ". . . le triomphe universel de la science arrivera à assurer aux hommes le maximum de bonheur et de moralité."—"Que reste-t-il après cela des prétendues 'réponses' où l'on m'a reproché d'avoir attribué à la science des ambitions qu'elle n'aurait jamais eues?"[163] Other comments on Berthelot's article were made by Sully Prudhomme who used the word "magistrales" in describing it, and by the modernist priest Marcel Hébert who thought Berthelot went to the opposite extreme from Brunetière. Berthelot should not have attributed to science alone the moral progress of mankind.[164]

Meanwhile preparations were going on for a massive demonstration of support for "science" in the form of a great banquet honoring Berthelot, regarded by both sides as the representative of his camp. The champion of the opposing forces beat the bell with an article in *Le Figaro* on April 4, the morning before the gathering. Brunetière blamed science for many things, such as the increase in war budgets, which might literally lead to bankruptcy for the nation. This was perhaps a legitimate debater's trick, considering that his opponent, a specialist on explosives, was also an ardent advocate of universal peace. But Brunetière also made aspersions against Berthelot's enjoyment of governmental and academic favors. At least Berthelot had not become bankrupt, in the service of science! Perhaps Brunetière was unaware that Berthelot had not taken out patents on inventions which might have made him as wealthy as Alfred Nobel. With heavy-handed irony, Brunetière declared he felt flattered by a banquet organized against himself. Not since King Louis-Philippe had any one individual received such a compliment.[165]

The banquet was held in a large hall near the eastern edge of Paris. It brought together close to eight hundred people, including forty Senators, seventy Deputies and many other dignitaries. Among the speakers and honored guests were Zola, the sculptor Rodin, Charles Richet, the biologist Edmond Perrier, the historian Aulard, the politicians Lockroy, Raymond Poincaré, Goblet, Henri Brisson. A previously published *comité d'honneur* listed Clemenceau, Doumer, Doumergue, Sully Prudhomme, Ary Renan, the scientists D'Arsonval and Camille Flammarion. The nominal sponsor was the Union de la Jeunesse républicaine. Clemenceau's hand in its preparation appears quite visible: his paper *La Justice* seems to have served as an organizing center for the arrangements. The significance of the meeting was expressed by *La Justice* in the words:

"honorer la science comme base de la politique républicaine." The invitations were inscribed: "Hommage à la science, source de l'affranchissement de la pensée."[166] This was the theme of several addresses, notably those of Berthelot and Zola. Both Zola's and Richet's talks were more aggressive than that of Berthelot. A representative of the Free Masons and a speaker for the official Positivist group added their messages. Brisson, *Président de la Chambre,* linked the occasion most obviously with politics: "Cette formule 'la banqueroute de la science' n'a pas été prononcé au hasard dans quelque controverse purement scientifique, philosophique ou religieuse; elle a été, avant tout, un mot d'ordre politique." The slogan was deliberately designed to "actuate clerical reaction." At the end he proposed a toast to Berthelot and also to "science, liberty and justice, and to the Republic—their epitome."[167] The meeting lasted so late into the night that almost everybody had to walk home for lack of trains or cabs. "Never," wrote *Le Temps,* "had the sleep of the Faubourg St.-Antoine been disturbed by echoes so philosophical."[168]

Berthelot's address was loudly applauded but it is hardly exciting reading today. In a less challenging style, it presents the same ideas set forth in his article "La Science et la morale." "La méthode scientifique est devenue la source principale, sinon unique, du progrès moral et matériel des sociétés d'à présent." He closed with a blandly rhetorical statement of his belief in inevitable progress through science: "Nous tendons vers le règne idéal de la fraternité et de la solidarité sociale, proclamées par la Révolution. Telles doivent être les conséquences de l'application de la science moderne à la morale et à la politique. En les poursuivant dans un esprit de modération, de tolérance, de justice et d'amour, leur évolution légitime amènera par degrés et sans violence une transformation complète des sociétés humaines."[169] While Berthelot was pronouncing these optimistic words of tolerance, justice and love, Alfred Dreyfus was on the way to Devil's Island. The degradation ceremony of Captain Dreyfus took place in January when Brunetière's article appeared. Apparently neither Berthelot nor his friends saw any connection of the remotest kind between the justice they spoke of and the fate of Dreyfus. That discovery still lay in the future.

The entire Parisian press gave its attention to the "Banquet of Saint-Mandé" called also the "Banquet Berthelot." The reactions form a spectrum extending from the royalist papers *Le Gaulois* and *Le Soleil,* which were most hostile, through the conservative *Journal des Débats,* which was quite unsympathetic, *Le Figaro* and *Le*

Temps, critical but fairly objective, to the favorable responses of the anticlerical *Le Constitutionnel*, *Le XIX^me^ Siècle*, Guyot's *Le Siècle*, *Le Petit Journal*, the Socialist *La Petite République*, the republican *Echo de Paris*, and naturally Clemenceau's *La Justice*.[170] Clemenceau himself had been ill and could not come, but he showed plenty of verve the next day in a letter-article addressed to Brunetière. He denied the banquet was aimed at Brunetière personally, but admitted in his characteristic spirited style:

> En affectant de vous étonner, monsieur l'Académicien, du bruit qu'a fait votre article dans le monde, vous me mettez dans le cas de vous dire que le sujet seul suffit très bien à expliquer tout cet émoi. Vous nous arrivez de Rome, et après avoir entretenu le Pape infaillible . . . vous proclamez emphatiquement que la science humaine, c'est-à-dire l'homme lui-même a fait banqueroute. Comment votre modestie pouvait-elle aller jusqu'à croire qu'une telle affirmation passerait inaperçue?

As a parting quip, he remarked: "Hier, j'étais sorti sans parapluie: une averse est venue. 'Encore une banqueroute de la science,' auriez-vous dit, en vous réfugiant sous une porte cochère. Moi, j'ai pris le tramway."[171]

Several dailies deplored the political character of the banquet. *Le Temps* disapproved "la prétention du radicalisme d'annexer la science à son programme électoral." Science should not be the subject of polemics. For this reason *Le Temps* had also regretted the assault by Brunetière.[172] *La Justice* retorted by defending the right, indeed the duty, of the scientist to play a political role.[173] Writing in *Le Figaro*, Jules Huret for his part observed that the speeches were characterized by "énormément trop de politique intolérante et surtout de franc-maçonnerie."[174] The *Journal des Débats* complained that science had been relegated to second place, after a certain philosophy, that of Homais.[175] *Le Journal des Débats* had printed one of the most complimentary reports on Brunetière's article, calling his conclusion "infiniment sage."[176] Edouard Hervé's paper *Le Soleil* affirmed the Free-Masonic character of the banquet, but expected little result from it.[177] Perhaps the most violent reaction came from the other royalist organ, Arthur Mayer's *Le Gaulois*, whose report bristled with charges of atheism, and hints of a plot by the Free Masons. Was not the Free Mason Dr. Blatin one of the speakers, and was not a brochure sold at the door bearing the imprimatur of the Grand Orient de France, a brochure consisting of Berthelot's article "La Science et la morale"?[178] In some of the

papers, reverberations continued for days or even weeks after the event.[179]

As an indication that the controversy did not pass unnoticed abroad, we may take the "Chroniques parisiennes" of the *Bibliothèque universelle et Revue Suisse.* Having traced the progress of the debate from the beginning, and complimented science for its modesty and discretion in disclaiming the pretention to omniscience, the chronicler came to write for the May issue a report full of recriminations against everyone participating in the banquet. The caption read: "Le banquet de Saint-Mandé. La science se laisse confisquer par les francs-mayons et les radicaux." It has been a bad month for science, he began. It would have been so easy for it to stay in its corner and avoid being compromised by bad company. The writer continued with mock sympathy:

> Mais cela ne faisait pas le compte des radicaux libres-penseurs, pour lesquels il n'y a pas de fête sans "manger du curé." Ils ont attiré cette pauvre naïve de science, représentée dans la circonstance par M. Berthelot, le grand chimiste, à un banquet où la société était très mêlée . . . et ce n'est pas leur faute s'ils ne l'ont pas étranglée séance tenante.
>
> Ce guet-apens (prévu du reste et annoncé) a eu lieu le jeudi 4 avril dans le Salon des familles, vaste restaurant d'un faubourg populaire. . . . L'impartialité m'oblige à constater que M. Berthelot a donné le mauvais exemple. C'est lui, le premier, qui s'est attaché dans son discours à établir un antagonisme irréductible entre la religion et la science.

Berthelot was not the most maltreated victim of the chronicler. The latter showed a cavalier regard for the facts in his report on Zola's speech: "M. Zola, toujours pratique, a engagé ses auditeurs à méditer sur les inconvénients commerciaux de la Foi." Without the Index, his book *Lourdes* would have sold more copies. "Donc la Foi est une mauvaise affaire. (J'arrange un peu, ou plutôt je traduis)"[180] writes the reporter, without blushing.

For a more philosophical judgment on the debate than the debaters could give, it is only right that we should consult the philosophers. Of these there were two, Darlu (the teacher of Proust) and Alfred Fouillée, who tried to arrive at a more thoughtful verdict. Actually, Darlu's article was written too early to deal with the later course of the controversy, but his commentary on Brunetière made some telling points. Science and religion are not basically in conflict perhaps, he wrote, but theological conceptions must take scientific conceptions into account. Meanwhile, if it is chimerical to expect from science nourishment for the soul, it is unwise and perhaps morally impermissible to avert one's eyes from scientific

truths because they seem painful to behold: "Il est possible que nous trouvions pénible la lutte de notre cœur et de notre raison: c'est la condition humaine. A ceux qui ne veulent que la paix, il est permis de se retirer dans les monastères; ils n'ont rien à nous apprendre."[181] Further, Darlu refuted the accusation so often made against the schools that they were indoctrinating students with scientism. He pointed out the influence in the Ecole Normale Supérieure and hence in the *lycées* of the philosophy of Lachelier and Renouvier. These men taught the limits and the relativity of science, the independence of ethics from science, in Kantian terms, the primacy of the practical reason. Thus, in a sense, the university system was working for the Church![182] Of course, this latter argument was not calculated to convince those, like Maurice Barrès and Fonsegrive, who did not care for Kant. Henri Bérenger was another who thought Kant's influence was deplorable. He called positivism "ce produit bâtard du kantisme et des méthodes scientifiques."[183]

Among many other books, the proponent of "idées-forces" Alfred Fouillée published a volume entitled *Le Mouvement idéaliste et la réaction contre la science positive.* If its title echoes Berthelot's "La Science idéale et la Science positive," the book itself deals with other questions besides those raised in the debate. Its introduction, however, is largely identical with an earlier essay devoted to Brunetière and Berthelot. The author, taking on the role of referee, rules that both are off-side: "Autant . . . il est légitime de ramener chaque savant sur son terrain propre, autant il est illégitime de rendre la Science (avec ou sans majuscule) responsable de ce qu'on a appelé les faux billets 'signés en son nom.' C'est l'ignorance non la science, qui a fait et fera toujours faillite." Brunetière sets science and religion too sharply apart, while totally ignoring philosophy which could fill the gap he leaves. But Berthelot makes a poor defense for science, and fails to show on what basis he would found his ethics. Evidently Berthelot's rather vague references to Kant's practical reason do not satisfy Fouillée. Hence what is missing in both contending parties is a philosophical point of view.[184] Only the objective and subjective sciences taken together and crowned with a philosophy of action can claim moral hegemony over mankind. There is a place left for religion since we must not draw the people away too fast from their mythological dreams.[185] We need not jump to skeptical or mystical conclusions because of the contemporary concern over the value of science. The reaction against science will have been useful if it serves to call forth a philosophy of action.[186] "Ne prépare-t-elle point une réconciliation de la science mieux

interprétée avec la morale mieux comprise, et n'est-ce pas par l'intermédiaire de la philosophie que cette réconciliation doit se produire?"[187] Though his own philosophical solution to the problem was not as widely accepted as that of Bergson, for example, Fouillée was more right than wrong in not expecting a strong mystical trend to develop at that time, contrary to the impatient predictions of so many writers in the first half of the decade, and all allowance made for the plays of Maeterlinck, for François de Curel's *La Nouvelle Idole* and Eugène Brieux's *L'Evasion*.[188]

Paul Bourget, who had originated the phrase "faillite de la science" back in 1883, would virtually disown it afterwards, in his comments on another herald of the reaction against science, the Vicomte de Vogüé. The latter, in his foreword to *Le Roman russe* (1886), had mockingly hailed *Bouvard et Pécuchet* with the words: "*Ecce homo*! Bouvard, voilà l'homme tel que l'ont fait le progrès, la Science, les immortels principes, sans une grâce supérieure qui le dirige; un idiot instruit qui tourne dans le monde des idées comme un écureuil dans une cage." Bourget remarks on this: "Soit, mais la Science n'en est pas moins la Science . . . Bouvard peut penser médiocre . . . il ne pense pas faux, s'il pense d'après la Science. Celle-ci n'a pas fait, elle ne peut pas faire faillite, tant que l'homme lui demande seulement ce qu'elle a promis: fixer les conditions suffisantes et nécessaires de certains phénomènes. . . . Elle n'épuise pas le Réel, et d'ailleurs elle n'en a jamais eu l'intention."[189] It is rather ironical that obituary remarks on positivism should sound after all so positivistic. Other writers who once pronounced against science were to perform, if not a complete *volte-face*, at least a ninety-degree turn. Pierre Lasserre and Henri Bérenger are two examples.[190]

A few months after the debate, Berthelot would, as we have already seen, discover how hard it can be to apply one's ideas in the international arena. "Chemical experiments were less dangerous than political." And Zola would continue work on his trilogy of the Three Cities. Literary historians, aside from René Ternois, have not accorded much importance to the science controversy in Zola's work. Some of Zola's notes, dating from 1895 and 1896, form a link between the debate and the last part of *Rome* as well as a good part of *Paris*. In the latter, the topic of the so-called bankruptcy comes up for discussion repeatedly by the author as well as by some of his characters. One of the notes, captioned "La Science et le Catholicisme," could apply to the trilogy as a whole: "Je reviens sur cette fameuse faillite de la Science. Est-ce que la science a jamais reculé? C'est le catholicisme qui a toujours reculé devat elle, et qui sera

forcé de reculer toujours."[191] The novel *Paris* is a repository of many of the arguments advanced from both sides in the debate.

Monsignor Martha is the suave and polished protagonist of the new religious spirit of Pope Leo XIII. In one of his sermons delivered before high Paris society, he outlines the main points of the program: "L'esprit nouveau, c'était le réveil de l'idéal, la protestation de l'âme contre le bas matérialisme . . . . c'était aussi la science acceptée mais remise à sa place, réconciliée avec la foi, du moment qu'elle ne prétendait pas empiéter sur le domaine sacré de celle-ci; et c'était encore la démocratie accueillie fraternellement. . . ."[192] A journalist refers jokingly to this "grand convertisseur." "Cela fait plaisir, par les temps nouveaux d'aujourd'hui lorsque la science a fait banqueroute et que, de tous côtés, dans les arts, dans les lettres, dans la société elle-même la religion refleurit en un délicieux mysticisme."[193] Pierre Fourment waxes sarcastic against the *normaliens* who out of snobbery scoff at science: "Après n'avoir juré que par Voltaire, les voici retournés au spiritualisme, au mysticisme, la dernière mode des salons." Pierre feels a pained contempt for their failure of nerve. But the student François denies that all the youth are like that: "La vraie jeunesse, elle est dans les Ecoles, dans les laboratoires, dans les bibliothèques. . . . Allez leur parler, à ceux-là, de la banqueroute de la science: ils hausseront les épaules. . . ."[194] Zola has obviously transferred into his novel the self-same phrases that had resounded during the height of the debate. There are even echoes of the celebrations by the Teodor de Wyzewas and the Henri Bérengers of the ineffable charms of ignorance. The effete scion of the Duvillards, Hyacinthe, confides: "la science, entre nous, quelle duperie, quel rétrécissement de l'horizon! Autant vaut-il rester le petit enfant dont les yeux s'ouvrent sur l'invisible. Il en sait davantage."[195] But there is another reason why the novel *Paris* is of particular interest for us.

Berthelot appears as a sort of *éminence grise* under the name of Bertheroy. Had Bourget written *Paris*, it might have been another *Le Disciple* with which to castigate Bertheroy as another Adrien Sixte. For there is a train of explosive powder running through the book, linking the three levels, of theory (Bertheroy), of technology (Guillaume Fourment), and of anarchist bombings (Salvat). But Bertheroy is not held responsible for what happens at the end of the chain. Zola makes him the honored apostle of a beneficent science. A science that is not only replacing religion, but will also prove more revolutionary than the panaceas of the socialists and

anarchists who talk, posture, and act (disastrously) in various chapters of the novel.[196]

In his mildly contemptuous detachment from politics, Bertheroy differs from Berthelot who had long been Senator and even twice been Minister by the time Zola wrote the book. To discuss Bertheroy's function in *Paris*, we must move the spotlight from the central figure of the disaffected priest Pierre Fourment who is Guillaume's younger brother. Pierre's charity activities bring him into contact with rich and poor, and thus he shuttles like Balzac's Rastignac between the world of luxury and the world of poverty. Bertheroy belongs to neither of these worlds. His entrance into the picture is fortuitous. An old family friend, he had known the father of Pierre and Guillaume, a chemist killed in a laboratory accident while experimenting with explosives. Now Bertheroy chances to visit Pierre's house just when Guillaume, wounded in Salvat's bombing of a wealthy baron's mansion, needs medical attention with no questions asked. Bertheroy dresses the wound, but refrains from trying to penetrate Guillaume's secret, although such reticence might conceivably render the venerable academician an accomplice after the fact of a fatal bombing. The wretched Salvat, jobless and desperate, had stolen from Guillaume's laboratory the explosive with which he has tried to wreak vengeance upon society. Guillaume had noticed Salvat's suspicious behavior and vainly sought to prevent the bombing, being himself wounded in the attempt. But he cannot reveal his part in the episode because the revelation would also bring out into the open the secret of the bomb's manufacture, an awesome invention he is not yet prepared to announce to the world. The device is indeed so destructive that Guillaume thinks of it as the ultimate weapon.

Salvat goes to the guillotine without breaking his silence on the source of the explosive. Guillaume had originally planned to give his invention to France so that his homeland could use it to establish universal peace. But losing his faith in his country's ability to use it justly, and thrown off balance by a disappointment in love, he conceives the insane scheme of blowing up the Sacré-Cœur and himself with it. Fortunately Pierre follows him into the crypt and dissuades him in the nick of time. The act was to be both a spectacular gesture of protest against the "priesthood" and a demonstration of the terrifying power of the bomb. He had arranged to have the formula mailed to the governments of the world so that its possession by all would serve as a deterrent against any future war. Thus universal peace would be guaranteed.[197] The anticipation of

some present-day thinking on "peace through mutual terror" would appear more striking if we did not know that generation after generation the invention of new weapons has been greeted by similar hopes. Did not Alfred Nobel himself make such predictions in the years just before Zola wrote the book?[198] The parallel with our own day is extended further when Guillaume decides, more sanely, to utilize his invention for the peaceful purpose of automotive power. All along, Bertheroy remains on the sidelines, hardly influencing the action at any point. He merely comments on the melodramatic events from a distance, scarcely doubting that the march of science will inevitably solve the painful human problems in which other characters of the novel are caught.[199]

A few traits detract from the complimentary portrait of Bertheroy. Zola may have preserved no grievance against Berthelot for maintaining the ban on the play based on *Germinal.* Yet certain passages on the venerable academician Bertheroy loaded with titles and honors might suggest that Zola had not completely forgotten. There is, for example, the attitude of Guillaume's son François presented as typical of the university science students:

> François qui gardait, devant l'illustre chimiste, la muette attitude d'un élève respectueux, finit par déclarer, au bout de quelques pas faits en silence:—Quel dommage qu'un homme d'une si large intelligence, affranchi de toutes les superstitions, résolu à toutes les vérités, ait consenti à se laisser classer, étiqueter, enfermer dans des titres et dans des Académies. Et combien nous l'aimerions davantage, s'il émargeait moins au budget et s'il avait les membres moins liés de grands cordons![200]

We recall that Zola's critic Brunetière had made similar references to Berthelot's enjoyment of financial favors from the government! If Zola were more known for irony than he is, we might suspect him of it in a conversation between Bertheroy and Guillaume which takes place later in the book:

> Bertheroy—A propos, ce Salvat, on l'exécute après-demain matin. J'ai un ami au Ministère de la Justice qui vient de me le dire.
> Guillaume—Ce sera un assassinat, cria-t-il avec véhémence. Bertheroy eut un petit geste de tolérance.—Que voulez-vous? il se défend quand on l'attaque . . . Et puis, vraiment, ces anarchistes sont trop bêtes, lorsqu'ils s'imaginent qu'ils vont modifier le monde, avec leurs pétards. Vous savez mon opinion, la science seule est révolutionnaire. . . .

That little gesture of tolerance looks odd in the circumstances, and does not enhance the stature of Bertheroy. Guillaume's reflections on the incident convey an impression of reproach:

> De nouveau, Guillaume voyait se dresser ce révolutionnaire singulier, certain qu'il travaillait, au fond de son laboratoire, à la ruine de la vieille et abominable société actuelle . . . mais trop désireux de son repos, trop dédaigneux des faits inutiles pour se mêler aux événements de la rue, préférant vivre tranquille, renté, récompensé, en paix avec le gouvernement, quel qu'il fût, tout en prévoyant et en préparant le formidable enfantement de demain.[201]

Berthelot, of course, had, only a few months before *Paris* was finished, been Foreign Minister, and, whatever Félix Faure thought of him, regarded himself as part of the Third Republic. Thus he cannot be identified in every respect with Bertheroy. On the other hand, the negative traits in the portrait of Bertheroy imply that Zola was not presenting him as his own spokesman. Zola did not think that pure science was enough to change the world, to his heart's desire.

The socialists and anarchists, however, did not make these distinctions, when they read Zola's novel. They took Bertheroy to be Zola's *porte-parole*, and identified him with Berthelot. The editor of *La Revue Socialiste*, Eugène Fournière, wrote: "J'ai seulement contesté la thèse fataliste de M. Berthelot, épousée par M. Zola, que la science-outil puisse transformer le monde en mieux sans le concours de l'homme-ouvrier." Jean Jaurès followed the same line: ". . . point malaisé de reconnaître dans ce personnage l'illustre Berthelot, qui, en même temps qu'il a réalisé tant de découvertes précises, ouvre devant l'humanité de si vastes horizons d'espérance. Mais où M. Zola se trompe, c'est lorsqu'il semble croire que la science toute seule sans une action humaine militante, révolutionnera l'ordre social. Oui . . . elle crée la possibilité de formes sociales nouvelles. Mais elle n'en crée que la possibilité." Léon Blum wrote in a similar vein; as did, in a more truculent style, the anarchist Jean Grave.[202] It was natural enough, from their point of view, to think of science in the restrictive sense. But we know that Berthelot gave to the word a much broader scope, embracing both positive knowledge and ideal aspirations of liberty, welfare and justice, grounded in experience and observation. He did not exclude the factor of social and political action, nor feel himself to be above that sort of thing, as Bertheroy is made out to feel. Berthelot's vague political ideals actually conformed pretty closely to the realities of Radical-Socialist activity.

In any case, Berthelot must have been satisfied with the figure he cut as Bertheroy, for he would in 1901 submit Zola's name for the Nobel Prize Committee's first literary award. But the naturalist

Zola was just the sort of writer Nobel disapproved of in his will, and Zola was rejected in favor of the more conventionally idealistic Sully Prudhomme.[203] It is a pity that Nobel died a year before *Paris* came out. For in several ways it was a book that he should have liked.

Another literary work echoing the science-religion controversy is the well-known novel *Jean Barois* by Roger Martin du Gard. Jean Barois and his free-thinking friends, late in 1895, launch their journal *Le Semeur* to promote the cause of science against traditional religion. The debate on the "bankruptcy of science" is clearly reflected in this novel, but although the name of Berthelot has been suggested in connection with the genesis of one of the leading characters, it is not possible to make a convincing case for such an identification. Marc-Elie Luce, the honored mentor of the free-thinking group of *Le Semeur*, is really so different from Berthelot that only certain of his ideas, and perhaps the similarity of their Christian names, provide a link between them. Luce is a historian, not a scientist; he is in his forties, not his seventies; and he becomes an outspoken Dreyfusard. Another character, Breil-Zoeger, expresses views reminiscent of Berthelot's article "La Science et la morale." He believes that a positive ethics can be based on science and on the already established evidence of certain laws of life. But this doctrinaire young positivist is even more different, temperamentally, from Berthelot than Luce. In a later number of the magazine, Breil-Zoeger proposes to publish a critique of the "metaphysics" of Pasteur. But the Dreyfus Case starts to break out into the open, and *Le Semeur* becomes a Dreyfusard organ.[204] The novel *Jean Barois* illustrates how the skirmish between free thought and traditional religion serves as a prelude to the turmoil-ridden Dreyfus campaign.

It would give our history a theatrical interest if we could say that the science debate was a dress rehearsal for the Dreyfus Affair. Many contestants in the first did find themselves again in opposition in the second conflict. Against Dreyfus would be Brunetière, Lasserre, de Vogüé, Bourget; while Lazare, Zola and Clemenceau, who had been defenders of science, would lead the Dreyfusards. Other supporters of science, not among Berthelot's cohorts, but famous for their support of Dreyfus, were Anatole France and Jean Jaurès. Prominent at the Berthelot Banquet, Richet and Delpech sided early with Zola; while Brisson eventually helped Dreyfus in the Cabinet, and Raymond Poincaré became an eleventh-hour Dreyfusard. Berthelot's long-time friend Clamageran furthered the cause in the Ligue des Droits de l'Homme and in the Amnesty Commis-

sion. On the other hand, "pro-science" figures like Perrier, Lockroy and Jules Soury turned up as anti-Dreyfusards, and Sully Prudhomme's stand was ambiguous.[205] Of the newspapers, *L'Echo de Paris*, so outspoken in favor of science, became outspokenly anti-Dreyfusard. With these exceptions, the coincidences are quite striking, and would be even more so if Berthelot had played a more forthright role in the Affair.

Of those who sprang to the aid of the condemned man, it cannot be said that Berthelot's name led all the rest. Some time before Zola published *J'Accuse*, Bernard Lazare, in his first lonely efforts to help Dreyfus, had approached Berthelot as well as Jaurès and others without success.[206] His signature is not among the 3,000 collected by Marcel Proust and other young writers and students on the petitions supporting Zola and calling for *révision*.[207] During this crucial month of January 1898, he did vote for Scheurer-Kestner's bid for Vice-President of the Senate.[208] But a year later he voted for Premier Dupuy's law of "dessaisissement," a measure compromising the authority and the freedom from outside pressure of the court which was examining Mme Lucie Dreyfus's appeal. Joseph Reinach characterized this action as follows: "Chose triste à dire, mais qu'il faut dire comme les autres, Berthelot. Il n'avait de Lavoisier que le génie."[209] It is only fair to remember that most of his colleagues assumed Dreyfus's guilt, and also that he was seventy years old. Was it only his years and his desire for tranquility, or was it also his honors and the cords of his ceremonial gowns that held him back? Such might be the implication of Zola's portrait of Bertheroy except for the fact that *Paris* was written before Zola himself entered the fray.[210]

Although Berthelot was hardly more than a retrospective Dreyfusard, the liberal tradition with which he was associated can with difficulty be separated from the Dreyfusard movement. His contribution to its *mystique* consisted of ideas which he had been disseminating for a generation. The fervor, the energy, the sacrifice, were contributed by others. And when the crisis was over and the victory won, many of his associates would promote and benefit from its *politique*. His son André, as *député*, took a Dreyfusard position in certain votes in the Chamber.[211] The poet Fernand Gregh recalls the organization of the "Dîner des Quinze-Vingts": "un dîner de dreyfusards et nous nous targuions d'avoir vu clair." The group included another son, Philippe, future Secrétaire of the Foreign Ministry.[212] Jean Giraudoux's novel *Bella*, based on the career of Philippe Berthelot, evokes with little change some of the back-

ground of his family, yet contrives to emphasize the Dreyfusard element in the Berthelot legend:

> Ce qui leur valait le plus de haine et aussi le plus de dévouement, c'est qu'ils ne croyaient pas que la science, le détachement des honneurs, la loyauté dussent les éloigner de la vie publique. Ils appartenaient à un parti. Ils se mêlaient à tous les grands remous sociaux . . . apprenant la politique dans l'affaire Dreyfus et la banque dans Panama.[213]

Other interesting facets of the family portrait by Giraudoux will be mentioned later.

Toward the end of the century Berthelot's interest in educational problems again came to the fore. In articles and addresses and in his appearance before the Ribot Commission, he promoted the teaching of science in the secondary schools. It was not only because of the technical and practical needs of society that he urged the development of a modern education based on science rather than the traditional classical type. He argued that science has an educational value as high as any other subject—a value both intellectual and moral. It teaches us the respect for truth. One cannot cheat with the laws of nature.[214] It teaches tolerance. It does not dry up the springs of the heart, nor inspire selfish vanity. All of this was not entirely convincing. Still pursuing the great debate, he declared: "Le Dieu des savants n'est pas un Moloch auquel ils offrent en holocauste les souffrances de l'humanité." Unlike Zola's Bertheroy, he now presented science as a conservative force. Shortly before the Spanish-American and the Boer conflicts, he opined that the growing rarity of war was a result of the spread of science. And on the domestic plane, he believed, it would provide the basis for the solidarity of all regardless of class. With this last point, he was paying a compliment to Léon Bourgeois.[215] Incidentally his statement that science was replacing religion and force in the government of men drew a spirited rejoinder from the famous Leo Tolstoy in an article entitled "What is Religion?" No society has lived or can live without religion, asserted the great novelist, calling upon men to abandon the experimental method and return to moral and religious searching.[216]

In 1901, Berthelot was elected to the French Academy, succeeding the mathematician Joseph Bertrand. In his discourse he gave a good portrait of the interesting personality of Bertrand, his former colleague in the Academy of Science, but his account of Bertrand's mathematical career naturally lacks the authority of the *éloges* he had pronounced of scientists closer to his own field like Chevreul

and Brown-Séquard.[217] The most heart-felt portion of the address is in the introduction where he calls the roll of past members whom he had counted among his friends—Claude Bernard, Taine, Leconte de Lisle, Alexandre Dumas, Victor Hugo, and especially Renan. (The mention of Hugo would surely have made Goncourt lift an eyebrow.) Berthelot refers to Renan and Bertrand in accents that leave a somewhat equivocal impression: "Ma joie et la leur auraient été doublées s'ils avaient pu me voir aujourd'hui à leurs côtés dans cette Académie française. . . . Les Divinités jalouses qui règlent la destinée humaine en ont décidé autrement! Je n'ai pu bercer mes amis dans leur dernier sommeil par la cantilène suprême qui consacre la mémoire de ceux qui ne sont plus!"[218] One almost suspects he secretly or unconsciously felt that his election was long overdue.

The year 1901 saw Berthelot honored again with the official *cinquantenaire* celebrating the fifty years since his first scientific publication, in the presence of the President of the Republic and of other governmental and scientific dignitaries.

He had another opportunity to evoke the shade of Renan at the inauguration in 1903 of the statue at Tréguier. An incident recorded by Fernand Gregh casts a curious light on the attitude of Anatole France toward Berthelot. Seeing him get off the train at Tréguier, Anatole France murmured: "Qu'est-ce qu'il vient faire ici, Berthelot? Ah! Oui, sans doute est-il détaché par quelque pyrotechnie." That seemed witty if sacrilegious to Gregh who held Berthelot in awe as the last representative of universal knowledge.[219] With the other indications we have cited earlier, this instance shows that the feelings of the one-time gentle cynic and now militant liberal fell a good distance this side idolatry as far as Berthelot was concerned. Nevertheless his address at the ceremony was an eloquent tribute to Berthelot:

> Je sens vivement l'honneur qui m'est échu . . . de parler après l'homme illustre que vous venez d'applaudir. Berthelot, Renan! J'unis vos deux noms, pour les honorer l'un par l'autre. Hommes admirables qui, situés sur les deux extrémités des sciences, en avez reculé les frontières. Tandis que Renan . . . appliquait au langage et aux religions la critique historique, vous Berthelot, par des expériences innombrables, toujours délicates et souvent périlleuses, vous établissiez l'unité des lois qui régissent la matière, et vous rameniez les énergies chimiques aux conditions de la mécanique rationnelle. Ainsi tous deux, portant la lumière dans des régions inconnues, vous avez gagné à la raison humaine, sur les larves et les fantômes, un immense territoire.[220]

While preparing this passage, perhaps Anatole France had reviewed

the eulogy Renan had paid to Berthelot, in which he compared his friend to the ancient Romans honored for extending the *pomœrium* of the city.[221]

Berthelot himself rose to the occasion at Tréguier and as part of his homage to Renan pronounced this moving peroration:

> Sans doute les flots de la Démocratie sont mobiles comme la la mer. N'importe! Ayons la foi. Ces flots nous porteront; ils porteront le vaisseau de la Raison et de la Démocratie construit, avec tant de souffrances et souvent d'amertumes, par nous et par nos prédecesseurs, et dont la solidité a déjà été éprouvée par tant de tempêtes.
>
> Confions-nous à l'onde agitée et à notre propre énergie. Fions-nous aux nobles instincts de la nature humaine. Non seulement le dévouement au bien, au vrai, au beau, trouve en lui-même sa propre récompense, mais soyons convaincus qu'un jour il dominera le monde.[222]

Until the end of his life Berthelot missed few opportunities to give expression to his philosophy of free-thought. Either with active participation or written messages, he encouraged the yearly meetings of the Congrès de la Libre Pensée. His letter to the Paris Congress in 1905 drew a protest from a religious society going under the name of Action Libérale Populaire. Their protest was conveyed in posters displayed on the walls of Paris attacking State lay education. On the poster were printed quotations intended to prove the death-bed recantations of illustrious skeptics like Virchow and Du Bois Reymond. It was a rather obvious hint to Berthelot, who hardly could have much longer to wait. But his reply was still unrepentant.[223]

Time was indeed running out for him. He continued work until almost the last, but Mme Berthelot's health caused him much concern. One day in March 1907 she died, and it was as if he had lost his own will to live. He survived her only a few hours. It seemed fitting that she should be buried by his side—in the Panthéon.

Something of the Berthelot spirit would survive after his death, not only in the memory of his example, but also in his four sons. Fernand Gregh describes Philippe as follows: "portant en lui l'esprit des Berthelot, quelque chose d'ardent et de glacé, de passionnément et froidement rationaliste qui, hérité du père, s'était diffusé dans ses quatre fils, André, Daniel, Philippe et René."[224] Giraudoux's novel *Bella* has already been mentioned in connection with Philippe Berthelot. The Berthelot spirit is distilled by Giraudoux into something at once more subtle and pervasive than it could have been in actuality. In the gatherings of the clan, named Dubardeau by the author, the conversations dealt less with personal relationships than

with science or philosophy. "Parfois celui qui dans une autre famille eût médit de cousins et de cousines avouait sa brouille, passagère, il l'espérait, avec Leibnitz, avec Hegel." Such was this family. "Par certains, elle était crainte et détestée. Ces âmes stérilisées paraissaient des ferments d'indiscipline, des virus d'orgueil. Le curé de Meudon, l'actuel, obligeait les femmes à se signer quand passait l'oncle Jacques." Giraudoux makes the sons into nephews of the great scientist. In other ways the life of Berthelot is turned with some alteration into the stuff of legend, as in this variation on his death: "La mort du mari entraînait, parfois dans la journée, celle de sa compagne. . . . Tous d'ailleurs savaient où ils allaient, c'est-à-dire au néant." As these quotations remind us, the passage into nothingness of which he was assured, did not lack some alleviation at least in the form of that meagre immortality conferred by mentions in novels.[225] In our conclusion we shall discuss, not the survival of his personality but the survival of his ideas.

Conclusion: A Berthelot Legend? Can one speak of a Berthelot legend? Without exaggerating the place of Berthelot in the mind of posterity, one can collect a number of references which justify using the expression. Perhaps instead of a consistent legend, one should speak of varying fragmentary images which disperse with the lapse of time without merging into one. Thus one can trace the changes in the public image of the scientist starting with the plaudits of Michlet and the Goncourts, as a miracle worker in chemistry. This image was, in the case of the surviving Goncourt brother, to lose its magic aura on closer approach to the man. Then there was the figment imagined by Pasteur of a positivist conspiracy led by Renan. Such a picture could not stand exposure to the light of day. Neither Berthelot nor Renan was a Positivist with a capital P. There was the more durable opinion that Berthelot had influenced Renan's apostasy. This became reduced to the residuum of an intellectual partnership to which Berthelot contributed a portion as a specialist in science and as a faithful believer in the republican ideal. The genuine influence of Berthelot on Renan has no doubt been unduly minimized in more recent times. Léon Daudet and Dr. Pierre Mauriac, for example, went so far as to question whether the two were even very close friends. One can understand, without sharing, their doubts, based on a certain lack of luster in the chemist's personality, that the brilliant Renan could have reflected any light from his dimmer companion.[226]

It seemed for a moment around 1896 that Berthelot's ministerial

mishaps would leave behind a legend of the chemist astray in politics. But his failure was not sensational enough. On the whole, his participation in political life lacks pronounced positive qualities. There is, as an instance, his almost complete absence from the Dreyfus Case. We may wonder how he found time from his absorbing chemical studies, several big books and a thousand articles, regular attendance at scientific meetings, many years as Secrétaire Perpétuel of the Academy of Sciences—to take part in politics, in educational and foreign affairs, and to compose his essays and his speeches on science, philosophy, morals, education and free-thought. Perhaps the answer simply is—that he did not find time, and that, in fact, with the exception of education, he never applied his full attention to these activities. Many of his public addresses leave the impression of having been delivered from the top of his head. His career on the political stage, aside from educational policy, was a sequence of missed opportunities for any permanent accomplishment consistent with his ideals. Thus we have the paradox of a believer in freedom of thought defending censorship of the play *Germinal,* and later the spectacle of a foreign minister whose pacific and internationalist aspirations get caught in a colonialist and confused nationalist policy. That he thought he could do justice to political tasks was the result of a worthy motive—the belief that a scientist owes a debt to society beyond his special field. That he did not realize the difficulties, nor discern the undercurrents at play, that he yielded to expediency, or paid himself with words—these were faults, as Zola said, that had been forgiven many a politician who was merely a politician. Perhaps he thought that his republican creed, maintained intact through the Second Empire, was a sufficient preparation. But this faith provided no recipes for the peculiar ills of the body politic. The best-intentioned devotion to welfare and enlightenment, conceived in merely general terms, was not enough.

The image of Berthelot as an example of scientism is the most persistent one. It is this conception which constitutes the most lasting Berthelot legend, and like any legend, it is compounded of both fact and fiction. The history of his phrase "Le monde est aujourd'hui sans mystère" illustrates the tendency in ideological quarrels to distort the ideas of one's opponents, the better to attack them with a sense of righteousness. So Berthelot was caricatured as the very type of the sciolist. No caricature is without some bit of truth. Berthelot had, more or less unwittingly, touched a sensitive nerve, but his clumsy thrust was turned against him. Then his leading role in the polemics over the "bankruptcy of science" fixed the

public image of a Berthelot proclaiming *ad urbi et orbi* the universal applicability of the scientific method.

Most of his opponents such as Brunetière took traditional positions. Thus Berthelot was never shaken in his belief that he was right. Brunetière and his cohorts were carrying on rear-guard actions while imagining that they were mounting a counter-offensive. A more real danger to Berthelot's position threatened from a sector he hardly knew existed, commanded by men like Bergson who were more sophisticated in the sciences than Brunetière. Indicative of the new situation developing was the attitude of young Fernand Gregh. He relates how he was dazzled by Bergson's *Sur les Données immédiates de la conscience*: "J'avais pourtant—je m'en souviens aujourd'hui avec quelque confusion— . . . fait quelque résistance d'abord à l'intuition bergsonienne dont je sentais qu'elle allait renverser l'édifice déterministe où nous étions, avec la science de Berthelot, si confortablement installés."[227] Critics of positivism like Pierre Duhem thought of Berthelot's generation as believing in the potential perfection of science. The young Léon Blum cited Henri Poincaré on the complexity of science against the earlier conviction of nature's simplicity. Glibly he remarked in his "Premiers Paradoxes sur Renan": "Personne ne considère plus la causalité comme une loi simple. Et c'est pourquoi la science n'est plus optimiste."[228] The persistence of the legend of Berthelot's scientism is well demonstrated by the comments as late as March 1963 of the Christian existentialist Gabriel Marcel. He refers to the dogmatism "en réalité périmé, qui sévit à la fin du siècle dernier, . . . je pense par exemple à un Marcelin Berthelot." He goes on to render homage to men like Poincaré and Duhem who succeeded in reducing the pretensions of scientism to attain a total description of the objective world just as it is. Marcel apparently thinks of scientism as equivalent to physicalism or naïve realism.[229]

Such a view of Berthelot takes no account of his repeated affirmation that science does not claim to offer the last word on the riddle of the universe. Even Remy de Gourmont who had mocked him for this presumption changed his mind, saluting Berthelot after his death as "un trop grand esprit pour ne pas se rendre compte que la nature même aux génies de son espèce, ne dit jamais le dernier mot de l'énigme." Of course Gourmont could not refrain from one last sally: "Et le sphinx l'a étouffé dans ses bras, chargé d'ans et de gloire, avec un sourire ironique."[230]

Marcel's assumption that scientists like Berthelot did not appreciate the role of imagination in scientific creation seems at first

sight more justified. Berthelot's skepticism about atoms was an instance of his attitude toward hypotheses, and he did express this skepticism in a rather dogmatic manner. But this is not what Marcel has in mind in charging Berthelot with dogmatism. The chemist was not as ignorant of the critical analysis of scientific method as Marcel imagines. Berthelot wrote in his tribute to Kant in 1904: "Dans la *Critique de la Raison pure* il a établi le caractère essentiellement subjectif des bases de la connaissance, la relativité des catégories de l'entendement humain et leurs antinomies irréductibles. Les conséquences de cette conception capitale, loin d'être épuisées, continuent à se développer chaque jour, au milieu des discussions relatives aux fondements mêmes des sciences physiques et mathématiques."[231] It is clear from this statement that Berthelot was neither a physicalist nor a naïve realist.

Rather than accusing him of dogmatism, one might complain that he expressed his faith in science in terms too vague and general. This is an aspect that appears in Zola's portrait of Bertheroy. Instead of throwing out a challenge, he tended to lull his audience and readership into complacency and a facile optimism. We must record his failure to anticipate the perils involved in the technological age, as well as his wishful thought that wars were becoming less frequent with the spread of enlightenment and the growth of international relationships. Nevertheless all of his forecasts have not proved hopelessly far off the mark. Let us take as an example his conviction that science could provide an explanation for morals. What are the behavioral sciences if not an extension and application of such thinking? The real problem comes in when one claims that science can also provide a normative basis for ethics. A writer like Paul Bureau, who understood perfectly what Berthelot meant by his notorious phrase about *mystery*, could say in his book *La Crise morale des temps nouveaux* (1907): "L'impuissance de la science à résoudre le problème de la vie morale est devenue si manifeste qu'elle n'est plus contestée par aucun homme averti. Seul M. Berthelot, que l'on pouvait excuser de conserver dans la vieillesse les illusions de l'adolescence, maintenait encore les audacieuses prétentions d'antan."[232] Yet Bureau went on to call for the study and analysis of social facts! Evidently he was opposed only to the kind of science he ascribed to Berthelot. The latter believed that the study of moral phenomena is subject to the same scientific standards as the study of physical facts, although he did not put it as provocatively as did Taine with that famous declaration: "Vice and virtue are products like sugar and vitriol." One can criticize Berthelot for

not formulating his ideas with sufficient precision to stimulate fruitful debate. His essay on "Science and Morals" was in part a fuzzy restatement of Kant's Practical Reason in somewhat more topical or contemporary terms. In his tribute to Kant he repeated the basic idea that Kant had founded morality on the inner notion of conscience, setting aside the claims of various forms of religious dogmatism and supernatural sanctions. Now this idea was not a scientific one in the usual sense; yet that is the way Berthelot always spoke of it. By calling the Practical Reason scientific he blurred the necessary distinction between the descriptive and the normative aspects of ethics.

We have seen that, contrary to the legend, Berthelot was far from supposing that science had answered the world enigma. What he asserted was that only through the scientific method of observation and experiment could man advance his knowledge of the universe and of himself. This is a continuing process whose end is not in sight—if there *is* an end. The science of the ideal can rise only on the foundations of positive science, but the farther it rises, the more problematic it becomes and the greater leeway is left for liberty of opinion. He would let a thousand flowers bloom if they grew from that ground! In 1895 he still held to that tenet, first presented in 1863. Let us recall that in the exchange with Renan it was Berthelot who hesitated to compose a *De Natura Rerum*, even in the tentative and playful form offered by his colleague. Berthelot had his troubles with semantics. His use of *mystère* was a glaring example. His use of the terms *science* and *expérience* also could be misunderstood. The former could mean simply knowledge, and the latter could just mean experience. Yet it was precisely his faith that science was true knowledge, that experiment was a controlled and therefore reliable form of experience, that mystery could not be its own answer.

An admirer described him as follows: "héritier des Encyclopédistes . . . il approfondit leur pensée en la reliant à un idéalisme inspiré de Kant. . . ."[233] That suggests a profundity he did not possess. But it is true that he was more of a Kantian idealist than an exponent of scientism. If at his narrowest he was something of an anticlerical doctrinaire, at his best he was a humanist and a rationalist. A man of good will. This is the least we can say for Berthelot. Historical justice may require a little more, but it can hardly be satisfied with less.

NOTES

1. M. Berthelot, *Les Origines de l'alchimie* (Paris: Librairie des sciences et des arts, 1938), p. v. Berthelot's Christian name is found spelled two ways, usually Marcelin but Marcellin in library catalogs.

2. Carl Snyder, *New Conceptions in Science* (New York, 1904), p. 344.

3. *Nobel The Man and his Prizes* (New York: Nobel Foundation, 1962), pp. 352–353.

4. Emile Perrin, *Marcelin Berthelot (1827–1907)* (Paris, 1927), p. 6.

5. Augustin Boutaric, *Marcellin Berthelot 1827–1907* (Paris: Payot, 1927). Cf. also Albert Ranc, *Pour connaître la pensée de Marcelin Berthelot* (Paris: Bordas, 1948).

6. Berthelot, *Chimie organique fondée sur la synthèse* (Paris: Mallet-Bachelier, 1860), I, pp. xxi, xxv f., cxlvii.

7. *Correspondance d'Ernest Renan et de M. Berthelot* (Paris: C. Lévy, 1898), pp. 184, 235.

8. Camille Matignon, "Marcelin Berthelot," *Annual Report of the Smithsonian Institution, 1907* (Washington, 1907), p. 670. Translated from *Revue générale des Sciences pures et appliquées,* 18^{me}année (May 15, 1907). In *La Mer* (Paris, 1861), Michelet wrote: "Je fais peu de cas des diamants. Les diamants vont courir les rues. M. Berthelot, qui refait la nature en partie double, qui crée tant de choses vivantes, bien plus aisément va nous prodiguer les diamants." P. 415. Michelet's prediction was about a century premature.

9. *Chimie organique fondée sur la synthèse,* II, p. 811. Berthelot adds: "La chimie possède cette faculté à un degré plus éminent encore que les autres sciences, parce qu'elle pénètre plus profondément et atteint jusqu'aux éléments naturels des êtres." P. 812.

10. Berthelot, *Leçon d'ouverture au Collège de France,* 1864. Quoted in Gaston Laurent, *Grands Ecrivains scientifiques (de Copernic à Berthelot)* (Paris: Colin, 1930), p. 368.

11. *Correspondance de Louis Pasteur 1840–1895,* réunie et annotée par Pasteur Vallery-Radot (Paris: Flammarion, 1951), II, p. 151, 154.

12. *Cf.* Reino Virtanen, *Claude Bernard and his Place in the History of Ideas* (Lincoln: University of Nebraska Press, 1960), pp. 11–12.

13. Ernest Renan, *Œuvres complètes* (Paris: Calmann Lévy, 1947), II, pp. 758 f.

14. Edmond and Jules de Goncourt, *Journal, Mémoires de la vie littéraire* (Académie Goncourt edition, Monaco, 1956), XIII, pp. 30–31. Later Berthelot pronounced a eulogy of Pasteur, but between the lines of the conclusion one senses an invidious note in the statement that the public honors applied science more than abstract science. *Science et morale* (Paris: C. Lévy, 1897), p. 255.

15. *Chimie organique fondée sur la synthèse,* II, pp. 656, 807.

16. Virtanen, p. 104.

17. Renan, *Œuvres complètes,* I, p. 632.

18. *Ibid.,* p. 647.

19. Goncourt, *Journal,* VIII, pp. 192–193.

20. Goncourt, *Journal,* IX, pp. 31–32, 124, 165. For Berthelot's inventions, *cf.,* Matignon, p. 681; A. J. Berry, *Modern Chemistry* (Cambridge University Press, 1948), p. 149; Laurent, pp. 358–361.

21. Pierre Duhem, *Introduction à la mécanique chimique* (Paris, 1893), pp. 46–51, 77–79. Also A. J. Berry, *From Classical to Modern Chemistry* (University of Cambridge Press, 1954), pp. 33–36. Berthelot's answer to Thomsen, *Bulletin de la société chimique de Paris,* nouvelle serie, XIX (1873), 485–489.

22. *Comtes-Rendus de l'Académie des Sciences,* tome 84 (Paris, 1877), pp. 1110, 1183, 1189, 1191, 1194, 1264 f., 1269 f.

23. Sir William Ramsay, *Essays Biographical and Chemical* (London, 908), "Pierre Eugène Marcellin Berthelot (1827–1907)," pp. 113–114. *Cf.*, Matignon, p. 680.

24. F. J. Moore, *A History of Chemistry* (New York: McGraw-Hill, 1918), p. 204.

25. Virtanen, p. 90.

26. Julien Benda, *De Quelques Constantes de l'Esprit humain* (Paris, 1950), p. 106. Georges Sorel, *Les Illusions du progrès*, (Paris, 1908), p. 163, n. 1.

27. Maurice Caullery, *La Science française depuis le XVII^e siècle* (Paris: Colin, 1948), p. 129.

28. R. Taton, *Reason and Chance in Scientific Discovery*, trans. A. J. Pomerans (New York: Philosophical Library, 1957), p. 148.

29. Lynn Thorndike, *A History of Magic and Experimental Science* (New York, 1923), I, pp. 193–194; II, pp. 215, n. 3, 217, n. 1.

Berthelot published the following:

Collection des alchimistes grecs, 3 v., avec C. E. Ruelle (Paris: Steinheil, 1887–1888).

Introduction à L'étude de la chimie des anciens et du moyen âge (Paris: Librairie des Sciences et des Arts, 1889).

Histoire des sciences: La Chimie au Moyen Age. Vol. I, *Essai sur la transmission de la science antique au Moyen Âge*. Vol. II, *L'Alchimie syriaque*, avec la collaboration de M. Rubens Duval. Vol. III, *L'Alchimie arabe*, avec la collaboration de M. O. Houdas. (Paris: Imprimerie Nationale, 1893.)

Berthelot's positivism and rationalism are criticized by G. E. Monod-Herzen, *L'Alchimie méditerranéenne* (Paris: Adyar, 1963), pp. 10–16. *Cf.* Michel Butor, *Répertoire* (Paris, 1960), p. 12.

30. Edmund von Lippmann, *Entstehung und Ausbreitung der Alchimie* (Berlin, 1918), Nachtrage I "Berthelot als Historiker," pp. 647–658. Lippmann states that Berthelot depended for Arabic and Syriac on Ruelle, Duval and Houdas without giving them due credit. P. 648.

31. Thorndike, I, p. 194.

32. Von Lippmann, pp. 653–654.

33. Berthelot, *Origines de l'alchimie*, pp. 10–12, 17–19.

34. *Ibid.*, pp. 247 f., 251 f., 264–274, 278–282. The philosopher Emile Boutroux considered this explanation of the alchemists' rationalist philosophy Berthelot's capital contribution in the book. See his review in *Revue Philosophique de la France et de l'Etranger*, XXI (1886), p. 528. Boutroux says further: "L'ouvrage de M. Berthelot est un exemple de ce que peut, notamment dans l'étude des choses anciennes, l'alliance de qualités et d'aptitudes diverses, trop souvent séparées chez les hommes d'aujourd'hui. Les œuvres des anciens étaient plus complexes que les nôtres: l'esprit humain n'avait pas encore sacrifié son unité à la diversité apparente des objets. Il y donc péril à ne considérer ces œuvres que d'un seulement de nos points de vue modernes, soit le point de vue de l'érudit, soit celui de l'historien, ou du savant, ou du philosophe: on n'en voit alors qu'un côté. . . . A l'objet à connaître doit être proportionnée l'intelligence qui connaît. . . . Cette proportion entre l'objet et l'écrivain se rencontre dans l'œuvre de M. Berthelot." Pp. 531–532.

35. Berthelot, *Origines de l'alchimie*, pp. 283–288, 297.

36. Berthelot, *Lavoisier: La Révolution chimique* (Paris: Alcan, 1890), p. 3. Sir Edward Thorpe, *Essays in Historical Chemistry* (London, 1911), pp. 149 ff.

37. *Origines de l'Alchimie*, pp. 290–291, 312, 319. The Pythagorean comparison occurs already in *Chimie organique fondée sur la synthèse*, I, p. cxxiv.

38. *Origines de l'Alchimie*, p. 289.

39. *Ibid.*, p. 294.

40. *Ibid.*, pp. 292, 308–311.

41. *Ibid.*, p. 290.

42. *Ibid.*, pp. 319–320.
43. *Ibid.*, p. 321.
44. *Ibid.*, 320.
45. Renan, *Souvenirs d'enfance et de jeunesse* (Paris: Nelson, n.d.), p. 241. Here is a *curiosum* we owe to Gabriel Astruc: "Renan à qui Marcellin Berthelot, cerveau universel, avait appris l'hébreu!" *Le Pavillon des Fantômes. Souvenirs* (Paris, 1929), p. 11.
46. Renan, *Œuvres complètes*, éd. déf. (Paris: Calmann-Lévy, 1960), IX, pp. 1090, 1105, 1148–1149.
47. Renan, *Souvenirs* . . . p. 244. *Cf., Correspondance Renan-Berthelot*, p. 199.
48. Marie-Louise Pailleron, *Les Ecrivains du second empire* (Paris: Perrin, 1924), p. 60.
49. *Hippolyte Taine Sa vie et sa correspondance* (Paris: Hachette, 1904), II, pp. 242 f.
50. Maurice Barrès, *Mes Cahiers* (Paris, 1929–1933), III, pp. 17, 79. A. Deschamps, *Le Journal de la Marne*, 5 déc., 1901.
51. *Cf.*, Jean Pommier, *Renan d'après des documents inédits* (Paris, 1923), p. 77. *Cf.*, Elie Carcassonne's review in *Rev. de l'Hist. litt. de la France*, XXXI (1924), 133. Also Richard M. Chadbourne, *Ernest Renan as an Essayist* (Ithaca, 1957), pp. 151, 156.
52. Renan, *Œuvres complètes*, IX, p. 102.
53. *Ibid.*, pp. 40, 46, 51, 53–54.
54. *Ibid.*, pp. 287, 295, 426 f.
55. Renan, *Souvenirs* . . . pp. 242–243.
56. Renan, *Œuvres complètes*, I, p. 547.
57. *Ibid.*, pp. 639 f.
58. *Ibid.*, p. 647.
59. *Ibid.*, pp. 658 f. Berthelot's essay "La Science idéale et la science positive" is given here with Renan's. It first appeared in *Revue des Deux-Mondes* (1863, 6), 445 ff. It is also found in Berthelot's *Science et philosophie* (Paris: Calmann-Lévy, 1894).
60. *Ibid.*, p. 670.
61. E. Caro, *Le Matérialisme et la science*, 2nd ed. (Paris, 1868), p. 42.
62. Berthelot, *in* Renan, *Œuvres complètes*, I, pp. 658, 667.
63. *Ibid.*, pp. 651 f.
64. *Ibid.*, p. 672. *Cf., Correspondance Renan-Berthelot*, pp. 292, 308.
65. Renan, *Œuvres complètes*, I, p. 639.
66. *Ibid.*, p. 641.
67. Mary Robinson, *The Life of Ernest Renan*, 2nd ed. (London, 1898), p. 75. *Cf.*, Lewis Freeman Mott, *Ernest Renan* (New York, 1921), p. 40. In his Tréguier address, Berthelot said that he aroused Renan's interest in geometry and anatomy. *Science et libre pensée* (Paris: Calmann-Lévy, 1905), p. 3.
68. Goncourt, *Journal*, XI, p. 94.
69. Renan, *Œuvres complètes*, I, pp. 570, 584 f., 605.
70. *Ibid.*, p. 547.
71. *Ibid.*, p. 587.
72. *Ibid.*, pp. 570, 564, 584.
73. *Ibid.*, pp. 570, 584, 652, 659, 668, 671.
74. Renan, *Œuvres complètes*, III (Paris, 1949), p. 400.
75. *Ibid.*, p. 488.
76. Pommier, p. 287.
77. Renan, *Op. cit.*, p. 495.
78. *Ibid.*, p. 500.
79. *Ibid.*, pp. 510 ff.
80. Pommier, p. 340, n. 1.

81. Renan, *Œuvres complètes*, III, pp. 723, 933–934. *Cf.*, Berthelot, *Science et libre pensée*, p. 3.

82. *L'Œuvre de Léon Blum (1891–1905) Critiques littéraires* (Paris: Albin Michel, 1954), pp. 175 f.

83. Renan, *Souvenirs* . . . p. 241. *Cf.*, Berthelot's introduction to *Correspondance Renan-Berthelot.*

84. Berthelot, *Science et libre pensée*, article on Clamageran, p. 128.

85. Renan, *Œuvres complètes*, I, p. 548.

86. *Correspondance Renan-Berthelot*, p. 306.

87. Berthelot, *Science et libre pensée*, p. 130 f. "Ferdinand Hérold," *Revue politique et littéraire*, XXIX (21 janv. 1882), 65 f. (Reprinted in *Science et philosophie*, pp. 370 ff.) *Cf.*, Emile Ollivier, *Journal* (Paris: Julliard, 1961), I, p. 302: II, p. 185.

88. Goncourt, *Journal*, IX, pp. 31 f., 124; XVII, pp. 123–126, 150–152. Henriette Psichari, *Renan et la Guerre de 70* (Paris, 1947), pp. 9, 208 f.

89. Goncourt, *Journal*, IX, pp. 31 f., 98, 165 f.

90. *Correspondance Renan-Berthelot*, April 29, 1871, p. 400.

91. *Ibid.*, p. 394.

92. *Ibid.*, pp. 429, 436.

93. *Ibid.*, p. 449.

94. *Ibid.*, pp. 483–489.

95. *Ibid.*, pp. 491, 498–499.

96. *Ibid.*, p. 502.

97. *Ibid.*, pp. 524–527.

98. *Ibid.*, p. 532. In his New Year greeting to the new Minister on Dec. 31, 1886, Renan humorously recalled their youth forty years before: "Certes si vous aviez été ministre alors, nous aurions réformé le monde. Cela n'aurait pas tenu, probablement." *Œuvres complètes*, II, p. 1036.

99. *Correspondance Renan-Berthelot*, p. 534.

100. *Ibid.*, p. 541.

101. Harry Levin *The Gates of Horn* (New York, 1963), p. 367.

102. See his *Science et Education* (Paris: Calmann Lévy, 1901), *passim*; *Science et libre pensée*, pp. 143 f., 171 f., 218. Berthelot, in his reply to the *Mercure de France* "Enquete franco-allemande," demanded that Germany "restitue aux populations annexées le droit moderne de choisir leur destinée." *Mercure de France*, XIV (April 1895), 9.

103. *Correspondance Renan-Berthelot*, August 26, 1880, p. 492.

104. Berthelot, "Ferdinand Hérold," 72–73. Cited in note 83.

105. Berthelot, *Science et libre pensée*, pp. 46–47. *Cf.*, Evelyn M. Acomb, *The French Laic Laws (1879–1889)* (New York: Columbia U. Press, 1941), pp. 73–82.

106. Goncourt, *Journal*, XIV, pp. 48, 229; XV, p. 12; XVII, pp. 24, 46, 121.

107. Berthelot, *Science et morale*, pp. 300–307.

108. Alexandre Zévaès, *Histoire de la Troisième République* (Paris, 1946), p. 290.

109. Berthelot, *Science et morale*, pp. 154–205.

110. Jacques Chastenet, *Histoire de la Troisième République* (Paris: Hachette, 1955), III, p. 90. Emile Combes says it was first planned to make Berthelot Minister of Education again, but when Ambassador Decrais declined the Quai d'Orsay, Berthelot took over the Foreign Ministry while Combes became Education Minister. Combes, *Mon Ministère, Mémoires 1902–1905* (Paris: Plon, 1956), pp. 66 f.

111. Paul Cambon, *Correspondance 1870–1924* (Paris: Grasset, 1940), I, pp. 397–399. Lack of leadership is also charged by Anatole France in *Le Mannequin d'osier*. Worms-Clavelin replies to Frémont's criticism of French policy in the Aegean: "Ah çà Georges, ne sois pas de mauvaise foi: tu sais bien que nous

n'avons pas de politique étrangère, et nous ne pouvons pas en avoir." *Œu. compl. ill.* (Paris, 1927), XI, p. 346.

112. In a letter "To an Armenian," Berthelot expresses satisfaction with his move, persuaded that it stopped the spread of massacres to Syria. France could not do more because of the stand of other European powers. *Science et libre pensée*, p. 169. *Cf.*, Victor Bérard, *Les Affaires de Crète* (Paris, 1900), pp. 102–103. Also the publication by the Ministère des Affaires Etrangères, *Documents diplomatiques français* (1871–1914), (Paris: Imprimerie Nationale, 1951), 1ère série, tome XII, p. 281.

113. Frederick L. Schuman, *War and Diplomacy in the French Republic* (New York: McGraw-Hill, 1931), pp. 123–124. But see Debidour, *Histoire diplomatique de l'Europe depuis le Congrès de Berlin*, 2nd ed. (Paris, 1917), p. 217.

114. But Sir William Ramsay says that "it was with difficulty that he was persuaded to sign the Anglo-French Treaty defining the position of Siam." Ramsay, p. 106. *Cf., Documents diplomatiques français*, XII, p. 404 f.

115. Chastenet, pp. 85, 90, n. 13. *Die Grosse Politik der Europäischen Kabinette 1871–1914* (Berlin, 1923), XI, pp. 81, 145–146, 333, 337. The epithet "old chemist" was the more discourteous coming from an Englishman, Lord Dufferin.

116. *Documents diplomatiques français*, XII, pp. 484–489, 493–494, 498–499, 503–504. Chastenet, p. 90. *Die Grosse Politik der Europäischen Kabinette*, XI, pp. 152–153, 156–163, 174–175, 196. Jean Darcy, *Cent Années de rivalité coloniale* (Paris, 1904), p. 402. Frantz Despagnet, *La Diplomatie de la Troisième République et le droit des gens* (Paris, 1904), pp. 695–696. Sir J. Rennell Rodd, *Social and Diplomatic Memories* 1894–1901 (London, 1923), II, pp. 42, 234. On Berthelot's resignation, Joseph Reinach quotes the paper *Le Radical* as follows: "Un grand savant qui se fourvoya quelques semaines, en 1895, dans le cabinet que présidait M. Bourgeois dit de lui en s'en allant: 'C'est le roi des fourbes.'" Reinach, *Histoire de l'Affaire Dreyfus* (Paris: Fasquelle, 1905), IV, p. 130, n. 3.

117. Zola, "L'Elite et la politique," *Œuvres complètes*, XXXVI, pp. 99–102. Jean-Louis, "La Chimie et la politique," *Revue Bleue*, V (4 av., 1896), 445.

118. *Die Grosse Politik der Europäischen Kabinette*, XI, p. 174.

119. Boutaric, pp. 163–164.

120. Berthelot, *Science et libre pensée*, pp. 143–152, 171 f.

121. Georges Suarez, *Briand Sa vie et son œuvre* (Paris, 1938), II, pp. 166–167. Barrès, *Mes Cahiers*, VI, p. 283. Charles Péguy deplored the "avilissement" of death in the funeral of Berthelot—a social event with music and conversation, referring to "les hautes dynasties de la science et des lettres et du monde moderne . . . les Berthelot et les Halévy." *Œuvres complètes, Prose 1898–1908* (Paris: Pléiade, 1959), pp. 1158–1160.

122. Goncourt, *Journal*, VI, p. 218. Mme Berthelot also impressed the brothers. Her "beauté psychique," reminiscent of a Poe heroine, became the "beauté séraphique" of Mme Gervaisais. VI, p. 136; XIX, p. 12.

123. *Ibid.*, XII, p. 174.

124. *Ibid.*, VII, pp. 75, 213; X, pp. 28, 147 f.; XI, p. 196; XIV, pp. 48, 125, 172; XV, pp. 8, 12. In 1890, Goncourt noted: "On causait de Berthelot, de cet homme à la fois si grand et si petit, et l'on parlait de la curiosité avec laquelle avait été attendu le premier acte de son ministère. Et le premier acte, d'après Lockroy, aurait été l'attribution à son usage seul des *lieux* du ministère de l'instruction publique." XVII, p. 46. A few months later, Goncourt was miffed when after all his praise of Berthelot, the latter sent him only his card without thanks or message. XVII, p. 121. In November 1895, Goncourt complained of the misleading report published in the *Echo de Paris* of an interview he had granted, and which was captioned "Monsieur Berthelot ministre": "Ce monsieur a dénaturé absolument ce que je lui ai dit de Berthelot, en sorte que le sentiment admiratif et sympathique de mon *Journal*, à part quelques critiques, est transformé en un sentiment méchamment hostile. . . . Enfin il me fait dire que jamais

Berthelot n'aurait eu le courage de me décorer comme l'a fait Poincaré: une phrase qui peut se penser, mais qui ne peut être dit que par un muffle." XXI, pp. 125–127. Berthelot might well have felt that with a friend like Goncourt, he did not need another enemy.

125. [Jules Troubat] *Souvenirs et indiscrétions*, nouvelle édition (Paris: Lévy, no date), pp. 149–150, 216. Jules Troubat, *Souvenirs du dernier secrétaire de Sainte-Beuve* (Paris, 1890), pp. 337, 340. André Billy, *Sainte-Beuve sa vie et son temps* (Paris, 1952), II, p. 190. Goncourt, *Journal*, VII, p. 26. André Maurois, *Lélia ou la Vie de George Sand* (Paris, 1952), p. 460. A less famous writer, Louis Ménard, who had been a chemist, was a friend of Berthelot. His son Philippe devoted a book to Ménard. *Cf.*, Henri Peyre, *Louis Ménard* (New Haven, 1932), p. 157.

126. Gustave Flaubert, *Correspondance* (Paris: Conard, 1930), VI, pp. 446–447; VII, pp. 298, 328. Guy de Maupassant also mentions the friendship between Flaubert and Berthelot in his "Etude sur Gustave Flaubert" preceding the edition of *Bouvard et Pécuchet* (Paris: Quantin, 1885), p. lvi.

127. André Chevrillon, *Portrait de Taine Souvenirs* (Paris: Fayard, 1958), pp. 74 ff. Berthelot's *Revue Blanche* statement is in vol. 13 (1897), 264.

128. Article in *Univers illustré*, Feb. 5, 1887, pp. 82 f., cited by Marie-Claire Bancquart, *Anatole France Polémiste* (Paris: Nizet, 1962), p. 138.

129. Perrin, p. 35.

130. Joris-Karl Huysmans, *Là-Bas* (*Œuvres complètes*, XII, Paris: Crès, 1930), I, p. 134.

131. Marc Citoleux, *La Poésie philosophique au XIX^e siecle: Mme Ackermann* (Paris, 1906), pp. 102, 106. Flaubert, *Bouvard et Pécuchet*, pp. 75–77.

132. Pierre Lasserre, *La Crise chrétienne* (Paris, 1891), p. 269. André Gide, *Les Cahiers d'André Walter* (Paris, 1952), pp. 112–113. Henri Bérenger, *L'Effort* (Paris, 1893), pp. viii, xxxv. Eugène Bosdeveix, *L'Angoisse* (Paris, 1892), p. viii.

133. Teodor de Wyzewa, *Contes chrétiens* (Paris, 1892), I, p. vii.

134. Lucien Muhlfeld, in *La Revue Blanche*, III, 215; IV, 290.

135. Anatole France, *Le Jardin d'Epicure* (Paris, 1895), pp. 279 f. Teodor de Wyzewa, *Nos Maîtres* (Paris, 1895), pp. 225 f.

136. Anatole France, *La Vie littéraire*, IV (Paris, 1900), pp. 43–46.

137. Anatole France, *La Vie littéraire*, II (*Œuvres complètes illustrées*, VI, Paris: Calmann Lévy, 1926), p. 379. Taine went farther than Berthelot: "On pourra tout savoir de l'homme et de la vie. Il n'y a pas de mystère définitif." Cited by André Chevrillon, "La Jeunesse de Taine," *Revue de Paris* (July 15, 1902), 30.

138. Edouard Rod, *Les Idées morales du Temps présent* (Paris: Perrin, 1891), p. 75. Many writers took up the defense of "mystery" without necessarily thinking of Berthelot: Henri Bérenger: "La Science est un sphinx qui n'a jamais livré la clé d'or du dernier mystère." *L'Ame moderne* (Paris, 1892), p. 28. Paul Desjardins: "Il faut avertir les simples . . . qu'il reste du mystère dans le monde. . . ." *Le Devoir présent* (Paris, 1892), p. 64. Others named Berthelot. Abbé Félix Klein refers to positivism in these words: "Il lui a rarement échappé des outrecuidances aussi stupéfiantes que celles de M. Berthelot, s'écriant 'Le monde est aujourd'hui sans mystères.'" *Nouvelles Tendances en Religion et en Littérature* (Paris, 1893), p. 18. Charles Recolin: "M. Berthelot, enivré des conquêtes de la chimie, s'écriait: 'Il n'y a plus de mystères.'" [sic] *L'Anarchie littéraire* (Paris, 1898), p. 168. Brunetière, *Questions actuelles* (Paris, 1916), pp. 390–391. Henri Massis and Alfred de Tarde will ironically recall Berthelot in their second "Agathon" book, *Les Jeunes Gens d'aujourd'hui* (Paris: Plon, 1913), p. 74.

139. Remy de Gourmont, *Epilogues, Réflexions sur la vie, 1902–1904*, 5^e éd., (Paris: Mercure de France, 1923), p. 18.

140. Paul Bourget, *Etudes et portraits* (Paris, 1894), I, p. 202.

141. Shepard B. Clough, *France a History of National Economics* (New York:

Scribners, 1939), p. 218. Henri Sée, *Histoire économique de la France* (Paris: Colin, 1942), II, p. 265.

142. Brunetière, "La Banqueroute du Nautralisme," in *Le Roman naturaliste* (Paris: Calmann Lévy, 1896), pp. 323–344.

143. Zola, *L'Œuvre* (*Œu. Comp.*, XXV, Paris: Fasquelle, 1928), p. 393.

144. Zola, *Le Docteur Pascal* (*Œu. Comp.*, XXXV), pp. 88–89, 333.

145. *Le Temps*, Jan. 2–3, 1895. *Cf.*, Eugène Bosdeveix: "La philosophie tomba aux mains des collectionneurs de petits faits, maîtres-queux de la cuisine expérimentale. . . . Mais la grande banqueroute arriva." *L'Angoisse*, pp. 57, 71. The free-swinging Max Nordau had another explanation: "The Jesuits invented the phrase 'bankruptcy of science,' and their pupils repeat it after them." He mentions Charles Morice, Louis le Cardonnel and Henri de Régnier as Jesuit pupils. *Degeneration*, trans., 9th ed. (New York, 1900), p. 114. *Cf.*, B. Guinaudeau, "La foi aux miracles," *La Justice*, Sept. 2, 1892.

146. Brunetière, "Après une visite au Vatican," reprinted in *La Science et la Religion* (Paris: Firmin-Didot, 1895). With notes on Berthelot's article "La Science et la morale." pp. 5–73.

147. *La Justice*, Jan. 3–4, 1895; *Le Constitutionnel*, Jan. 3, 1895; *L'Art et la Vie*, Feb. 1, 1895, 133–135.

148. Edouard Herriot, *Jadis* (Paris: Flammarion, 1948), I, pp. 110–114.

149. Wickham Steed, *Mes Souvenirs* (Paris, 1926), I, p. 54.

150. Victor Giraud, *Les Maîtres de l'Heure* (Paris, 1911), p. 101. J. van der Lugt, *L'Action religieuse de Ferdinand Brunetière (1895–1906)*, (Paris, 1936), pp. 58 f.

151. Brunetière, *La Science et la Religion*, pp. 12–15, 18–21.

152. *Le Figaro*, Jan. 3, 1895.

153. *La Justice*, Jan. 3–4, 1895.

154. *L'Echo de Paris*, Jan. 5, 11, 12, 15, 22, 1895.

155. *Revue scientifique*, Jan. 12, 1895, pp. 33–39.

156. Denys Cochin, "Du Rôle philosophique des sciences," *La Nouvelle Revue*, XCII (1 fév., 1895), 522–535.

157. Georges Fonsegrive, "Le Bilan de la science," *Les Livres et les Idées 1894–1895* (Paris, 1896), pp. 82–84.

158. Jean Jaurès, *Action socialiste* (Paris: Bellais, 1899), I, p. 275.

159. Berthelot, "La Science et la morale," *Science et morale*, pp. 1–6. René Ternois deems that by their "uncalled-for" replies Richet and Berthelot goaded Brunetière into taking a more extreme position than he had at first intended. *Zola et son Temps: Lourdes Rome Paris* (Paris, 1961), p. 587.

160. Berthelot, *Science et morale*, pp. 14 f. *Cf.*, "La Science idéale et la science positive," in Renan, *Œu. Comp.*, I, p. 668.

161. *Science et morale*, pp. 15, 19. Compare in "La Science idéale et la science positive": "un édifice caché derrière un nuage. . . . Cette construction est nécessaire, car chaque homme le fait à son tour, et construit à sa manière, d'après son intelligence et son sentiment, le système complet de l'univers. Mais il ne faut pas se faire illusion sur le caractère d'une telle construction. Plus on s'élève dans l'ordre des conséquences, et plus on s'éloigne des réalités observées, plus la certitude, ou, pour mieux dire, la probabilité diminue." *In* Renan, *Œuvres complètes*, I, p. 671.

162. *Science et morale*, 21–24, 34.

163. Brunetière, *La Science et la Religion*, p. 19, note.

164. Sully Prudhomme, *Que Sais-je?* (*Œuvres, Prose*, Paris, 1908), p. 4. Marcel Hébert, "Science et Religion," *Annales de philosophie chrétienne* (March 1895), 570–576.

165. Brunetière, *Figaro* article in *La Science et la Religion*, pp. 98–104.

166. *Science et morale*, pp. 36–39. *La Justice*, March 17, 26, 29, April 4.

167. *Revue scientifique*, April 13, 1895, pp. 466 f. Zola's talk reprinted in *Mélanges, Préfaces et Discours* (*Œu. Comp.*, XLVIII), p. 312.

168. *Le Temps*, April 6, 1895.

169. *Science et morale*, pp. 39–48.

170. *Le Gaulois*, April 5; *Le Soleil*, April 6; *Journal des Débats*, April 5; *Le Figaro*, April 4; *Le Temps*, April 5, 6; *Le Constitutionnel*, April 6; *Le XIX^e^ Siècle*, April 6, 7; *Le Siècle*, March 30, April 5; *Le Petit Journal*, April 3, 5: *La Petite République*, April 6; *Echo de Paris*, April 5, 6: *La Justice*, April 4, 6.

171. *La Justice*, April 6.

172. *Le Temps*, Jan. 2–3, April 5.

173. *La Justice*, March 29.

174. *Le Figaro*, April 5.

175. *Journal des Débats*, April 5 evening edition.

176. *Ibid.*, Jan. 2.

177. *Le Soleil*, April 6.

178. *Le Gaulois*, April 5. The article closes with the words: "Mais, à quand le banquet Brunetière?"

179. *La Justice*, April 7, 8, 9. *La Petite République*, May 11. *Le Figaro*, June 19, refers to Balfour's *Foundations of Belief* as showing the polemic was not limited to France.

180. *Bibliothèque universelle et Revue Suisse*, LXV (Feb. 1895), 375–378; (March 1895), 609–610; LXVI (May 1895), 378–380.

181. A. Darlu, "Après une visite au Vatican de M. Brunetière," *Revue de métaphysique et morale*, III (1895), 239–242. Another philosopher writing in the same review, F. Rauh, was more conciliatory. "Science Morale et Religion," *RMM*, III (1895), 367–374.

182. Darlu, p. 249.

183. Henri Bérenger, *L'Effort*, p. xii. Fonsegrive, *Essais sur la Connaissance* (Paris, 1909), pp. 112–130.

184. Alfred Fouillée, "L'Hégémonie de la science et de la philosophie," *Revue philosophique*, XLI (Jan. 1896), 2–5.

185. *Ibid.*, p. 15.

186. *Ibid.*, pp. 23–25.

187. Fouillée, *Le Mouvement idéaliste et la réaction contre la science positive* (Paris, 1896), p. v.

188. Curel's play, published in *La Revue de Paris* in 1895, performed by Antoine in 1899, presents science as the "new idol" to which human vivisection provides sacrifices! Brieux's play (1896) also attacks science on behalf of religion.

189. E. M. de Vogüé, *Le Roman russe* (Paris, 1886), p. xxxiii. Bourget, préface, E. M. de Vogüé, *Pages choisies* (Paris, 1912), p. xxix.

190. Lasserre, while supercilious about the Berthelot Banquet, has altered his attitude since *La Crise chrétienne*: "Pour nous modernes, la culture scientifique profondément comprise (et non comme au banquet de Saint-Mandé) . . . est et sera de plus en plus la culture humaine par excellence." *L'Art et la Vie*, IV (Dec. 1895), 661. Henri Bérenger vigorously assails Brunetière for his talk of "banqueroutes et faillites d'ailleurs imaginaires." Bérenger continues: "Si enfin il a beaucoup de clients, mais pas un disciple . . . c'est qu'il est autoritaire sans avoir la vraie autorité." *La France intellectuelle* (Paris, 1899), p. 42.

191. Zola, *Mélanges*, pp. 161–162. The words quoted are used in *Rome* where Zola writes also: "dire qu'elle fait banqueroute parce qu'elle ne saurait expliquer le monde d'un coup est simplement déraisonnable. . . . Elle ne peut faire banqueroute, car elle ne promet pas l'absolu, elle qui est simplement la conquête successive de la vérité." *Rome* (*Œuvres complètes*, XXXIII), pp. 674–675. *Cf.* René Ternois, *Zola et son temps*, pp. 560–561.

192. Zola, *Paris* (*Œuvres complètes*, XXXVII), p. 101.

193. *Ibid.*, p. 65.

194. *Ibid.*, pp. 185–188.
195. *Ibid.*, p. 370.
196. *Ibid.*, pp. 138, 550.
197. *Ibid.*, p. 519.
198. Ragner Sohlman and Henrik Schück, *Nobel Dynamite and Peace*, trans. B. and B. Lunn (New York, 1929), p. 227.
199. Zola, *Paris*, pp. 550 f.
200. *Ibid.*, pp. 183–184.
201. *Ibid.*, pp. 437–438.
202. *Ibid.*, pp. 571–577.
203. *Nobel the Man and his Prizes*, p. 91.
204. Roger Martin du Gard, *Jean Barois* (*Œuvres complètes*, Paris: Pléiade, 1955, tome I), pp. 325, 343–344, 346 f. On the "faillite de la science," *cf.*, pp. 524–525. Robert Jardillier rejects the notion that *Jean Barois* is a *roman-clé* in "Le Problème de la foi chez R. Martin du Gard . . .", Numéro spécial de la *Revue Arts et Livres*, no. 7 (1946), 87.
205. Reinach, *Histoire de l'Affaire Dreyfus*, IV, pp. 390, 402 f., 502 f.; VI, pp. 83, 123. Berthelot, *Science et libre pensée*, p. 141.
206. Alexandre Zévaès, *Jean Jaurès* (Paris, 1951), p. 139.
207. *Livre d'hommage des lettres françaises à Zola* (Paris: Société libre d'Edition des gens de lettres, 1898).
208. Reinach, *Histoire de l'Affaire Dreyfus*, III, p. 239 and n. 2.
209. Reinach, V, p. 21.
210. *Cf.*, Henri Guillemin, *Zola Légende et vérité* (Paris, 1960), p. 135, n. 28.
211. Reinach, II, p. 224; V, p. 133.
212. Fernand Gregh, *L'Age d'airain* (Paris: Grasset, 1951), p. 104.
213. Jean Giraudoux, *Bella* (Paris: Grasset, 1926), p. 27.
214. Berthelot, *Science et éducation* (Paris: Soc. franç. d'Imprimerie et de Librairie, 1901), pp. 68–69. *Cf.*, *Enquête sur l'Enseignement secondaire* prés. par M. Ribot (Paris: Chambre des Députés, 1899), I, p. 24.
215. Berthelot, *Science et éducation*, pp. 3–7.
216. *The Works of Leo N. Tolstoy*, trans. Leo Wiener (Boston, 1905), XXIV, p. 78 f.
217. *Science et éducation*, pp. 113–139, 247–283. *Science et libre pensée*, p. 253.
218. *Science et éducation*, p. 114.
219. Gregh, *L'Age d'airain*, pp. 45–46.
220. A. France, *Vers les Temps meilleurs* (Paris: Emile Paul, 1906), II, pp. 33–34.
221. Renan, *Œuvres complètes*, I, p. 861.
222. *Science et libre pensée*, p. 14.
223. *La Raison*, Oct. 1, 1905. *Le Siècle*, Sept., 1905.
224. Gregh, *L'Age d'airain*, p. 104.
225. Giraudoux, *Bella*, pp. 13–14, 19, 20, 21–22. Another novel in which Berthelot is remembered is Georges Duhamel's *Les Maîtres* (Paris: Mercure de France, 1937), pp. 38, 41, 124.
226. Léon Daudet, *Le Stupide XIX^e^ Siècle* (Paris, 1922), p. 12. Pierre Mauriac, *Aux Confins de la médecine, Nouvelles Rencontres* (Paris, 1930), p. 197.
227. Gregh, *L'Age d'Or Souvenirs d'enfance et de jeunesse* (Paris: Grasset, 1947), p. 155.
228. Léon Blum, *Œuvres*, III, pp. 235–242.
229. Gabriel Marcel, in *Les Nouvelles littéraires*, March 21, 1963, p. 1.
230. Gourmont, *Promenades philosophiques* (Paris: Mercure de France, 1908), II, p. 137.
231. *Science et Libre Pensée*, pp. 28–29.
232. Paul Bureau, *La Crise morale des Temps nouveaux* (Paris, 1907), p. 352.
233. Marcellin Berthelot, *Pages choisies*, direction F. Strowski, Le Florilège contemporain (Paris: Crès, 1923), p. 6.

A NOTE ABOUT THE AUTHOR

Reino Virtanen is a Professor of Romance Languages at the University of Nebraska. He received his Bachelor of Arts, Master of Arts, and Doctor of Philosophy degrees from the University of Wisconsin.

Professor Virtanen is the author of CLAUDE BERNARD AND HIS PLACE IN THE HISTORY OF IDEAS, University of Nebraska Press, and of articles and reviews in such publications as *PMLA, Symposium, French Review,* and the *Journal of the History of Ideas.*