FRANÇOIS MAGENDIE

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A BIOGRAPHY OF

FRANÇOIS MAGENDIE

FRANÇOIS MAGENDIE, M.D.

1783-1855.

A BIOGRAPHY OF

FRANÇOIS MAGENDIE

By PERCY M. DAWSON, M.D.

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Brooklyn-New York

ALBERT T. HUNTINGTON

MCMVIII.

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Biomedical

To

WILLIAM H. HOWELL,
JOSEPH ERLANGER,
ERNEST G. MARTIN,
and
AUGUST E. GUENTHER,

my dear colleagues in the seminary, this
little book is affectionately dedicated.

PREFACE

IN the year nineteen hundred and four the members of the Seminary of the Department of Physiology at the Johns Hopkins University devoted themselves to the study of the lives of several celebrated physiologists. At that time I undertook to prepare a paper on the life and work of François Magendie. After revision, this paper was published in the *Medical Library and Historical Journal* (1906, iv, pp. 45-56, 198-206, 292-306, 364-377; 1907, v, pp. 24-33). As the result of a suggestion of Mr. Albert T. Huntington, the editor of this Journal, some new material has been added to the biography and the whole is now published in the present volume.

To write a really complete and satisfactory biography of Magendie, one should have read far more extensively in the literature of the time than I have done; but as it may never be my lot to take up this study again, I have thought it best to publish the work just as it is, in the hope that it may be of interest to the reader and afford a point of departure for the more elaborate researches of some future biographer.

It is an agreeable duty for me to ackowledge with thanks my indebtedness to Dr. Robert Fletcher, of the Library of the Surgeon General's Office, for the loan of several books relating to Magendie; to Prof. Albert P. Brubaker, of Jefferson Medical College, Philadelphia, for some very interesting data concerning Megendie's life (p. 10) and for the medallion portrait (facing p. 34); to Mr. Huntington for the portrait (*Frontispiece*) of Magendie, and for much valuable aid in the preparation of the bibliography (see Appendix); to Dr. Henry M. Hurd, of the Johns Hopkins Hospital, and Miss Susan E. Coyle for many useful criticisms and suggestions.

PERCY M. DAWSON.

Johns Hopkins University, Baltimore, Md.,
October 19, 1907.

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BIBLIOGRAPHY

THERE are seven principal sources of information with regard to Magendie's life and work.

(1) "Fr. Magendie. Leçon d'ouverture du cours de médecine du Collège de France. (29 février 1856.)" 8vo. *Paris,* 1856. This address was delivered by Claude Bernard and to it was appended an incomplete list of the writings of Magendie.

(2) "Éloge historique de François Magendie, suivi d'une discussion sur les titres respectifs de Bell et Magendie à la découverte des fonctions distinctes des racines des nerfs." 8vo. *Paris,* 1858. This "Éloge" was delivered at the annual public meeting of the Académie des Sciences (Feb. 8, 1858) by Jean-Pierre-Marie Flourens, the permanent secretary of the Academy. Here also is given a list of Magendie's publications but it seems, however, to be only a copy of Bernard's list. The address was also printed in the *Gaz. méd. de Paris,* 1858, 3. s., xiii, 93-106. Both address and discussion were translated into English by C. A. Alexander and published in the annual *Report of the Smithsonian Institution,* 1866, 91-125.

(3) "Fr. Magendie" among the "Éloges lus dans les séances publiques de l'Académie de Médecine (1845-63)," by E.-F. Dubois, the permanent secretary of the Academy. Two volumes of these addresses were published in Paris in 1864, that on Magendie being in vol. ii, pp. 116-200. The address was also printed in the following periodicals: *Gaz. des hôp.,* Paris, 1857, xxx, 590-92; *Gaz. méd. de Paris,* 1857, 3. s., xii, 793-814; *Mém. Acad. de méd.,* Paris, 1858, xxii, pp. i-xxxvi; and *Rev. thérap. méd.-chir.,* Paris, 1858, pp. 24, 53 and 77.

Eyriés (Biog. universelle [Michaud] ancienne et moderne, Paris, xxiv, 31) and L. Herman (La grande Encyclopédie, Paris,

xxii, 994) seem to have derived their material from the three preceding sources, for their articles contain no additional information.

(4) *Journal de physiol. expér. (et path.)*, i-x, 1821-1830.

(5) *Comptes rendus hebdom. de l'Acad. des Sc.*, i-xlii, 1835-1856.

(6) Three letters received by Professor Brubaker, of the Jefferson Medical College, of Philadelphia. These were written respectively by the "Archiviste de la Seine," the "Conservateur de Père Lachaise," and the "Conservateur du Cimetière de Sannois," and were answers to enquiries made by Professor Brubaker.

(7) The works of Magendie himself.

For convenience the following abbreviations have been adopted in the foot-notes of this volume:

B = Éloge de Bernard (1).

C = *Comptes rend.*, etc. (5).

D = Éloge de Dubois (3).

F = " " Flourens (2).

J = *Jour. de physiol. expér.*, etc. (4).

The figures in parentheses found in the text refer to the titles of Magendie's publications as given in the Appendix.

FIRST PERIOD, 1783-1809

François Magendie was born on October 15, 1783, in Bordeaux. While he was yet an infant, his mother, Marie-Victoire de Peray-Delaunay, died of an acute illness. His father, Antoine Magendie,[1] originally of Bearne, was a surgeon, who in 1792 came to Paris bringing with him the little François, then only nine years old.[2] At that time there was in Paris but one all-absorbing idea, one topic of conversation, namely, social regeneration; and Antoine Magendie was soon among the foremost of the ultra-republicans. "A man of upright purpose,[3] but incapable of allowing any folly to pass without taking his share in it, he imagined that in order to endow his son with a civic energy corresponding to the elevation of his own principles, it was necessary to educate him according to the precepts delivered by Jean-Jacques.[4] The new Émile, left to his own devices, wandered at will, with a liberty which strongly resembled absolute abandonment. In order to preserve him from instructions which might warp his judgment, he was left, on principle of education, in complete ignorance. His only resource as regards the world of intelligence was observation, which alone, said his guide, could secure him entire *independence*.

"Finding, perhaps with reason, less difficulty in reforming abuses than in combating maladies, the enthusiastic patriot had abandoned a practice which only bored him, for the more congenial pursuit of unremunerative civic appointments.[5] With his

[1] Born at Pontaque, 1746, son of Laurent Magendie and Marie Cazajous; died at rue de Verneuil No. 32, Paris, May 17, 1813.

[2] It has been stated that Antoine Magendie married again and that the step-mother took but little interest in the young François. (*Med. Times and Gazette,* London, 1855, N. S., xi, 558 and 583.)

[3] Flourens. Unless otherwise stated the quotations in this chapter are from this authority (see Bibliography).

[4] Jean Jacques Rousseau: "Émile ou de l'Éducation," published in Paris and the Low Countries, 1662.

[5] Antoine Magendie was mayor of the tenth "arrondissement" and a member of the board of hospital administration, etc.—F., p. 134. The tenth "arrondissement" comprises the quarters Saint-Vincent de Paul, Porte-Saint-Denis, Porte-Saint-Martin and Hôpital-Saint-Louis.

practice went the comforts of the household, but what imported such a sacrifice as this? The exaggeration of patriotism and the reality of discomfort proceeded to such lengths that he would have constrained his pupil, while seeking to persuade him that this would be a further step towards independence, to make his own shoes. At this point the good sense of the boy revolted; he protested against all these follies: declared that he preferred to be dependent and well-shod, and concluded by asking to be sent to school.

"The primary school had no pupil more ardent; admitted late and endowed with an energetic will, the young Magendie quickly outstripped all competitors. His father was not at all shocked at the inequality which his son found the means of establishing from the first;... and clapped his hands on hearing that the great prize had been awarded to this neophyte of fourteen for a composition 'On the Knowledge of the Rights of Man and of the Constitution.'[6]

"The *Journal des Hommes Libres*[7] soon afterwards announced 'that there was still hope for the most tender age, when the corrupting poisons of the reaction had not blighted it in its first bloom, since the son of citizen Magendie, municipal officer, elector, member of the commune, etc., having met with a child who was weeping and dared not appear in the presence of his father, had comforted, encouraged and carried him back to the bosom of his family.' A *prix de vertu,* ostentatiously awarded on this occasion, completed the glorification of the young republican...

"According to the almost universal practice of those who preach liberty, the father of Magendie reserved the exclusive use of it for himself. He announced to his son that in order not to derogate from the family dignity, he must prepare to invest himself with the robe and bonnet of the doctor." Accordingly Magendie began the study of medicine, entering the Paris hospitals at the age of fifteen.[8] Through his father's influence he became a pupil of Alexis Boyer,[9] who was at that time second surgeon to the Charité and professor of clinical surgery at the École de Santé, an institution founded in 1795 by the élite among the physicians and surgeons of the capital. Boyer soon per-

[6] "De la connaissance des droits de l'homme et de la constitution."

[7] 5 germinal, an VI.

[8] This is the age given by Eyriés: "Magendie" in "Biographie universelle (Michaud) ancienne et moderne," Paris, xxvi, p. 31. Sixteen years is the age given by the *Med. Times and Gazette,* loc. cit.

[9] Le baron Alexis Boyer (1757-1833).

ceived the young man's worth and made him his prosector. Later, at the examination which took place on "7 Floréal, An XI"[10] (1803), he obtained an appointment as hospital interne. In this new position he continued his labors with characteristic energy and zeal.

With his medical studies he now combined literature, for since he had been taught none of the ancient languages he was desirous of supplying this deficiency. This he did by means of the excellent courses given by M. Lemare, which were attended by some of his most distinguished contemporaries.

The salons which the storm of the revolution had temporarily closed had now opened again. There "through the memory of a common calamity, all were friends" and there Magendie "was received as a young man of taste and worth, and there he dissembled, with truly Roman stoicism, the distress of his situation. 'Yet,' as he himself would jocosely say in aftertimes, 'during a period which seemed no short one, there remained for me, all deductions made, not more than five sous a day to live upon; and still I had a dog. We shared with one another; and if he was not fat, neither was I.'"

In the course of time Magendie became assistant and then, after a brilliant examination, prosector to the Faculty. "His dexterity as an anatomist, his coolness, his hardihood, gave presage of a superior surgeon." "For a while he gave courses in operative surgery, which were well attended. He even devised a new operation for the resection of the lower jaw."[11] "But the life of compulsory fellowship, of equality reduced to practice, the contact of rivalries never divested of the weapons of attack, proved an intolerable ordeal for his austere and imperious nature." It has also been stated that he was about to compete for the post of surgeon at the General Board of the Paris Hospitals but was induced to abandon the idea by Dupuytren[12] who considered him a dangerous rival.[13] However this may be, Magendie renounced his intention of becoming a surgeon.

He brooded with so melancholy a spirit over the obstacles

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[10] D: p. 122.

[11] B: p. 18.

[12] Baron Guillaume Dupuytren, born in 1777, became in 1803 second surgeon at the Hôtel-Dieu and in 1815 surgeon-in-chief. In 1811 he became professor of anatomy in the École de Médecine, an institution founded in 1795 for the purpose of training surgeons for the army.—Richeraud: Biog. univers. Michaud, xii, p. 60. Paris, 1855.

[13] *Med. Times and Gazette,* loc. cit.

before him that his retreat was invaded by that bitter discouragement which long suffering entails—Magendie wished to live no longer. One morning, however, a lawyer presented himself at the asylum of the student. "Why," cried the young man in surprise, "I have neither lawsuit nor business, what do you want with me?" "Nothing," replied the stranger, "that can be disagreeable to you. You have become heir to a sum of twenty thousand francs, and I am here to place it at your disposal." All at once the good spirits of Magendie returned; he "immediately made arrangements for the acquisition of pretty horses and attractive dogs, all placed in the care of a sprightly and fashionable groom, who was charged besides with the duty of keeping a light equipage always in readiness for the use of the improvident but joyous owner of these superfluities. That not a moment of this transient prosperity might be lost, and at the same time no encroachment upon his work be allowed, he had all of these paraphernalia lodged as near as possible to the hospital. 'Thither,' said M. Magendie afterwards, 'I used to run when I had a moment to spare, so that my whole recreation was literally centered in the stable.' The twenty thousand francs were, of course, soon spent, but a little relaxation does much good; it had renewed the elasticity of his spirit."

His money gone, Magendie found it necessary to become a practicing physician "in spite of himself."[14] In 1808 he received his doctorate, his inaugural dissertation being on fracture of the cartilage of the ribs and on the movements of the palate (1) Doubtless a rather unique figure among the physicians of his or indeed of any time, he refused to bow before what he called the "the great idol of human credulity."[15] But as yet Magendie's notions had little weight in the medical world and moreover he soon gave himself almost entirely to the science of his choice, experimental physiology.

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[14] F: p. 11.

[15] "La grande idole de la crédulité humaine."

SECOND PERIOD, 1809-1821

Vitalism.

THE question, What is life? has been answered in two different ways. "On the one hand[16] stand the vitalists, who see in the phenomena of life only special actions, having no relation to the usual laws of chemistry and physics but accomplished through a peculiar force called life, vital force, and so forth; on the other are the materialists, iatro-mechanicians, or chemists as they have been variously styled, who see in these manifestations of life nothing but the phenomena of ordinary chemistry and physics subject to the ordinary laws which govern these phenomena outside the organism.

"In France at the beginning of the nineteenth century, medicine and physiology were dominated by the anatomico-vitalistic ideas of Bichat which were then reacting against the iatro-mechanical and chemical theories of Borelli, Sylvius de la Boe, Boerhaave and others." Bichat, "a man of astonishing genius, physiologist-anatomist *par excellence,* created general anatomy and at the same stroke anatomical physiology.... In his 'General Anatomy'[17] he tried to realize a vast conception which consisted in reducing, just as in the recently established field of chemistry, anatomical tissues and physiological phenomena to certain simple elements." He attributed "all the functions of life to those peculiar properties of each living tissue, which he designated under the name of vital properties, as distinct from physical or chemical properties... 'There are in nature,'[18] said he, 'two classes of objects, two classes of properties. The objects are organic and inorganic, the properties are vital and non-vital. Sensibility, contractility, these are vital properties. Weight, elasticity, affinity, these are non-vital properties.' To each of the systems of anatomical tissues correspond certain definite vital properties, and each phenomenon of life has necessarily, as its origin, a vital property which is only the functional manifestation of the tissues..."

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[16] B: p. 3 *et seq.*

[17] Anatomie générale, appliqué à la physiologie et à la médicine. *Paris,* 1802, 2v. 8vo.

[18] B: pp. 5-6.

"Such a generalization in which everything was united by logical deduction, anatomical structure and vital property, physiological and pathological phenomena, was well calculated to seduce and enthral all minds...But Bichat died," in 1802, "having hardly had time to deliver to posterity the fruits of his genius, and his immediate successors, launched on this slippery declivity of anatomical deduction, contented themselves with their creations of systems; and experimentation, which can alone permit us to decide the question and prevent us from error, was lost to view. Not only the system of exhaling vessels, the vital properties of sensible, organic and animal contractility and so forth were accepted as realities, but the imagination, always aided by some sort of logic the better to captivate the reason, had invented a horde of other properties still more imaginary. Finally everyone wished to have a special vital force for the least phenomenon of the organism, and by this tendency all physicians were blindly carried away."

Such was the condition of physiology in France when in 1809 Magendie's first publication appeared, under the title of "Some general ideas upon the phenomena peculiar to living bodies" (2). Cool, unenthusiastic, skeptical, Magendie was not drawn into the common whirlpool, and this first publication was a severe criticism of the "vital properties" of Bichat, "especially the strange abuses which his successors had made of them in multiplying them *ad infinitum*. 'Why then,' said he, 'is it necessary in respect to every phenomenon of the living body to invent a peculiar and special vital force? Cannot one be content with a single force which one could designate *vital force* in a general way, while admitting that it gives rise to different phenomena depending on the structure of the organs and tissues which function under its influence? But is not this single vital force still too much? Is it not an hypothesis pure and simple, inasmuch as we are unable to perceive it? And would it not be more advantageous if physiology began only when the phenomena of the living body became appreciable to the senses?'"[19]

Surrounded by a carnival of rampant speculation, Magendie developed an extraordinary repulsion for all theories. When any one spoke to him of medical doctrine or theory, he showed instinctively a feeling of horror. It produced upon him the effect of a false note upon the trained ear of a musician. His reply was always the same. "All that," he used to say, "is nothing but

[19] B: pp. 7-8.

words !"—"To express an opinion, to believe," wrote Magendie, "is nothing else than to be ignorant... One could with justice say to you 'You believe, therefore you don't know.'" [20]

Early Writings.

Magendie now began to show a prodigious activity. Within the next five years he published seven memoirs, four of which were read before the Academy. In these the author dealt with a great variety of topics. In his study of the organs of absorption in the mammalia (3) he demonstrated by means of a series of ingenious experiments the power of the veins to absorb poisons injected into the tissues. He showed that the stomach was not necessary for the act of vomiting (6) and that swallowing might take place without the aid of the epiglottis (9). The remaining memoirs were on pulmonary transpiration (5), on examination of images in the fundus oculi (7), on emetics (8), and on the function of the œsophagus (10).

Consequently, when in 1814 Magendie, who had been twice designated by the conscription, was again summoned, the Academy interposed in view of his prospective services and requested his exemption. This was accordingly granted by a special decree dated March 5th of that year. "You owe this favor," wrote M. de Motalivet, Minister of the Interior, "to the success which you have achieved in the sciences, and I doubt not that you will redouble your efforts to render yourself more and more worthy of it." [21] Magendie soon showed that the confidence of the Academy had not been misplaced.

Before 1821, the year in which he became an academician, Magendie published nine more monographs. In one of these (13) he showed the necessity of the presence of nitrogen in the food and emphasized the importance of a varied diet. From his study of the circulation (16), he concluded that those persons are in error who affirm that the arteries possess the power of independent rhythmic contractility.

The monographs on the deglutition of air (12) and on the mechanism of absorption in the mammalia (24) were among those read before the Academy. There was also a paper on the lymphatics of birds (21) and another on the gases in the human intestine (14). In the investigation of ipecacuanha (15) which Magendie carried out in company with Pelletier, emetin, the active principle of the drug, was discovered, and his interest in pharma-

[20] J.

[21] D: p. 125.

cological problems was further shown by three other memoirs on strychnia (22), on the salts of morphia (18) and on hydrocyanic acid in the treatment of phthisis (20). During this period Magendie also published three books through which he soon obtained an international reputation.

The first of these was his "Text-book of Physiology" (11), a work which appeared in two octavo volumes, containing so much good sense and sound science that even to-day they are found attractive reading. The attitude of the author and the object which he had in view may be gathered from the preface, some passages of which run somewhat as follows:[22]

"The physical sciences, with scarcely a single exception, were systematic until the time of Galileo and Bacon. From that period, and in a great degree from the influence of the writings of the illustrious Bacon, they have undergone a most salutary change. From being systematic and synthetic, they have become theoretic and analytic; and from that period their march towards perfection has been extremely rapid.

"It is unpleasant but it is at the same time necessary to remark that in the midst of this general progress of the sciences, physiology, that important branch of human learning, still retains its systematic form." "What is the consequence of all this? —It is that physiology, brilliant as it appears in our modern treatises and notwithstanding the improvements which it has derived from the talents of many distinguished men, is a science still in its cradle."

Further on he continues: "One will especially find in this book facts, the truth of which I have done all in my power to establish as definitely as possible, by observations upon man in a healthy or morbid state, and by experiments upon living animals."

"In concluding it is proper to remark that this book is solely designed for students of medicine. If they find here, in terms clear and simple, all that is positively known of physiology, I shall have accomplished the object which I have proposed to myself."

This work was deservedly popular. Between 1817 and 1836 it went through four editions in Paris. Between 1822 and 1844 there appeared three American editions; while two German translations were published in Tübingen in 1826 and 1836, respectively.

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[22] Précis élémentaire de physiologie. Paris, 1816. Vol. I, p. ii *et seq.*

The second book, published in 1818, was the first edition of his work on "Gravel and Its Treatment" (17). This was subsequently translated into German and Dutch. In it Magendie called attention to the fact that most gravels and many stones are composed of uric acid, a substance rich in nitrogen, whence he concludes that a diet poor in nitrogen is the proper one for persons suffering from these maladies.

Lastly may be mentioned the publication two years later of the famous "Formulary" (23), in which he discussed the action and preparation of a large number of drugs which were at that time new or almost new to the profession. Among these were strychnia, morphia, iodine, potassium iodide, prussic acid, veratria, sulphate of quinine, croton oil, and so forth. The popularity of this work is attested by the many translations and editions which have appeared, namely: Paris, 7 editions; Amsterdam, 1; Leipzig, 1; London, 3; Philadelphia, 2; New York, 2; Milan, 1; Pesaro, 1; and Fahlun (Sweden), 1.

The Prize in Experimental Physiology.

Meanwhile Magendie's intense aversion to all hypotheses, together with his devotion to the experimental method, seems to have won for him the friendship of the great Laplace.[23] The latter "wished that all science should consist of nothing more than an assemblage of facts rigorously concatenated; and having, according to the happy expression of Cuvier, *'subjected the heavens to geometry,'* he probably did not despair of establishing the same order of things on earth." [24] Indeed, Laplace had maintained before the Academy that the two sciences most worthy of the attention of great minds were physiology and astronomy, and added, "If I put physiology in the first place, it is not only because it still awaits its Newton."[25] Magendie, "confident in his own strength, held himself aloof with a disdainful pride" from his contemporaries. "But one day the illustrious, the stiff, the judicious Marquis de Laplace volunteered the first advances toward him," and at the few words of encouragement which fell from the lips of this great man, Magendie, "who thought himself secure from all enthusiasm, was only the more carried away by it."

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[23] Pierre Simon, Marquis de Laplace, 1749-1827. Became professor of mathematics at the military school in Paris, and in 1773 member of the Academy of Sciences. Best known as an astronomer and geometrician.

[24] F: p. 21.

[25] Dedication of "Recherches sur les ossements fossiles."

"It was not long after this that Laplace said to his old friend Montyon:[26] 'It is greatly to be regretted that learned societies have not at their disposal the means of sustaining the zeal of enquirers who have established themselves in the right method of procedure: the young Magendie, for instance, who gives to his physiological labors the invariable basis of experiment, deserves to be encouraged.' 'Are not your own exhortations the most powerful encouragements?' was the reply. 'They are not sufficient,' answered Laplace; 'for those who aspire to reach our academies there should be graduated approaches, which would consist of competitions and prizes.' The prize for experimental physiology was thereupon established [27] by the aged philanthropist and Magendie was the first to be distinguished by it." [28]

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[26] Antoine-Jean-Baptiste-Robert-Augat de Montyon, 1733-1820, became councillor of state in 1775. He lived for many years in England and became a member of the Royal Society. He was devoted to the king, with whom he returned to Paris.

[27] This foundation received the authorization of the king, July 22, 1818.

[28] F: p. 28.

THIRD PERIOD, 1821-1855

JOURNAL AND CONTROVERSY.

The Journal of Experimental Physiology, 1821-1831.

In Paris during the early part of the last century many new medical and scientific periodicals were added to the considerable number already in existence. The facilities for the publication of work in physiology and experimental medicine seem to have been excellent, and Magendie at first availed himself of them. He contributed to the *Journal Universel des Sciences Médicales,* the *Nouveau Bulletin de la Société Philomatique,* the *Annales de Chimie et de Physique,* the *Nouveau Journal de Médecine, etc.,* but chiefly to that famous periodical edited by Boyer, Velpeau and Leroux in which five of Magendie's monographs appeared. There was, however, at that time no journal devoted exclusively to experimental medicine, and probably it soon appeared to Magendie that there was room for such a publication. Be this as it may, in June, 1821, appeared the first number of his *Journal de Physiologie Expérimentale,* or, as it was subsequently called, *Journal de Physiologie Expérimentale et Pathologique.**

From the title-page of this new journal we learn that at this time Magendie was physician of the central bureau of admissions to the civil hospitals and infirmaries in Paris[29], member of the Philomathic Society, of the Société Médicale d'Emulation, and also member of the medical societies of Stockholm, Copenhagen, Wilna, Dublin, Philadelphia,[30] etc.

The introduction to the first number, which is here partly quoted and partly paraphrased, runs as follows: "The two cen-

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* *Journal de Physiologie Expérimentale et Pathologique* is the title of vols. II to X inclusive.

[29] Magendie received this appointment July 18, 1818.

[30] To this list were added, in 1824, member of the Royal Medical Society of Edinburgh, and the Reale Accademia dell' Scienze di Torino, and, in 1827, Physician to the Hôspice de la Salpêtrière and Consulting Physician to the Col. royal de Henri IV. In the first few vols. the address of the editor is given, "Rue de Seine, No. 30."

turies which have just closed have seen the birth and growth of the physical sciences. The task of the early discoverers was two-fold. In the first place they had to make the actual discoveries, and in the second they had to overcome the prevailing prejudices. Experimental physiology began with the discovery of the circulation of the blood in the seventeenth century, but it has not progressed with the same rapidity as astronomy, physics and chemistry, perhaps because in this field there have been no geniuses such as Galileo or Newton, perhaps because popular prejudices have been stronger here than in the case of the physical sciences.

"What subject indeed is more fertile in gross errors and absurd beliefs than that of health and disease? Consider the painful disquietude you would produce in the minds of the majority of men if you said to them: *'There are no such things as rheumatismal humour, gouty humour, scabby virus, venereal virus, and so forth. Those things which are so designated are imaginary things, which the human mind has created to hide from itself its own ignorance.'* The chances are that you would be taken for a lunatic just as it but recently befell those who maintained that the sun was immovable and that the earth turned.

"Having taught this science [Physiology] for fifteen years, cultivating it through choice, and having resolved never to separate it from practical medicine, because I regard it as the best guide to follow in a great number of maladies, I believe that I would be doing something useful in publishing a periodic work designed to contain all facts which tend to throw light upon the history of man in health and in disease. I shall receive therefore with acknowledgment and place in the collection which I now announce, all physiological work, all medical researches which, based on precise observations, exact experiments and controlled by a spirit of severe impartiality and love of truth, appear to me to be suitable for illuminating the phenomena of life.

"One advantage which distinguishes the majority of journals devoted to the physical sciences is that they are edited by savants who strengthen such publications by enriching them with their own discoveries, and who are therefore at the same time more competent to judge the work of others. The works which I have published in medicine and physiology give me, perhaps, some claim to the confidence of the public.

"The *Journal de Physiologie Expérimentale* will consist of four numbers per annum, which will appear regularly every three months. Each number will contain six sheets in octavo, more

if the material be abundant. Plates will be added when deemed desirable. Subscription, 12fr. per annum."

By way of "enriching" the journal "with his own discoveries," Magendie contributed thirteen articles to the first volume. Some of these, however, were only reprints of his former publications, added, doubtless, to complete the "six sheets in octavo." Such padding soon became unnecessary and the editor's articles became fewer and fewer. That the number should have fallen off is not surprising. Indeed it seems wonderful that he could have found time to contribute at all, since he systematically verified all results of experiments sent to him for publication, as would appear from a foot-note in one of the early numbers of the journal in which he asks his contributors to send in their articles at least one month in advance that he might have time to verify the principal experiments before sending their accounts to the printer.[31] Moreover, Magendie's literary activity was not confined to editing his journal. He re-edited Bichat's "Researches on the Phenomena of Life and Death," 1822, (36) and his "Treatise on the Membranes," 1827, (60) both with commentaries. He also re-edited, with considerable additions, his own book on gravel (1828). In 1825 he published with Desmoulins an "Anatomy and Physiology of the Nervous System" (52). In 1823 and 1828 appeared his two memoirs, on the Nervous System, and on the Brain, and finally, the second edition of his Text-Book and the second to seventh editions of the Formulary.

Thus founded, the *Journal de Physiologie Expérimentale* led a flourishing existence for eleven years. Kergaradec's celebrated memoir on the auscultation of the fœtal heart appeared in the second volume, while among the best known contributers were Andral, Breschet, Velpeau, Poiseuille, Flourens and Bernard. Financially, the journal met with " a success," wrote Magendie,[32] "which I had hoped for only with time; I had even deposited the funds necessary for supporting it for several years. But this precaution was needless; with the second number the expenses were covered. I am doubtless very much flattered by this result, but I also sincerely congratulate the friends of science, especially those who wish to see medicine depart from that state of imperfection in which it has been up to our day, and in which many persons through prejudice or other less excusable motives are induced to maintain it." He adds: "I have never

[31] J: I, p. 101.
[32] J.

intended that this publication should be of the nature of a financial speculation; I have devoted the profits to perfecting the work."

It would be tedious to give even in outline the contents of Magendie's numerous contributions to the *Journal,* tedious even to give in full their titles, for there were twenty-six of them, not counting editorials and reports; but for the purpose of emphasizing the wide range of his investigations, an enumeration of some of the subjects treated will not be unprofitable.

There were five articles[33] on human and comparative anatomy, six[34] on the special senses and peripheral nerves, eight[35] on the central nervous system, six[36] on the physiology and surgery of the circulation, six[37] on clinical medicine and therapeutics, two[38] on hydrophobia and, finally, a description[39] of two new sorts of gravel. There is also one series of articles which is worthy of especial attention, for not only were the experiments therein described of extraordinary importance, but their publication gave rise to a well-known and rather bitter controversy. The discussion of this topic will, however, be reserved for a separate sub-section.

The Bell-Magendie Controversy, 1822 and 1847.

In the third number of Volume II of his *Journal* occurs one of Magendie's most noteworthy contributions to physiology, namely, his article on the functions of the spinal nerve roots (40).

"For a long time," he writes, "I had wished to perform the experiment of cutting the anterior and posterior roots of the nerves arising from the spinal cord of an animal." Having secured a litter of pups Magendie laid bare the cord. "I had then before my eyes the posterior roots of the lumbar and sacral pairs, and, raising them up successively on the blade of a pair of small scissors, I cut them on one side. . . . I reunited the wound by means of a suture through the skin and observed the animal. I thought at first that the member corresponding to the cut nerves was entirely paralyzed. It was insensitive to pricks and to the strongest compression; it also appeared to me to be immovable; but soon, to my great surprise, I saw it move perceptibly, although sensibility was always entirely absent. A

[33] See Appendix: 28, 29, 33, 34, 38.
[34] *Ibid.:* 40, 41, 49, 50, 54, 65.
[35] *Ibid.:* 25, 45, 46, 47, 51, 53, 61, 67.
[36] *Ibid.:* 24, 26, 30, 31, 32, 63.
[37] *Ibid.:* 35, 37, 55, 58, 66, 68.
[38] *Ibid.:* 27, 48.
[39] *Ibid.:* 59.

second and a third experiment gave me exactly the same result. I began to regard it as probable that the posterior roots of the spinal nerves might have different functions from the anterior roots, and that they were particularly designed for sensibility."

Then, with considerable difficulty, Magendie succeeded in cutting the anterior roots. "As in the preceding experiments, I made the section on only one side. . . . One can imagine with what curiosity I followed the effects of this section. The results were not doubtful; the member was completely immovable and flaccid, although it preserved an unequivocal sensibility. Finally, that nothing might be neglected, I cut at the same time the anterior and posterior roots; there was a complete loss of sensation and motion. . . ."

"I am following up these researches, and will give a detailed account of them in the next number. It is sufficient for me to be able to affirm to-day as positive, that the anterior and posterior roots of the nerves which arise from the cord have different functions; that the posterior appear to be more particularly devoted to sensibility, while the anterior appear more especially associated with movement."

As promised by Magendie, the next number contains a second article on the same subject, entitled, "Experiments on the function of the roots of the nerves which arise from the spinal cord."(41) In this communication the author states that, having become curious to know what the effect of cutting the dorsal or ventral roots would be upon the convulsions caused by strychnia, he proceeded to decide the question by means of experiments. These consisted in unilateral section of one or both sets of the nerve roots supplying the hind leg. As might have been expected, in the leg of which the dorsal roots had been cut, the tetany was just as complete and intense as when these roots were left intact; while, on the other hand, in the leg of which the ventral roots had been cut, the muscles remained lax and motionless.

The publication of these articles at once gave rise to what is known as the Bell-Magendie controversy, for it was asserted that Magendie had done no more than confirm and elaborate the experiments already performed in England by Sir Charles Bell.[40] The basis of the claim made for Bell was a pamphlet printed by

[40] John Shaw stated that M. Magendie "corroborated some experiments which had been previously made in this country; but of the performance of which M. Magendie does not appear to have been aware."—*London Med. and Physical Journal*, 1822, xlviii, p. 343.

him in 1811 and entitled, "Idea of a New Anatomy of the Brain, submitted for the observations of his friends."[41] This work was never intended for general distribution, but was privately circulated among Bell's friends. In it the author described the following experiment:

"On laying bare the roots of the spinal nerves, I found that I could cut across the posterior fasciculus of nerves, which took its origin from the posterior portion of the spinal marrow, without convulsing the muscles of the back; but that on touching the anterior fasciculus with the point of the knife, the muscles of the back were immediately convulsed."[42]

From this experiment Bell concluded that the dorsal and ventral roots have different functions, but in the nature of these functions he was mistaken, for he supposed that upon the ventral roots depended not only motion but also sensation, while to the dorsal roots he attributed the function of control of the growth and sympathies of the parts.

In the interval between his first and second communications, Magendie had been made aware of the existence of this pamphlet, and consequently he was able to add to his second article the extract from Bell's work which has been quoted, and concluded with the following comment with regard to it: "M. Bell, led by his ingenious ideas regarding the nervous system, has been very near discovering the functions of the spinal roots."[43]

The dispute never took on an international character, for although the claim of Bell was taken up in England with considerable vim and venom by John Shaw, one of Bell's pupils, several English authors gave unqualified preference to the claim of Magendie. Mayo,[44] for example, wrote in his text-book, "Mr. Bell was carried by his experiments very near the truth, but he failed at that time to ascertain it. . . . Before Mr. Bell published any other account of the function of these nerves, Magendie had given to the world the true theory of their uses." Magendie himself appears to have preserved a dignified silence, a silence which was, however, misinterpreted even by some of his colleagues, as will now be shown.

On February 22, 1847, Flourens read before the Academy a "Note concerning the effects of the inhalation of ether upon the

[41] *Lond.*, [*1811*]. 36 pp. 8vo.

[42] *Loc. cit.*, p. 22.

[43] J: 1822, ii, p. 371.

[44] Herbert Mayo. "Outlines of Human Physiology. 3 Ed. London, 1833, p. 255. See also: *Med. Times and Gazette,* London, July-Dec., 1855, N. S., xi, p. 558.

medulla oblongata."[45] At the conclusion of the paper Magendie arose. "Our honorable colleague,"[46] said he, "attributes to Sir Charles Bell the discovery of the functions of the spinal nerve roots. . . . It is not without great surprise that I hear him express himself in such a positive manner. . . . If I did not know of his good will, I might be mistaken with regard to his intentions. . . . I beg M. Flourens that when he prints his memoir he will indicate precisely the works of the English physiologist in which the discovery in question may be found described. This is not, I think, too much to require of the impartiality of our colleague."

"In stating that the discovery belongs to Bell," replied Flourens, "I merely followed the common opinion. . . . No one would be more happy than I, could I proclaim that one of the most beautiful discoveries in physiology belongs to France."

"I know," returned Magendie, "that several works on physiology couple the name of Sir Charles Bell with mine . . . but M. Flourens goes very much farther in denying me all participation in the discovery. . . . No doubt M. Flourens has not spoken without having proofs before him. . . . When he has made these known, I shall discuss them. . . . Until that time I maintain that Sir Charles Bell was a complete stranger to the discovery; I declare that my colleague is ill-informed, and his assertions not at all exact."

Flourens replied[47] that he would present his proofs at the next meeting of the Academy and added that Magendie could without doubt refute them since he, Flourens, had based his opinion largely on the attitude of Magendie himself.

Accordingly, on the following Monday, March 1, 1847, Flourens opened the discussion with these words:[48] "I beg the Academy to note carefully that I do not seek proofs against my honorable colleague, I seek only to justify my own opinion. . . . In 1833, in the *Journal des Savants,* I expressed myself thus: 'That which we call a nerve is a very complex structure; the simple structure is the nerve fibre. . . . It is only in these fibres that the properties are shown to be distinct and isolated.

" 'It is this which is really the great conception which dominates all the work of M. Bell; it is his experimental analysis,

[45] Note touchant les effets de l'inhalation de l'éther sur la moelle allongée; *Compt. rend. Acad. d. Sc.,* Paris, 1847, xxiv, p. 253.

[46] *Loc. cit.,* p. 258.

[47] *Loc. cit.,* p. 259.

[48] Sur la découverte de siège distinct de la sensibilité et la motricité; xxiv, 316. *Loc. cit.,* p. 316.

which was not confined to the nerve, but reached successively each of the primitive elements of the nerve, which is the source of all those results . . . with which he has enriched physiology. . . . But on the one hand M. Bell relied too much upon conjectures and deductions drawn from anatomical facts alone. . . . On the other hand he relied too little upon experiment; and thus it is through lack of being sufficiently eager to resort to experiment that he has allowed a French physiologist, M. Magendie, to share with him the glory of one of his most beautiful discoveries, that of the distinct function of the posterior and anterior roots.' That is what I thought, that is what I wrote in 1833. But in 1842 an event occurred which had a great influence on my opinion.

"In 1842 the Academy awarded the prize in experimental physiology to M. Longet, for four memoirs . . . one of which bore the title: 'Memoir on the functions sensory and motor of the columns of the cord and of the roots of the nerves which arise from them.'[49] In this memoir, M. Longet . . . attributed . . . the honor of the idea of the distinct function of the . . . roots . . . to M. Bell: he attributed to himself . . . the merit of the first . . . decisive experiments. Why did not M. Magendie speak?[50] . . . If he had said 'Those are my experiments,' . . . the committee would have paused. His silence was the first cause of my error.

"There is nothing more in favor of M. Bell except a single fact . . . the following passage in a memoir . . . published in 1811: . . ."[51]

Magendie then spoke[52]: "The . . . facts which our honorable colleague has just cited appear to me to be exact, only he interprets them in a manner which I cannot allow. If . . .I have kept silence during the affair which has just been recalled by my colleague, no one could have interpreted it as a sort of abandoning of my claim; for the report made to the Academy . . . ran verbatim 'that I believed that I ought to decline, as I could not be judge and party in questions in which I myself was much concerned.' I pass on now to the works of M. Bell. . . .

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[49] Mémoire s. l. fonctions sensoriales e. motrice d. cordons d. l. moelle épinière e. d. racines d. nerfs qui en émanent.

[50] The members of this commission were Magendie, Duméril, Becquerel, Flourens and de Blainville.

[51] This was the passage already quoted. Cf. footnote [42].

[52] *Compt. rend. Acad. d. Sc.*, Paris, 1847, xxiv, p. 319.

"It was I who first made them known in France. I analyzed them in my *Journal de Physiologie.* I have set forth their originality. . . . Charles Bell had before me, but without my knowledge, the idea of cutting separately the spinal roots; he had likewise the merit of discovering that the anterior influences muscular contraction more than the posterior. . . . With regard to the establishment of the fact that these roots have . . . distinct functions, that the anterior preside over the movements and the posterior over sensation, that discovery belongs to me . . . and ought to remain as one of the columns of the monument which the physiologists of France have raised since the beginning of the century."

THE ACADEMY, 1821-1855.

Already in 1819 Magendie had been elected a member of the Academy of Medicine and now on November 19, 1821, he was called, largely, it is said, through the influence of Laplace, to fill the chair in the Academy of Sciences left vacant by the death of Corvisart.[53] Of the latter body, of which he was president during 1837, Magendie continued to be an active member for the next thirty-five years.

As much of the work of the Academy was performed by special committees elected from among its members, it was as a member of such committees that Magendie played a prominent rôle.

Committees for Verification.

The various activities with which the Academy was busied at that time might roughly be classified under four heads. In the first place the custom prevailed of appointing committees to inquire into the truth of papers presented before the Academy. Thus the half-dozen memoirs which Magendie himself had read before the Academy had been passed upon by committees made up of Cuvier, Humboldt, Pinel, Percy, Halle and Thenard; and now that Magendie had become an academician, it fell to his lot to examine many of the communications made by others. This often entailed a great deal of labor, for the more important experiments described by the authors had to be repeated and their truth or error demonstrated. But Magendie entered into this

[53] See Adhémard Lecler, "Académie des Sciences," in *La grande encyclopédie,* Paris and Leipzig, Vol. I, p. 205. Desmarets-Jean-Nicholas Corvisart (1755-1821) became, in 1797, Professor of Medicine at the Collège de France; later, physician to Napoleon, and in 1811 a member of the Académie des Sciences.

work with such unusual zeal that he was often carried far beyond the limits of simple verification, and his reports to the Academy often bore the character of independent researches.

Committees on Prizes.

A second branch of academic committee work was the examination of the claims of competitors for certain prizes. The latter had been founded by various philanthropic persons and to the Academy had been given the privilege of awarding them. This it did upon the recommendation of special committees of academicians elected by ballot. Those prizes in which Magendie was especially concerned were the following:

1. The prize in experimental physiology, founded by Baron Montyon. To this reference has already been made. It consisted of a sum of 900 fr. and was awarded annually "for the best contribution to the progress of experimental physiology, printed or written."

2. The prize in medicine and surgery;[54] also a Montyon foundation. This prize—or rather these prizes—aggregated a considerable sum, amounting sometimes to as much as 17,000 fr. It was distributed annually among several competitors in amounts proportionate to their respective merits.

3. The great prize in the physical sciences, a medal and 3,000 fr., awarded by the Academy at intervals of several years.

Exactly how many times Magendie served on these committees is uncertain, but from the time that the proceedings of the Academy began to be regularly published (1835), Magendie's name was never absent from any of them until his death in 1855.[55] He served twice, moreover, as one of the five judges of the Montyon prize "relating to the means of rendering an art or trade less unhealthy," and twice on the committee for awarding the Manni prize for the best contribution to the subject of apparent death, and also in the case of many special prizes offered but once, or perhaps but for a few times by enthusiasts who desired to be the means of contributing something to human knowledge with respect to certain subjects of special interest to themselves.

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[54] "For the authors of the works or discoveries most useful to the art of healing."—*Compt. rend. Acad. d. Sc.*

[55] A note in the *J. d. physiol. expér. e. path.* (1828, vii, p. 136) states that Magendie was one of the committee on the prize in medicine and surgery for the preceding year.

The Gelatin, Hippiatric and Other Commissions.

Thirdly, the Academy frequently elected committees for the purpose of arbitration or research, or elected representatives upon the commissions which were from time to time formed under various departments of the government.

Magendie was frequently called upon to take part in this sort of work and among the commissions of which he was a member may be mentioned the following: The commission established by the Minister of Public Instruction in which Magendie was associated with MM. de Cardaillac, Professor of Philosophy, and Letronne, Inspector-General of Studies, which had for its object the investigation of the new method of teaching children to read proposed by M. Laffore.[56] Later, at the request of the same ministry, he took part in the proceedings of the committee for considering the advisability of sending a physician to Germany to study the methods of treatment employed at the various watering places in that country.[57] There were also the commissions to note the effect on sheep of large doses of arsenic, to report upon an artificial arm presented to the Academy by the Dutch sculptor, Van Petersen,[58] to consider the proposed suppression of the botanical garden in Toulon,[59] and so forth.[60] Two of the commissions of which Magendie was a member were of sufficient importance to merit especial attention. They were the Hippiatric Commission and the yet more famous Gelatin Commission.

The Hippiatric Commission.

In September, 1836, the Minister of Public Instruction[61] invited the Academy to appoint one of its members to take part in a commission organized in accordance with a decision of the Minister of War, for the purpose of supervising the experiments relating to the treatment of glanders in horses, proposed by M. Galy. Magendie was forthwith elected.

Four years later the new Minister of War appealed directly to the Academy.[62] He stated that, since the loss of horses from glanders had been out of all proportion to that occurring in foreign armies, a commission of army officers had been appointed

[56] "Rapport, etc." J: 1829, ix, p. 364.

[57] "Rapport, etc." (Com. MM. Pouillet et Magendie, rap.). C: 1850, xxx, p. 471.

[58] C: 1845, xx, p. 428.

[59] "Rapport, etc." C: 1849, xxix, p. 369.

[60] See *Ibid.*: 1839, ix, p. 536; and 1841, xiii, p. 940.

[61] C: Sept., 1836, iii, p. 372.

[62] *Ibid.*: Jan., 1840, x, p. 73.

by his predecessor to look into the matter, and that this commission had now stated its opinion that the ravages of the disease were due to the unhealthiness of the stables and advised certain improvements. On the matter of ventilation, however, the minister wished the advice of the Academy. The latter, therefore, appointed a commission composed of Magendie, Chevreul, Poncelet, Breschet and Boussingault[63] to attend to the matter.

The work of Magendie upon these commissions doubtless met with the approval of the authorities, for when in 1844 the Hippiatric Commission was organized under the War Department, Magendie was appointed president. Beside the four academicians, Magendie, Rayer, Payen and Boussingault, the commission comprised M. Crétu (*maître de requêts*), the director of the Alfort veterinary college, a member of the Academy of Medicine, the chief veterinarian of the municipal guard, four veterinarians of the army and a chemist.

Within the next fourteen years this commission published four volumes of memoirs, and to these Magendie and Rayer made valuable contributions in experimental physiology. One of these memoirs (89) was read by Magendie before the Academy in 1845. It was a comparative study of the parotid and mixed saliva of the horse with relation to chemical composition and action upon food.

The Gelatin Commission.

At the beginning of the nineteenth century[64] several chemists, among whom was d'Arcet, Sr.,[65] were busying themselves in experiments which had for their object the extraction of the organic material from bones. At that time it was believed that as much bouillon could be obtained from one pound of bones as from six pounds of meat, and hence it was as a problem in institutional economics that the work of these investigators was viewed with interest. In 1817 d'Arcet, Jr., devised a new method of extracting the bones, a device which soon supplanted the older methods in which the use of papain or boiling with acids had been resorted to. The statement of d'Arcet that he was now able to make five beeves out of four, coupled with the approval with which the Collège de France looked upon his results, led to the quite general introduction of d'Arcet's extract of bones into the hospitals and

[63] *Ibidem*, p. 74.

[64] See *Bull. Acad. d. Méd.*, xv, p. 324, Jan. 8, 1850, p. 367, Jan. 22, 1850.

[65] D'Arcet (C:) or Darcet (*Bull. Acad. d. Méd.*)

almshouses in Paris, where 60 grams of this gelatin were regarded as equivalent to 1,500 grams of meat.

But soon criticisms and complaints began to arise in various quarters. On June 30, 1821, M. Donné read a paper[66] before the Academy of Sciences. He had experimented on himself, he said, and had promptly lost two pounds in weight, while animals which he had fed with gelatin soon showed such a distaste for it that they preferred to die of starvation rather than eat it.

Moreover, on November 8th of the same year appeared a report[67] of the physicians and surgeons of the Hôtel-Dieu. Their six conclusions may be summarized by saying that in comparison with the bouillon made with meat, that in which gelatin was employed was more distasteful, more putrescible, less digestible, less nutritious and that, moreover, it often brought on diarrhea. This report was signed by Petit, Récamier, Caillard, Baron Dupuytren, Breschet, Guéneau de Mussy, Honoré Husson, Sanson, Magendie, Bally, Henri Duval and Gendrin, secretary.

The Academy of Sciences now took steps in the matter and appointed a committee of investigation known as the "Gelatin Commission."

Two years later (1833) Edwards and Balzac[68] reported before the Academy a series of experiments on dogs in which they showed that although gelatin had some nutritive value, it was incapable of sustaining life. In the following year (1834) Grannal,[69] after performing some experiments upon his own family and some of the students at the Val-de-Grace, reported to the Academy results which were extremely unfavorable to the use of gelatin.

But the Gelatin Commission remained silent, and as years passed various individuals began to show signs of impatience. Seven years had gone by when M. Grannal[70] asked the Academy to urge the members of the commission to bring in their report. To this Magendie, who was at that time President of the Academy, replied that the experiments of the commission were still in progress and that he was unable to say when they would be completed. In the following year some remarks of M. Arago

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[66]Meeting of the Academy, June 6, 1831; also, "Mémoire sur l'emploi de la gélatine comme substance alimentaire." Paris, 1835. 8vo.

[67]C: Aug., 1841, xiii, p. 286.

[68]*Arch. gén. de méd.*, Paris, 1833, 2. Ser., i, p. 313.

[69]Meeting of the Academy, Sept. 1, 1834. *Gaz. méd. d. Paris*, 1834, 2. Ser., v, p. 578.

[70]C: 1837, iv, p. 183.

hinting at the slowness of the commission called forth a formal protest from Dumas, Thénard and Magendie, and Arago apologized.[71]

At last the report[72] was ready on August 2, 1841. Magendie presented it to the Academy in the name of the commissioners, Thénard, president;[73] d'Arcet, Dumas, Flourens, Breschet, Serres and himself. In the introduction Magendie called attention to the fact that M. d'Arcet had tactfully declined taking any part in the experimental work, but had rendered valuable assistance in collecting documents relating to the gelatin question. He then proceeded to say that, considering the problem of finding the nutritive value of certain gelatin soups too narrow, the question which the commission proposed to itself was this: "Can one by an economical procedure extract from bones a food which, either when eaten alone or when mixed with other substances, can take the place of meat?" In order to facilitate this inquiry the commission had been divided into two sections; one composed of chemists, while to the other was allotted the physiological experiments. These sections now presented a joint report.

The scope and character of the work can readily be seen from the titles of a few of the various sections into which the report was divided:

History of the extraction of gelatin and its employment as a food.

Experiments on gelatin, pure, flavored, in fasting, in association with other substances.

Experiments on gelatin and meat bouillon.

Comparative chemistry of various bouillons.

Experiments on the parenchyma of bones, on tendons, on the nutritive properties of albumen, fibrin, etc., mixed, unmixed, flavored or unflavored.

"We are very conservative in our conclusions," ran the report; "but we can state the following positively:

"1. By no known process can there be extracted from bones a substance which, either when taken alone or when mixed with other substances, can replace meat.

"2. Gelatin, fibrin, albumen, taken alone, support animals for a very limited time. In general these substances soon excite an

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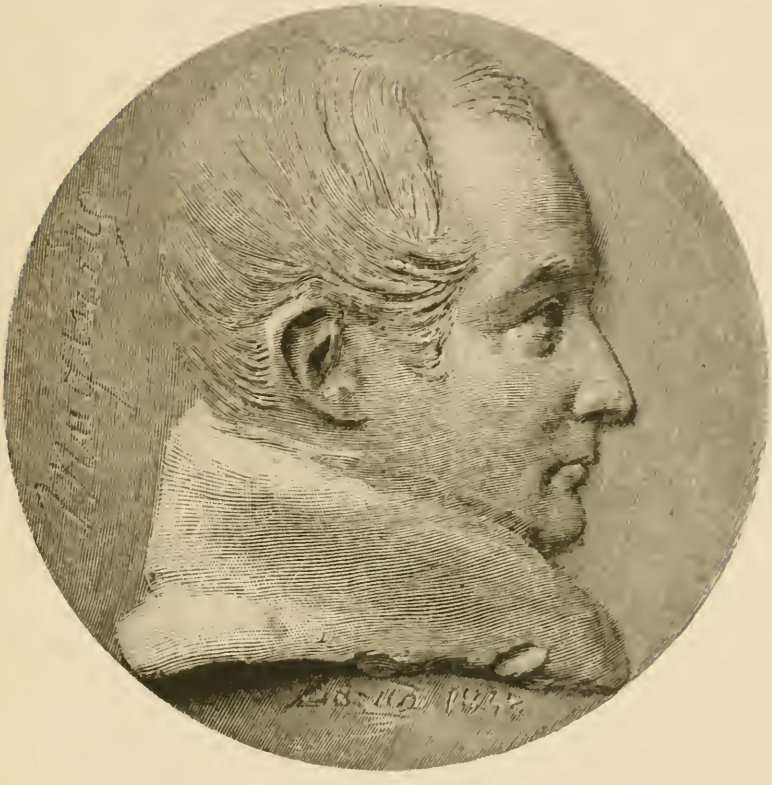
[71] *Ibid.*: 1838, vii, p. 1131.

[72] "Rapport fait à l'Acad. d. Sc. au nom d. l. Commission dit d. l. gélatine." *Ibid.*: 1841, xiii, pp. 237-283.

[73] *Ibid.*: 1844, xviii, p. 986.



FRANÇOIS MAGENDIE,

Engraved by E. Schladitz after the Medallion by David d'Angers.

intolerable distaste to a degree which renders starvation preferable.

"3. The same immediate principles artificially united, and rendered of an agreeable sapidity by seasoning, are accepted with more resignation and for a longer time than when they are isolated; but finally they have no better effect upon the nutrition, for animals which eat them, even in considerable quantities, die with the symptoms of complete inanition.

"4. Meat (muscle) in which gelatin, albumen and fibrin are united by the laws of organic nature and are associated with other materials as fats, salts, etc., suffice even in very small quantities for a complete and prolonged nutrition."

The remaining five conclusions, though interesting, are perhaps of somewhat less importance than those which have already been quoted.

The work of the Gelatin Commission was not completed with this report, but as Magendie seems to have resigned[74] a few years later, before the appearance of a second report, the doings of the commission cease to have any bearing on this biography.

Memoirs, the "Comptes Rendus."

The last and perhaps the most important phase of Academic activity was the presentation, at the meetings of that body, of memoirs recording the results of original investigations. The papers which Magendie read before the Academy were numerous and their contents varied. At first they were published either in the form of monographs or in one of several medical and scientific periodicals, especially in the medical journal of Leroux and the *Journal de Physiologie Expérimentale*. To these earlier memoirs reference has already been made.

In 1831 Magendie's journal came to an end, but soon (1835) another and still more famous periodical came into existence, the *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences.*

Nothing impresses one with the wonderful intellectual life of Paris at that time more than simply running the eye down the list of contributers to the first volume of the *Comptes:*

Agassiz,	Berthelot,	Gay-Lussac,
Ampère,	Biot,	Geoffroy-Saint-Hilaire,
Arago,	Cuvier,	Humboldt,
Baudelocque,	Delacroix,	Laplace,
Becquerel,	Flourens,	Magendie.

[74] See C: 1844, xviii, p. 564.

Of all Magendie's contributions to the *Comptes,* of which there were about a dozen in the next twenty years, the most interesting was his series of articles on recurrent sensibility. In the second paper on the function of the spinal nerve roots, which Magendie published in his *Journal* in 1822, he described not only the effect of section of the roots upon the convulsions caused by strychnia, but also the results obtained by direct stimulation of the roots. These results were surprising, for on stimulation of the anterior roots Magendie obtained signs of pain, while stimulation of the posterior roots caused muscular movements. To the latter phenomenon he does not again refer, so that one is left in the dark as to whether it was a reflex or an error in observation. The fact, however, that stimulation of the anterior roots causes pain seems to have again recurred to his thoughts.

On May 20th, 1839, Magendie communicated to the Academy the results of some experiments on the nervous system (83). The author's summary of his results reads as follows: "The sensory and motor nerves of the cord are both sensitive when both are intact.

"If one cuts the sensory nerves, the motor nerves immediately lose their sensibility.

"If one cuts the motor nerves in the middle, the end which remains attached to the spinal cord is quite insensible; the opposite end, on the contrary, retains an extreme sensibility. In this case the sensibility goes from the periphery to the centre.

"If one cuts the sensory nerves in the middle, the end which is attached to the cord is very sensitive; the end which is adjacent to the ganglion has, on the contrary, lost all its sensibility."

A few weeks later Magendie presented a second paper (84) before the Academy. In this he declared that having been impressed by the fact that the sensibility of the ventral roots depends upon the integrity of the dorsal roots, he was minded to try similar experiments on the columns of the cord. He therefore stimulated the ventral columns of the cord and found that they showed evident sensibility, although they were not so exquisitely sensitive as the dorsal columns. This sensibility of the ventral columns disappeared in great part, not only on section of the dorsal roots, but on section of the ventral roots also. Why this round-about path? Magendie said that he did not know, and that more experiments ought to be made for investigating this subject.

At the next meeting of the Academy a letter[75] from M. A.

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[75]A. Longet. Fait physiologique relatif aux racine d. nerfs rachidiens. C: 1839, viii, p. 881.

Longet was read in which the author claimed for himself the credit of the discovery of recurrent sensibility. He stated that he had performed the essential experiment in the presence of Magendie, and that all Magendie had done was to confirm and amplify it before hurrying off to the Academy to report the discovery as his own. Without entering into the details of the Longet-Magendie dispute, which was soon dropped, it may be said that both Bernard and Flourens appear to have disregarded entirely Longet's claim, but it seems probable that Magendie did not give enough credit to Longet for his experiment, and that consequently the latter was led to claim a good deal more than was his due.

The spinal nerve roots seem to have brought more trouble in their train than any other structure investigated by Magendie. One of his discoveries was claimed for Bell, another was claimed by Longet. Nor did this end the matter, for when in 1847 Magendie again reports upon the subject of recurrent sensibility (91), he complains sadly that the Academy had not treated him fairly, for it had on two occasions honored memoirs in which his results in regard to this phenomenon were pronounced erroneous. He then proceeds to repeat all his previous statements concerning recurrent sensibility, and next to describe some new experiments which amplify and confirm the results already obtained. Finally he reports a series of experiments which he had performed in company with Claude Bernard, and which proved that the sensory function of the facial nerve depends entirely for its presence upon the integrity of the trigeminal.

Of the other articles published in the *Comptes* some are of considerable interest. With Bernard (93) he showed that stimulation of the dorsal spinal nerve roots causes a rise in the blood pressure, and that the same result could be obtained on stimulation of a ventral root, but only when the dorsal root was intact as in the case of recurrent sensibility. He observed also that this change in the circulation occurred in the absence of all signs of pain on the part of the animal.

In another paper (90) he comments on the interest felt by chemists in the study of ferments and catalytic action. He then describes as the result of his own researches the discovery of a new property of the blood, namely, that of converting starch into glucose and dextrine. Starch injected into the blood disappeared and in its place dextrose could be demonstrated.

Besides the articles already referred to there are others of somewhat less interest, such as the three reports on nervous

cases treated with galvanism (80, 81, 85), a note on the composition of the blood in various diseases (86), an article on the action of ammonium nitrosulphate on animals and man (78), and another on the cow-pox (88).

It was a custom for each academician to present a copy of his latest book at one of the sessions of the Academy, sometimes accompanying it with a short summary of its contents. Consequently the *Comptes rendus* contains notices and abstracts of many of Magendie's larger works.

Personality of the Academician, Magendie.

Although an able academician, whose clear sight and energy made him invaluable as a worker, the asperity of his character was such that it must have rendered his presence at times a source of great discomfort to his colleagues. "His ineradicable sarcasm spared no one. His abrupt sallies by their very suddenness disconcerted all prevision and set at naught all academic tradition. He never insinuated that an opinion was erroneous or a fact misstated, he plainly said so."

"Our honorable colleague," cried Magendie,[76] when Breschet had finished reading his paper on glanders,[77] "our honorable colleague has just passed judgment in a manner so positive, so absolute, upon certain questions of the greatest importance, that wishing to reply and believing that I can do so with some success, I find myself with no other resource than to employ phrases both sharp and clear, which might compare without disadvantage with those which he has used.

"I say to my honorable colleague, without any oratorical precautions: when you say that chronic glanders is the same disease as acute glanders you are wrong! When you say that chronic glanders is contagious you are wrong again! When you say that chronic glanders is transmitted to man by way of contagion you are expressing an opinion which nothing proves and which, if it were spread about on the authority of your words, might have the most disastrous consequences.

"I could easily multiply the number of these denials, but I will confine myself for the moment to the three principal points discussed in your memoir. . . ."

The incident above quoted is by no means unique, for Magen-

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[76]C: Feb. 10, 1840, x, p. 223.

[77]Breschet and Rayer: De l. Morve chez l'homme, chez l. solipèdes e. quelques autres mammifères. C: Feb. 10, 1840, x, p. 200.

die never left any room for doubt with regard to his meaning.[78] Flourens moreover intimates that Magendie claimed for himself the whole field of physiology, and that no experiments could be done nor discoveries made without arousing his jealousy. But Bernard leads us to believe that it was really a matter of principle which led him to seek so diligently for the flaws in the work of others, that he might by so doing the more readily arrive at the truth. It is probable that an impartial critic to-day, one who had not himself been roughly handled, as Flourens had been, by this perhaps over-strenuous skeptic, would agree with Bernard and would see in Magendie a rough but honest champion who hacked and hewed his way toward the truth utterly regardless of the more sensitive feelings of others and utterly contemptuous of the shallow euphemisms which society at all times fosters. Magendie's method was, however, so unusual that another instance should be cited to emphasize and illustrate this important trait in his character. One of the best instances of his violent and unexpected attacks is found in the records of the ether controversy which took place in 1847. On February 1st of that year Velpeau read before the Academy a note "On the Effects of Ether."[79] He recorded the results of numerous operations with this anesthetic. For the relaxing of muscles in the setting of fractures and the reduction of dislocations, he had also found it most useful. He dwelt upon the wonderful result of ether anesthesia and his discourse glowed with enthusiasm.

Velpeau's remarks, however, called forth a perfect tirade on the part of Magendie,[80] who in a long harangue soundly rated the surgeons in general and Velpeau in particular. "The surgeons," said he in substance, though these were not his exact words, "are catering to the public demand for the miraculous and sensational. They perform experiments on human beings which cannot be justified. Our knowledge of this drug is too scanty to warrant this wholesale use of it. Unconsciousness may be produced by other drugs, such as alcohol, but they are not used in operations for very obvious reasons, yet the surgeons hasten to employ ether, a drug with which we are so little acquainted. Might not the use of ether initiate in patients a craving for it? Who, indeed, would commit himself while in a state of complete unconsciousness into the hands of a surgeon when bungling and mal-

[78] See C: 1839, ix, p. 776; 1845, xxi, p. 51; and 1849, xxix, p. 417.

[79] Sur. l. effets d. l'éther. C: Feb. 1, 1847, xxiv, p. 129. Feb. 1, 1847.

[80] *Ibid.*: p. 134.

practice might go on unknown to him? Would one not rather endure the pain? Of what use is an anesthetic which still permits the patients to shout and struggle as though tormented with horrible dreams? Finally, may not the knowledge of the ease with which it can be employed lead to its use for criminal purposes?"

In replying,[81] Velpeau expressed his great astonishment at Magendie's attack. He resented the implication that he was a rash experimenter. Who indeed in all Europe was more free in resorting to experiments both on man and animals than he who had just attacked the surgeons? Ether had been abundantly tested by the most accomplished persons both in America and in England. Velpeau then at some length explained to the Academy that the facts advanced by Magendie were exceptional and that his fears were groundless. But Magendie was not silenced. "He would not reply," he said, "to M. Velpeau, who had contested none of his assertions. He would, however, show the disadvantages of ether anesthesia. In long operations one dares not use it, for our knowledge of the after-effects of the drug is too scanty; it is contraindicated in operations near nerves which might be cut or tied but for the warning given by the conscious patient; in parturition it is worse than useless since it interferes with the normal pains; in mouth and face operations it should not be used lest the blood should fill up the lungs of the helpless patient. Such examples might be multiplied indefinitely."

The next meeting of the Academy was opened by a paper by Roux on "The Effects of Ether."[82] This again aroused Magendie, who at once began a long and vehement discourse[83] which may be paraphrased and abridged as follows: "If, at the last meeting of the Academy, my words seemed to be marked by a certain degree of animation, I beg you to note that they were directed less against a new therapeutic agent than against the extreme eagerness with which patients have everywhere been experimented upon.

"During the past week the subject of ether narcosis has been engrossing all minds. Among the many cases operated upon, we hear of those in which the giving of ether was accompanied by cries, lamentations and signs of suffering. Three cases have been reported by Vidal, in which there was sensory exaltation

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[81] C: Feb. 1, 1847, xxiv, p. 138.

[82] Sur. l. effets d. l'éther. C: Feb. 8, 1847, xxiv, p. 168.

[83] *Ibid.*: p. 170.

so that the pain of the operation was increased. In three women who had come to the Versailles hospital, for the extraction of some teeth, the administration of ether was followed by convulsions, recurring for several days. In some there have been dreams, the most unpleasant and the most violent and sometimes even a condition resembling delirium tremens. The dreams are sometimes extraordinarily erotic in character. Women thus intoxcated have been seen to rush upon the surgeon-operator with such evident intention that in this singular and novel situation the danger is no longer to the patient, but to the surgeon." [Laughter.]

"I should hope," he continued, "that no one supposes that I had the intention of provoking hilarity. On the contrary, I regard the consequences of ether intoxication as extremely serious. I should be very unhappy if my wife or my daughter had been the subject of scenes similar to those of which I have been a witness, in which chaste and modest girls have been transformed in a few minutes into bacchanals. Might not the taking of ether lead to results similar to those produced by the hashish and opium of the Orient?"

Magendie then proceeded to describe in detail the distressing results of the administration of ether in a case of excision of the tonsils. The facts, he said, had been obtained from a physician who had been present at the operation which took place at the Charité. In conclusion, he expressed his belief that the zeal and activity which had characterized surgeons during the last few days might contribute greatly to our knowledge of the effects of ether anesthesia.

Roux,[84] whose paper had been the cause of this second attack upon anesthesia, replied much as Velpeau had done at the preceding meeting. Magendie's objections were not serious, for such cases as those reported were quite exceptional. Then Velpeau, the surgeon of the Charité, began to defend himself; Magendie had not told all that there was to tell with regard to the tonsilar excision. The young man on whom the operation had been performed, a very neurotic individual, had insisted on being etherized. He had never been completely under the influence of the anesthetic and his subsequent symptoms were due to hysteria. He added that he had never stated that ether was of value in all cases. He knew that in operations in the mouth it

[84] C: Feb. 8, 1847, xxiv, p. 175.

was of little value and he knew of many other cases in which the usefulness of ether was more than questionable.

This, however, did not close the incident, for a week later Magendie laid before the Academy a letter from M. Constantin James,[85] confirming the statements made by Magendie with regard to the patient at the Charité. Velpeau was, however, prepared for this and forthwith produced a letter signed by his three internes, who denied some of the assertions made by Magendie. He then proceeded to discuss at length the advantages and limitations of ether anesthesia, concluding with the words: "Finally, there is one remark which I shall permit myself to make to the public and the laity; it is that ether in doing away with pain does not remove the danger of the operation, and that the possibility of operating without suffering is not a reason for operating without necessity."

Then Magendie again spoke:[86] "Since my colleagues have come to acknowledge the dangers of the administration of ether and the precaution required in using it, I regard the discussion as terminated, the more so if they put into practice the opinions which they profess.

"I do not regard the testimony of three of M. Velpeau's pupils as of equal value to that of a physician and former interne at the hospital in question, but this discussion is becoming personal and ought not to be continued before the Academy."

Magendie then concluded with the following words: "Gentlemen, in throwing myself against the general infatuation, in protesting against experiments made upon men with a substance of whose properties we have not a complete knowledge even today, I knew very well that I would raise up formidable opposition. But I declare that after having devoted so many years to labors which, unless I deceive myself, have not been sterile for the welfare of humanity, I had not expected to be represented as the apostle of pain, and, shall I say it? as opposing a useful discovery for the sole reason that it did not emanate from myself! But what does it matter! I have the consciousness of having performed a duty in putting my colleagues and the Academy itself on guard against an innovation which, though it may have some day a real utility, has already resulted in sad consequences and can be the occasion of deplorable abuses."

As has already been stated, this is by no means the only in-

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[85] C: Feb. 15, 1847, xxiv, p. 230.

[86] *Ibid.*: p. 238.

stance[87] of Magendie's belligerent nature. Sometimes, as in his dispute with M. Payen, he was shown to be clearly in the wrong, having been guilty of unintentional misstatement. In this case Magendie frankly and publicly acknowledged[88] his error when it was shown to him.

MEDICAL PRACTICE.

"The Great Idol of Human Credulity."

We have seen that as a man of science the two most characteristic traits of Magendie were his skepticism and his devotion to the experimental method. These characteristics also found expression in his practice of the profession of medicine. "To the young practitioners vaunting the success of their prescriptions, he would reply with good-natured sarcasm: 'It is evident that you have never tried the plan of doing nothing.' If the extreme simplicity of this kind of treatment called forth not unreasonable objections, 'Be assured,' he would add, 'that for the most part when disturbance manifests itself, we cannot discover the causes; we can at most only perceive the effects. Our only usefulness in the presence of nature, which in general tends to the normal condition, consists in not interrupting her; it is only now and then that we can aspire to be sufficiently skilful to aid her.'" [89]

"This disease," said he, in one of his lectures at the college, "is rather an indisposition than a true malady,[90] at least when not aggravated by treatment. For if the physician appears to give it importance, if he makes frequent visits to his patient, if he questions him gravely, advises bleeding and other energetic measures, it is possible that a simple indisposition may become a serious or even fatal illness: one has only too many examples of this. But if you content yourself with that which simple preservation indicates, if the patient being a little cold is warmed, if you have him drink some aromatic infusion, it is certain that the disease will then be a slight affection which will never entail a serious mishap." His bluntness and skepticism seem never to have interfered with his success in practice, for his reputation was such that many in their confidence in his integrity and skill

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[87]See also the discussion following the report of Regnault. C: 1841, p. 1076.

[88]C: March 6, 1843, xvi, p. 554; and March 20, 1843, xvi.

[89]F: p. 39.

[90]Leçon sur le choléra-morbus, pp. 5-6. Magendie is here speaking of "cholérine."

were more than ready to overlook his eccentricities, one of which was, as has already been stated, his refusal to "bow before the great idol of human credulity." In this connection Flourens tells the following amusing anecdote.[91] "On a certain occasion, on leaving a little boy whose condition presented alarming symptoms, he said: 'Let him do just what he pleases; that is all I prescribe.' Usually sparing of his time and visits, he lavishes both in behalf of this child, but adds nothing to his medication. On the evening of the third day, all at once his brow clears, and taking the invalid by the ear, he exclaims: 'Little rogue, you have not allowed me a moment's rest'; and giving him a little slap, 'Get up now and run about.' The delighted father asks, 'What then was the matter with the child'? 'What was the matter? *Ma foi,* I don't know; neither I, nor the whole faculty, if they could be honest with you. But what is certain is that everything has returned to its normal state,' and with this he disappeared."

Naturally, the lovers of medical miracles were rudely shaken when he told them that their only malady was a craving for being gulled, and it is probable that no would-be invalid ever came twice to him to be consoled for imaginary ailments.

But Magendie always preferred hospital to private practice. There he seems to have been beloved, for the poor patients of the Salpêtrière[92] presented him with a memorial when, in 1830, he quitted that hospital for the Hôtel-Dieu.

Now it ought never to be supposed that Magendie's skepticism paralyzed all his therapeutic efforts. Magendie was, above everything else, an experimenter, and if he did not accept traditional methods of treatment, he followed the suggestions of the experiments which he had himself performed on animals. Of the many instances of the way in which Magendie turned his laboratory experience to practical use the following may be cited; not, however, because the results in these cases were most satisfactory, but because the account is perhaps the most dramatic.

In the article entitled "Experiments on Hydrophobia" (27), Magendie comments on the impotence of all known drugs in

[91]F: pp. 39-40.

[92]Magendie received the appointment of Médecin Suppléant to the Salpêtrière, July 12, 1826 (Dubois, p. 180). La Salpêtrière has now the oldest hospital buildings in Paris. It is remarkable for the extent of its grounds and buildings, which cover some seventy-four acres. It was founded by Louis XIV. as a refuge for old women, and received its name from some saltpetre mines which had occupied the same site.

combating this terrible disease. He then vividly describes his method of dealing with a mad dog which he had been hastily summoned to see. It appears that Magendie had noticed that a depression, especially of the nervous system, always occurred in animals when water had been injected into the circulation. He therefore called to his aid several students on whose courage, address and coolness he could rely, seized the frenzied animal and injected sixty ounces of water at 40° C. into the jugular vein, from the peripheral end of which ten to twelve ounces of blood were simultaneously withdrawn. The animal at once became quiet and soon went to sleep. At the end of five hours, the dog showed some difficulty in respiration and in this state died, but, adds Magendie, doubtless with a feeling of satisfaction, "there was never any return of the rabies."

Not long afterwards Magendie was sent for by M. Caillard, resident physician at the Hôtel-Dieu, to come to a case of hydrophobia in its last stages (48). Magendie found the patient strait-jacketed and in a desperate plight. Seeing that death was imminent, he felt justified in resorting to heroic measures. He therefore had the man held firmly while he injected a considerable quantity of water into a vein of the forearm. The injection required one hour and forty minutes, the pulse fell from one hundred and eighty to eighty, the patient became calm and drank water, the strait-jacket was removed. The man now appeared quite normal and was without fever. On the eighth day the patient died, not of rabies, however, but of pyæmia. This case also was a source of satisfaction to Magendie, for he had cured the man of hydrophobia. As for the pyæmia, he was at a loss to account for its origin, which is not much to be wondered at, seeing that the nature of septic infections was at that time (1823) quite unknown.

Such was the physician who, in 1828, was proposed by his friends as a candidate for the vacant chair of medicine at the Collège de France. But his coldness and reserve antagonized the Minister, so that Récamier[93] received the appointment instead.

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[93]Joseph-Claude-Anthelme Récamier (1774-1852), in 1801, was appointed physician to the Hôtel-Dieu, and succeeded Laënnec as professor of medicine, in 1826. In 1831, after his resignation, he retired for a time to Switzerland. Returning to Paris, he became a practitioner of great reputation. He was an ardent vitalist.—A. Boullée. Article: "Récamier." *In*: Biographie Universelle (Michaud) Ancienne et Moderne. Paris. Vol. 25, p. 292.

THE COLLÈGE DE FRANCE.

Nomination, 1830.

In 1830, Récamier, who at that time was Professor of Medicine at the Collège de France, refused to take the oath of allegiance to the newly proclaimed[94] King, Louis-Philippe, and his Chair at the College consequently became vacant. "This Chair," said Claude Bernard,[95] referring to this period, though the words were spoken twenty-five years later, "cannot be compared with any other. It is not such a Chair as that in the Faculty of Medicine, for example, which remains limited to the same special branch of pathology in fixed relation to the other Chairs, which taken all together represent to the student the sum of our knowledge of the medical sciences. In the Collège de France it is abstract science only which should be kept in view and this Chair should comprise the sum of scientific medicine in its greatest universality and in the highest expression of its progress. But this collection which we call medicine is composed of a host of special sciences—anatomy, physiology, pathology, and so forth. All these sciences, which constitute medicine, have not been developed simultaneously, but, on the contrary, successively and incompletely. Now since it is impossible to embrace this whole collection at once, the Chair of the Collège de France has always represented progress, in medical science, in whatever branch it was most conspicuous at any time. As a result, the character of the course should vary in the different periods of the science, according as scientific progress is present in one branch of medicine rather than in another. This is what I wish to prove by casting a glance back over the list of professors who have succeeded each other in the Chair since its foundation in 1542. I shall take from it certain names at random: Vidus Vidius (1542); Sylvius, or Du Bois[96] (1550); Riolan (1604); Guy-Patin (1654); Tournifort (1703); Astruc (1732); Ferrein (1742); Corvisart (1794); Laënnec (1831) * * * I ask you what tradition or relation could be established between such different men as those whom I have just enumerated? Their names alone show the successive modifications of the Chair in relation to the needs of the day and the progress of the science." "And now," asked Bernard, "which

[94]Louis-Philippe accepted the title of king August 9, 1830.

[95]B: p. 22.

[96]Jacobus Sylvius, or Jacques Du Bois.

of the medical sciences is to-day the most active and shows the most rapid progress? It is obviously experimental physiology."

The opinion which Bernard expressed in 1855, seems to have been held by many in 1830. Unquestionably Magendie, as the representative of the rising science of experimental physiology—a science which dominated the chair of medicine at the Collège for the next fifty years—was the proper successor of Récamier.

Already, in June and September, 1830, there had appeared in the *Gazette Médicale de Paris*[97] an article which doubtless expressed the opinion of some of those best competent to judge. After a severe but impartial criticism of Magendie's work and views, this article ends with a still sharper criticism of the Faculty of the Collège and with an expression of the hope that Magendie might succeed in obtaining the nomination. The concluding paragraph reads as follows: "The choice of men in the reorganization which is being prepared will be significant. * * * The Faculty is careless, the instruction is lacking in breadth. It is necessary to remedy these two defects and this can be done only by the judicious renovation of the personnel of the school. Each new name indicates the principle which presides over this regeneration. The name of Magendie gives a guarantee in this respect and this is why we speak it at this time. M. Magendie enjoys a name which is pretty well renowned in the world of savants, and a reputation for independence which we believe to be well merited; the school can only gain by joining him to itself, for it will acquire thereby the consideration of those beyond its own circle and an element of independence within itself. With regard to the interests of science, we have no doubt that these will be sufficiently served by this appointment; for with M. Magendie there will enter into the school a new scientific spirit different from that which now dominates there. He will bring there new doctrines which, though we are a long way from endorsing them, ought to have a voice. Teaching bodies, like all other bodies, become modified in spirit only very slowly; they willingly live under the domination of traditions; the principal characteristics of their doctrines are conservatism and exclusiveness. When one considers that at the time of the mighty invasion of the system of M. Broussais[98] the school could not be appreciably

[97] Vol. 1, pp. 223 and 326. June 12, and September 4, 1830.

[98] François-Joseph-Victor Broussais (1772-1838) was born at St. Malo, and came to Paris in 1799, where he obtained his degree in 1803. In 1805, he became an army surgeon, serving in Germany, Holland, Spain and Italy,

affected and opposed the invasion with an unshaken firmness, one wishes to see broken in some way that solidarity, that uniformity of ideas which has in it something of egotism and lethargy. The acquisition of men with fixed and inflexible opinions of their own will contribute to this happy change. We are indeed a long way off, we repeat it, from wishing too great success to the theories, be they general or special, of M. Magendie, and if their implantation in the school seems to us to be good, it is not so much because of their intrinsic value as because they are very different from those which long custom has rendered sacred there. The ideas of M. Magendie will break up uniformity and stimulate activity."[99]

Magendie received the appointment and in the year 1830 took possession of the Chair of Medicine at the Collège. The opportunity had at last arrived for introducing into the forefront of medical teaching in Paris the ideas which had made him famous in physiology, and of establishing in medicine the experimental method. But Magendie's activity in this field was destined to receive a sudden, though only temporary, check.

Cholera in Paris, 1832.

In 1826, a cloud began to gather in the valley of the Ganges. It grew slowly and gradually spread westward. It arrived at Cabul in 1827, and in the next year reached the Persian capital, driving the Shah and his terror-stricken court in flight to the mountains. It was the second pandemic of Asiatic cholera[100] and now it crossed the frontier and swept down upon Europe. Ohrenberg was smitten in 1829. For a while St. Petersburg was protected by a triple cordon of troops, but soon the pestilence crept in through the lines. Leaving death and riot in its wake, the cholera passed from St. Petersburg to Cronstadt, Hamburg, and

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and returning to Paris in 1814. His doctrine resembles that of John Brown. It points to excitation or irritation as the fundamental phenomenon of life, and to an over-irritation as the principal cause of disease. His lectures were attended by crowds of enthusiastic students. His "Examen de la doctrine médicale généralement adoptée" (1816) drew upon him the hatred of the whole medical faculty. By degrees his views were accepted, and, in 1831, he became professor of pathology in the Academy of Medicine.

[99]"Elles briseraient l'uniformité et provoqueraient du mouvement."

[100]See: E. C. Wendt. A Treatise on Asiatic Cholera. *New York,* 1885; page 16. Also: A. Hirsch. Handbook of Geographical and Historical Pathology. Transl. by Chas. Creighton. *London,* 1883. Vol. 1. page 397.

thence to Sunderland.[101] Meanwhile, it had crossed the Polish frontiers, overridden the Prussian and Austrian armies posted to intercept it, and devastated Germany.

In 1832, Magendie came before the Academy. "I am a physician," he said,[102] "and that vocation calls me to the focus of evil. I am going to Sunderland, hoping that by studying the cholera in the place of its appearance I shall bring back from there some useful suggestions. Give me more authority by making me your delegate." Accompanied by Guillot,[103] he proceeded to the infected seaport. Thence, he was directed to the seat of the first outbreak among the fishing population scattered along the coast. Here he found collections of individuals dwelling in most miserable huts, exposed to dampness, filth, and vice; living, sleeping and eating among the dead and dying, with instincts so brutal as to preclude the hope of any helpful intervention. Dejected he returned to Paris, where to the often repeated question "What shall we do?" he could only answer sadly, "I do not clearly know."

How the disease reached Paris[104] is unknown, but there seem to have been unreported cases there before the great outbreak on March 24, 1832. By the first of April the mortality had risen to 500 a day, and before the end of three weeks 7,000 persons had perished. The Parisians at first met the cholera with the careless bravado which characterized them, but as the disease spread, this changed into a panic. Most of the Deputies and Ministers fled, but the Royal Family remained in Paris. King Louis-Philippe was only restrained from visiting the Hôtel-Dieu by the efforts of his councillors. The Duke of Orleans went in his stead, accompanied by the Minister Casimir-Périer. The latter was smitten by the disease and died.

"The rich," said Magendie,[105] "will not lack physicians," and he turned his steps towards the Hôtel-Dieu. Physicians, Sisters of Charity, ladies of the wealthy and of the less opulent classes, all rivalled each other in their courage and activity in the homes and in the hospitals.

Among the most ignorant, mad rumors changed terror into

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[101]Sunderland, a seaport in Durhamshire, twelve miles southeast of Newcastle-on-Tyne.

[102]F: p. 47.

[103]Natallis Guillot subsequently became a member of the Faculty.

[104]*See* H. Martin. Histoire de France depuis 1789 jusqu'à nos Jours. 2 Ed. *Paris*, 1879. Vol. 5, pp. 23-24.

[105]F: p. 49.

fury. The cry went up that this was not an epidemic, but a conspiracy of which the poor were victims, and mobs surged through the streets howling, "Vengeance! Death to the doctors! Death to the poisoners!" M. Grisquet, the Prefect of Police, seemed powerless. He had issued an order forbidding the throwing into the streets of dirt, garbage and rubbish, but the people, led by the rag-pickers, rioted and erected barricades. Political parties accused each other of the poisoning, and persons were killed by the rabble in their frenzy.

At length the epidemic abated, having in the six months of its visitation carried off 18,402[106] persons out of a population of about 800,000 souls.[107] The rioting ceased. Paris became in outward appearance as of old. Magendie returned to his laboratory and his experiments, but not, however, until he had received the cross of the Legion of Honor. "I think it very well awarded," [108] he was heard to remark with his characteristic frankness.

Lectures, 1832-1852.

During the great epidemic of 1832, Magendie continued his lectures at the Collège, and then was given the classic series on the cholera (74). In these he found abundance of opportunity for decrying the unwholesome tendency of those who sought to explain the origin of the epidemic by speculative reasoning. "In confining ourselves,"[109] said he, "to scientific and experimental progress, one does not reach such results as these. After having discussed all the facts which the cholera has furnished us, it is possible that we may find it our duty to avow frankly that several questions of the greatest importance relative to the epidemic are still unsolved. If such be our conclusion, I shall not hesitate to acknowledge it; my mission to you is not to please, but to enlighten, to show you the true path without which science can make no certain step."

This series of lectures was followed by another on the physical phenomena of life (79). Here he dealt first with the relations of the processes of life to certain physical properties of the tissues, porosity and imbibition or absorption, viscosity and the

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[106]P. Langlois. Article on "Cholera." La Grande Encyclopédie, Paris, xi, p. 212.

[107]E. H. Vollet (Article on "Paris," *ibidem*, xxv, p. 1068) states that the population of Paris in 1831 was 785,812; in 1836, 899,313 persons.

[108]F: p. 50.

[109]Leçons sur le Choléra-Morbus. Pages 4-5.

circulation of the blood, elasticity and the behavior of the arteries. Thence he passed to a discussion of the heart sounds in health and in disease. Animal hydraulics next occupied his attention and in this connection he demonstrated many phenomena of the circulation by means of Poiseuille's new instrument of precision, the mercury manometer. He estimated the changes in the venous and arterial pressure resulting from the injection of such liquids as warm water, cold water, weak alcohol, coffee and so forth, and also the effect of painful or agreeable sensations. All the changes in blood pressure thus obtained he attributed to alterations in the heart action. The effect of defibrination was then observed and the resulting extravasations of blood commented upon. The effect upon the blood of various drinks, drugs and gases was next treated, "topics which," he said, "throw much light upon some very important diseases," and finally the microscopical appearances of the blood corpuscles were carefully considered.

A third series of lectures was then begun, this time on the functions and diseases of the nervous system (82). These lectures, like those on the physical phenomena of life, were collected by Constantin James and subsequently published.

Throughout these courses of lectures, in the midst of an inexhaustible wealth of facts, one finds everywhere the two prevailing ideas of Magendie—the inseparability of medicine and physiology, and the all-importance of the experimental method. He was lavish in his experiments; instead of lecturing he often performed researches in the presence of his class. "He had a gift," says Flourens, "of seizing phenomena as they passed and as they were, so to speak, on the wing."

Still, as a teacher, Magendie was never popular. He followed no plan, and at the commencement of a lecture did not know whither his fancy might lead him. For those persons, therefore, whose object it was to study the principles of science, his lectures were not at all adapted; but for those anxious to find out how new discoveries are made, and wishing to become discoverers themselves, there could not be a better school than the courses given by him.

Relation of Magendie to His Students.

In his intercourse with his students the singular asperity of Magendie's character again showed itself. "When a young man full of the ardor of youth, came to consult Magendie regarding ideas, projects of work, on which he had based the fondest hopes,

he always experienced at the hands of Magendie a complete disillusioning. These frank councils were often badly received. But Magendie thought them a useful test whereby later and more cruel deceptions might be avoided. If, on the other hand, one came to him with a fact, with the result of an experiment of which he wished to speak, Magendie's first reply was always a denial: 'All that that you are saying,' he would reply, 'is impossible, you are mistaken.' * * * But if one opposed him and, strong in the truth of what he was saying, wished to take him to see it, Magendie never refused to go; on the contrary he asked to go, and, if a good experiment were performed for him, which fully proved the statement which had been made, he was most happy to acknowledge it and to compliment the author who forthwith acquired his esteem and sympathy." [110]

"Theoretical discussions were always distasteful to him;[111] he desired nothing but facts, he wished only to see. 'I have eyes but no ears,' he used to say. When some one said to him, 'According to this law it should happen thus, or analogy indicates that the phenomenon will take place in such a way;' 'I know nothing about it,' he would reply, 'experiment and you will say what you have seen.' Experiment, such was the reply which he invariably made during forty years to all questions of this kind. The worship of experimentation was never carried so far; argument and induction were absolutely nothing to Magendie." This characteristic is seen again and again in his writings and also in the following anecdote told by Bernard, who for many years assisted him in his experiments.

"One of the great savants with whom Germany is honored, the celebrated Fr. Tiedemann,[112] came once upon a time on one of his journeys to Paris to pay a visit to Magendie, who was then occupied with researches on the cerebro-spinal fluid (87). Magendie offered, as is the custom among savants, to show him his experiments and have him see the cerebro-spinal fluid oscillating below the visceral layer of the arachnoid. 'That is contrary,' replied Tiedemann, 'to the law of Bichat which we know regarding

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[110]B: pp. 28-29.

[111]This and the remaining quotations in this subsection are from Bernard.

[112]Friedrich Tiedemann (1781-1861), anatomist and physiologist, was born in Cassel, and was graduated in medicine at Marburg. He became a pupil of Cuvier in Paris. Later, in 1816, he became professor of anatomy and physiology at Heidelberg. He died at Munich.

serous membranes. The liquids which are secreted by these membranes are never outside of them; they are enclosed in their cavities.' 'I have not concerned myself about that,' replied Magendie, 'whether or not it accords with the law of the physiology of the serous membranes, but I take it upon myself to show you upon a living animal that the cerebro-spinal fluid lies under the visceral fold of the arachnoid.'"

"He esteemed experimenters more than philosophers. He distrusted those who held premature generalizations; he thought that these generalizations could be made very easily and, so to speak, quite of themselves, when the number of facts was sufficient. According to him the collecting of material was for the present the only occupation of the physiologist." "In our familiar conversations," writes Bernard, "he sometimes stated his opinion on this subject in a manner which was both picturesque and satirical. 'Everyone,' he used to say to me, 'compares himself to something in his sphere more or less grandiose, to Archimedes, to Michel Angelo, to Newton, to Galileo, to Descartes, and so forth. Louis XIV compared himself to the sun. With regard to myself, I am more humble; I compare myself to a ragpicker; with my hook in my hand and my basket on my back, I traverse the domain of science and gather up what I find.'"

Vivisection.

"Experimental physiologists," writes Bernard,[113] "ought not to forget a real service which Magendie rendered in habituating the public, so to speak, to the idea of the scientific necessity of experimentation on living animals. Such experiments used to be shut up and, as it were, hidden from the public in the depths of the schools. To-day one can advertise in the streets of Paris a course in vivisection given in a particular building." "In England," adds Bernard, "this prejudice still persists."

Certain it is that the name of Magendie was hateful to the ears of the English antivivisectionists, who had denounced to Parliament, in 1820, "this stranger" [Magendie was then in London] "whose offensive temerity has broken through all the humanitarian barriers established by English zoöphilism."[114]

"Though as a vivisector," writes Bernard,[113] "M. Magendie

[113]B: p. 14 *et seq.*
[114]F: p. 25.

has always put himself above prejudices, still he never braved them with ostentation, and he explained in his course how the science of the phenomena of life, necessarily based on a study of the living, demands vivisection, and how this kind of experiment, dominated and inspired by the spirit of science, no more deserves the reproach of cruelty than the vivisection of the surgeon dominated by the idea of saving the life of his patient."

"I am far from disavowing my experimental studies,"[115] said Magendie on one occasion to the assembled academicians, "but I beg my honorable colleague to observe that I experiment upon animals precisely because I do not wish to experiment on men." Again in the preface of the fifth edition of his "Formulary," he deprecates the fear "which has been and still is entertained by many, that the medicines might act altogether differently upon man and upon the other animals, * * *" "Nothing, however," he adds, "is more false than this idea; fifteen years' experience in my laboratory and at the bedside of the sick, enables me to affirm that these medicines and poisons act in the same manner upon man as upon the other animals. My confidence in this respect is such, that I do not hesitate to use on myself the substances which I have found harmless in their effects upon other animals; and I should not advise any one to make the inverse experiment."

That Magendie did not treat with gruffness and discourtesy those who differed from him on the question of vivisection is expressly stated by Bernard, who also tells an anecdote to illustrate this point.

"I had then been," writes Bernard,[116] "M. Magendie's assistant for fifteen years and was helping him in an experiment, when he saw enter an elderly man, tall, dressed in black, wearing on his head a hat with a very broad brim, a coat with a narrow collar and short breeches. From this costume we readily perceived that we were in the presence of a Quaker. 'I wish,' said he, 'to speak with M. Magendie.' M. Magendie made himself known. The Quaker continued, 'I have heard thee talked of and I see that the report is true; for it is said that thou performest experiments on living animals. I come to see thee to demand of thee by what right thou actest thus and to tell thee that thou

[115]C: February, 1847, xxiv, p. 142.

[116]B: p. 15.

must desist from these experiments because thou hast not the right to cause animals to die or to make them suffer, and because thou settest in this way a bad example and also accustomest thyself to cruelty.' All the paraphernalia of the experiment were immediately put aside, and M. Magendie proceeded to develop his argument in justification of the vivisectors. 'It is necessary,' he replied to the Quaker, 'to place yourself at another point of view in order to judge experiments on living animals. It is certain that if they did not have for their aim and their result the service of humanity, they might be taxed with cruelty. But the physiologist who is moved by the thought of making a discovery useful to medicine, and consequently to his fellow man, does not merit such a reproach. Your compatriot Harvey,' he added, 'would not have discovered the circulation of the blood had he not performed experiments on the deer in the park of King Charles I. Now who dares deny that this discovery has rendered the greatest service to humanity, and who dares accuse its author of having been cruel? War,' continued M. Magendie, 'would itself be a barbarous cruelty, if one did not consider its aim and its result for humanity. But what one can condemn is perhaps the chase, for then animals are caused to suffer and are killed merely for pleasure.' * * * 'Oh! certainly,' interrupted the Quaker, 'I condenm war and hunting just as much as I condemn experiments on living animals. In all these cases man gives himself rights which he has not got; that is what I wish to prove and I am traveling in order to cause to disappear from the world these three things, war, hunting and experiments on living animals.' Without doubt the Quaker was not convinced by M. Magendie, and no more was M. Magendie by the Quaker. But I wish to show that M. Magendie used to treat the subject with all the consideration which was due to it, and in this case, besides, to the worthy sentiments which had prompted the journey of the Quaker."

Certain it is that Magendie was one of the heroes of the pestilence, a kind physician at the Salpêtrière, a lover of animals who in the days of his prosperity spent all his spare time in his stables and in the days of his poverty shared his five sous a day with his dog. Hence, in the absence of conflicting evidence, it seems justifiable to conclude that he was neither unreasonably inconsiderate nor heartless in his treatment of the subjects of his study and experimentation.

THE LAST DECADE.

Resignation from the Hôtel-Dieu.

On retiring from active work at the Hôtel-Dieu, in 1845,[117] Magendie received the title of honorary physician to the hospitals of Paris. He still frequented the sessions of the Academy and there took a very active part in the discussions of that body. This seems, however, to have ceased after 1849, if we may judge from the absence of his name from the accounts published in the *Comptes Rendus.*

The date of Magendie's removal from Paris to the country is uncertain but probably occurred about this time. His activity remained unabated, however, for Flourens informs us that he established a little dispensary in his house for the benefit of his rustic neighbors, and performed numerous experiments in plant physiology and in agriculture.[118]

He must still have spent much of his time in Paris, for he was the president of the advisory committee on public hygiene which was established under the Department of Interior in 1848. In this capacity he had opportunity to do battle successfully with charlatanism. His services led the government to offer him, in 1851, the cross of the Commander of the Legion of Honor. This, however, he refused, thinking that its acceptance might detract from his reputation for disinterested loyalty.[119]

In 1851-2 he was still lecturing at the College, and his lectures were collected, analyzed and published in the latter year by Dr. Fauconneau Dufresne (94). He still continued to sit on the board of examiners for the prizes in experimental physiology[120] and medicine and surgery, but it is interesting to observe that among the other members of these committees the name of Magendie's pupil and successor Claude Bernard has begun to appear.

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[117]D: p. 180. Also: *Gaz. méd. de Paris,* 1845, ser. ii, xiii, p. 714. In C. Schaile's directory, "Les Médicins de Paris" (Paris, 1845, p. 445), Magendie's address is given as "Quai Malaquais, 5," and his consultation hours "From 12 to 2 P. M." In the summer of 1905 Professor Brubaker found two old three-story houses, Nos. 5 and 7, still standing on the Quai facing the site of the old Hôtel-Dieu.

[118]F: pp. 52-53. A street in Sannois still bears Magendie's name.

[119]F: p. 55.

[120]*See* C. xlii, Jan. 28, 1856, pp. 137 and 147.

As late as 1853, Magendie presented to the Academy the fourth volume of memoirs[121] published by the Hippiatric Commission.

Death of Magendie, 1855.

At last heart disease, the fatal malady from which he had suffered for many years, began to press him hard. Nevertheless, even sickness and the approach of death did not break his spirit. He regarded his symptoms as interesting phenomena and studied them, and one of his last speeches to a colleague began with the words, "Here you see me completing my experiments." Those who might have had something to complain of in regard to his bluntness, all went to see him. Magendie was touched by sentiments which he had "merited rather than attracted."[122] "Know," said he to one of his former competitors, "that my asperity increased in proportion to the worth which I recognized in those towards whom I exercised it."

On Sunday, October 7, 1855, in his country house at Sannois, ten miles from Paris, Magendie died in his seventy-first year. Next day at the opening of the session[123] President Regnault "announced to the Academy the sad loss which it had just sustained in the person of M. Magendie, deceased the evening before after a long and painful illness." Flourens, the permanent secretary, added "that this loss, greatly felt by all persons who cultivate the sciences, will be peculiarly felt by those who are interested in the progress of experimental physiology, a science in which Magendie had by his great labors made for himself an eminent place."

The funeral services were held, October 11th, at the Church of the Madeleine, in the presence of a great number of notable scientists. The procession was led by Drs. de Puisaye and Roberty, nephews of the deceased. The cords of the canopy were held by Flourens and Serres, of the Academy of Sciences, Stanislas Julien, of the Academy of Inscriptions and Belles-Lettres, Villermé, of the Academy of Moral and Political Sciences, Dubois (d'Amiens), Permanent Secretary of the Academy of Medicine, and Davenne, Superintendent of the Bureau of Public Aid.

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[121]C: xxxvi, Aug. 8, 1853, p. 231. The third volume had been presented by Magendie two years earlier. See: *Ibid.*: xxxiii, Sept. 1, 1851, p. 253.

[122]Phrase used by Fontenelle in speaking of an Academician of his day.

[123]C: xli, 1855, p. 547.

The burial took place in the cemetery of Père Lachaise[124] and orations were made over the grave by Andral (for Serres) in the name of the Academy of Sciences, by Flourens in the name of the College of France, by Dubois (d'Amiens) in the name of the Academy of Medicine, and by Villermé in the name of the Committee on Public Hygiene.

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[124]Magendie's monument in Père Lachaise bears the following inscription:

"F. Magendie
1783-1855
Martini Gabrielle de St. Maurice
1826-1904
H. Magendie *née* de Puisaye
1802-1868."

The lot in this cemetery was acquired by Magendie's widow after her husband's death. She was then living at No. 8, rue d'Anjou St. Honoré. Henriette-Bartienne (born de Puisaye) was the widow and heiress of Nicolas-Théodore Audinot. Her home was at No. 17, rue de Vendôme (now rue Béranger). On April 10, 1830, at the age of twenty-eight, she was married to Magendie, who was then forty-seven years of age and at that time was residing at No. 30, rue de Seine. The civil marriage ceremony was performed at the Mairie of the sixth arrondissement (approximately the present third arrondissement or *Mairie de Temple*). The religious ceremony took place in the rue de Temple at the Church of St. Elizabeth.

MAGENDIE'S RÔLE IN SCIENCE

The death of the renowned savant was the occasion of several lengthy addresses. Flourens, the permanent secretary of the Academy of Sciences, made an address, and so did Dubois, the permanent secretary of the Academy of Medicine. Bernard, his pupil and successor in the chair of medicine at the Collège de France, devoted, according to custom, his first lecture to a review of Magendie's life and work. Accordingly, his merits, his shortcomings, his eccentricities have all been discussed and criticised by those of his colleagues who survived him. What then is their verdict? What is the debt which posterity owes to Magendie? Is it great? What is its character?

Flourens, Dubois and Bernard have answered these questions so carefully and fairly, in words so precise and admirable, that one cannot do better than quote from their addresses.

"'Science,' said Guizot,[125] 'has its sublime speculators who are, so to speak, its prophets who detect instantly the great laws of the universe and grasp them, as Columbus discovered the New World, hastening to the search in the faith of an idea. Around them are drawn up the sagacious observers who excel in searching out, establishing particular truths, describing them and uniting them successfully to the domain of science. And into this domain thus enriched enter legislative minds who classify the facts received, note their relations and determine their laws, and transform them into those general formulas which define the present state of science and become the points of departure and the instrument of future conquests.'

"Magendie had nothing in common with those enthusiastic and exalted minds which, inspired by pure speculation, launch themselves a little recklessly into the field of science, and he despised even those minds which hasten to co-ordinate and frame general laws from facts observed by others . . . His mission was not more humble but more simple, more attainable. An observer distrustful and acute, an experimenter ingenious and critical, Magendie was exclusively devoted to verifying and establishing particular scientific facts. Magendie, it is true, made no important discovery in physiology, he has stated no new law,

[125] D: pp. 117, 118. Guizot's address on the occasion of the reception of M. Biot at the Académie Française.

but he has put facts hitherto full of obscurity in such light, he has given such a degree of certainty to the evidence of things previously doubtful or imperfectly known, that he can with good right place his name by those of discoverers."

"I believe," said Dubois in his funeral oration,[126] "that one does not go too far in saying that not one discovery has been made in our day which has not been controlled and verified by M. Magendie, that no problem has been solved of which M. Magendie has not sought on his own account to dissipate the obscurities and penetrate the mysteries. Others have shown more initiative and by their inventive genius have made splendid the field of science, but no one knew better than he how to order its boundaries and establish its true domain."

"If M. Magendie," writes Claude Bernard, "did not have the ambition to leave behind him generalizations, he did wish to leave behind him investigators for the definite establishment of experimental method in the medical sciences, and in this respect he has the glory of having completely attained his goal . . . Look at the physicians and even the physiologists at the beginning of the century. Experimenters were rare. To-day it is very different: one cannot count the physiologists who perform experiments; on the contrary, one counts those who do not, and the physiologists who are not experimenters are anomalies which we can no longer understand."

"Abroad, the experimental method has been propagated everywhere and has spread far and wide in physiological science. Up to still more recently physiology in Germany was dominated by systems of philosophy. To-day it advances with great strides along the path of experimentation. In many of the German universities there are so-called physiological institutes which are nothing but laboratories in which experiments on living animals find convenient assistance from physics and chemistry, in arriving at knowledge of the phenomena occurring in the living organism. Note well that all these things are of recent date, that they have followed the impulse which has been given in France to experimental physiology."

In the words of Flourens, "M. Magendie has transmitted to us the torch of experimental physiology which has not trembled in his hand for one single instant during almost half a century."

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[126] E. F. Dubois. Discours prononce aux obseques de M. F. Magendie. *Mém. d. l'Acad. d. Méd.*, Paris, 1856, xx, p. xxx. An incomplete list of Magendie's works is appended to this article.

APPENDIX

TITLES OF MAGENDIE'S PUBLICATIONS, ARRANGED CHRONOLOGICALLY.

1. Sur les usages du voile du palais, avec quelques propositions sur la fracture du cartilage des côtes. *Paris,* 1808.

2. Quelques idées générales sur les phénomènes particulier aux corps vivants. In: *Bull. d. sc. méd. Soc. med. d'émulat. de Par.,* 1809, p. 145.

3. Mémoire sur les organes de l'absorption chez les mammifères. *Paris,* 1809. Also in: *J. de physiol. expér.,* 1821, i, p. 18.

4. Examen de l'action d. quelques végétaux sur l. moelle épinière (avec R. Delille). *Paris,* 1809. Also in: *Nouv. bull. d. l. Soc. philomath.,* i, p. 368.

5. Expériences pour servir à l'historie de la transpiration pulmonaire. In: *Nouv. bull. d. l. Soc. philomath., Paris,* 1811, ii.

6. Mémoire sur le vomissement. *Paris,* 1813.

7. Mémoire sur les images qui se forment au fond de l'oeil et sur un moyen très simple de les apercevoir. *Paris,* 1813.

8. De l'influence de l'émétique sur l'homme et les animaux. *Paris,* 1813.

9. Mémoire sur l'usage de l'épiglotte dans la deglutition. *Paris,* 1813. Second "Mémoire." In: *J. de méd. d. Leroux,* 1813, xxvi.

10. Mémoire sur l'oesophage. *Paris,* 1813. Also in: *J. de méd. d. Leroux,* 1815, xxxiv, p. 255.

11. Précis élémentaire de physiologie. 2 vols. *Paris,* vol. i, 1816; vol. ii, 1817.

Idem. 2. Ed. 2 vols. *Paris,* 1825.

Idem. 3. Ed. 2 vols. *Paris,* 1833.

Idem. 4. Ed. 2 vols. *Paris,* 1836.

11a[1]. The same. A summary of physiology. Transl. from the French by John Revere. *Baltimore,* 1822.

11a[2]. The same. An elementary compendium of physiology, for the use of students. Transl. from the French, with copious notes and illustrations, by E. Milligan, M.D. Revised and corrected by a physician of Philadelphia. With an appendix. *Philadelphia,* 1824.

11a[3]. The same. An elementary treatise on human physiology. Transl. enlarged, and illustrated with diagrams and cuts, especially designed for the use of students of medicine, by John Revere. *New York,* 1844.

11b[1]. The same. Lehrbuch der Physiologie. Aus dem Französischen übersetzt von D. Hofacker. *Tübingen,* 1826. 2 vols.

11b[2]. The same. Lehrbuch der Physiologie. Transl. from the 3. French ed. by C. L. Elsässer. 2 vols. *Tübingen,* vol. i, 1834; vol. ii, 1836.

12. Mémoire sur la deglutition de l'air atmosphérique. *Paris,* 1816. Also in: *J. de méd. d. Leroux,* 1816, xxxvi, p. 9.

13. Mémoire sur les propriétés nutritives des substances qui ne contiennent pas d'azote. *Paris,* 1816. Also in: *J. de méd. d. Leroux,* 1817, xxxviii, p. 306.

14. Note sur l. gaz intestinaux de l'homme. In: *Ann. d. chim. et d. phys.,* 1816, ii.

15. (Magendie et Pelletier). Recherches chem. et physiol. s. ipecacuanha. In: *J. univ. d. sc. méd.,* 1816, iv, p. 322.

16. Mémoire sur l'action des artères dans la circulation. In: *J. de méd. d. Leroux,* 1817, xl, p. 208; also in: *J. de physiol. expér.,* 1821, i, p. 102.

17. Recherches physiologiques et médicales sur les causes, les symptômes et le traitement de la gravelle. *Paris,* 1818.

Idem. Avec quelques remarques sur la conduite et le régime que doivent suivre les personnes auxquelles on a extrait des calculs de la vessie. 2 ed., revue et augmentée. *Paris,* 1828.

17a[1]. The same. Physiologisch-medicinische Untersuchungen über die Ursachen, Symptome und Behandlung des Grieses und Blasensteines. Aus dem Französischen übersetzt von Joh. Gottfried Zöllner. *Leipzig,* 1820.

17a[2]. The same. Physiologische und medicinische Untersuchungen über den Harngries, seine Ursachen, Symptome und Behandlung, nebst einigen Bemerkungen über Diät und Verhalten derjenigen, die von Harnsteinen befreit worden sind. Nach der 2. Aufl. des Französischen bearbeitet von Dr. Friedrich Ludwig Meissner. *Leipzig,* 1830.

17b. The same. Physiologisch-geneeskundig onderzoek, aangaande de oorzaken, verschijnselel en genezing van de graveelen steenziekte. Uit het Fransch. *Rotterdam,* no date.

18. Note sur l'emploi des quelques sels d. morphine commes médicament. In: *Nouv. J. de méd.,* 1818, i.

19. Reflexions sur une mémoire de M. A. Portal relatif au vomissement. In: *Nouv. J. de méd.,* 1818, i.

20. Recherches physiologiques et chemiques sur l'emploi de l'acide prussique ou hydrocyanique dans le traitement des maladies de poitrine et particulièrement dans celui de la phthisie pulmonaire. *Paris,* 1819.

20a. The same. Physiological and chemical researches on the use of prussic or hydrocyanic acid. . . . Transl. from the French, with notes, etc., by James G. Percival. *New Haven,* 1820.

21. Mémoire sur les vaisseaux lymphatiques des oiseaux. *Paris,* 1819. Also in: *J. de physiol. expér.,* 1821, i, p. 48.

22. Notes sur l. effects de l. strychnine sur l. animaux. In: *Ann. d. chem. et d. Phys.,* 1819, xvi.

23. Formulaire pour la préparation et l'emploi de plusieurs nouveaux médicaments, tels que la noix vomique, la morphine, l'acide prussique, la strychnine, la vératrine, les alcalis des quinquinas, l'émétine, l'iode, etc. *Paris,* 1821.

Idem. 2. Ed. *Paris,* 1822.

Idem. 3. Ed. *Paris,* 1822.

Idem. 4. Ed. *Paris,* 1824.

Idem. 5. Ed. *Paris,* 1825.

Idem. 6. Ed. *Paris,* 1827.

Idem. Edition entitled: Formulaire pour la préparation et l'emploi de plusieurs nouveaux médicaments, tels que la noix vomique, l. sels d. morphine, l'acide prussique, l. strychnine, l. vératrine, l. sulfate d. quinine, l. cinchinine, l'emétine, l'iode, l'iodure d. mercure, l. cyanure d. potassium, l'huile d. croton tiglium, l. sels d'or, l. sels d. platine, l. chlorures de chaux et d. soude, l. bicarbonates alcalins, l. préparations d. phosphore, l. pastilles digestives d. Vichy, l'écorce d. l. racine d. grenadier, etc. *Paris,* 1829.

23a[1]. The same. Formulary for the preparation and employment of several new remedies. . . . Transl. from the sixth edition of the Formulaire . . . by Joseph Houlton. *London,* 1828.

Idem. London, 1829.

23a[2]. The same. Transl. from the French, with annotations and additional articles, by James Manby Gully. *London,* 1835.

23a[3]. The same. Transl. from the 8. French edition by Charles Wilson Gregory. *London,* 1835.

23a[4]. The same. Transl. from 5. ed., revised and augmented by John Baxter, with notes and additions. 2. ed. *New York,* 1828.

23a[5]. The same. Transl. from the French by Robley Dunglison. *Philadelphia,* 1824.

23a[5]. The same. Transl. from 6. ed. . . . by J. Houlton. *Philadelphia,* 1834.

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