FEPS

Federation of European Physiological Societies

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Letter of the President of FEPS

The fact that the Nobel Prize for Medicine was initiated as a Nobel Prize for Physiology and Medicine no longer seems to be common knowledge. It certainly reflected the situation at that time, when Physiology was considered to be the leading science in Medicine from which most innovation could be expected. Since those days many new scientific disciplines have been created which also contribute decisively to the progress in understanding the function and diseases of the human organism at the cellular and genetic level as Physiology continues to do. In the face of this rapid progress in natural sciences, one sometimes hears the opinion that the traditional natural sciences such as Physiology have played their part and may eventually be replaced totally through mergers with newer disciplines. As a consequence of this, physiology departments already exist no more in some countries. Instead they are diluted into “life sciences” or only temporarily existing “research programmes”. On being confronted with this development, many physiological societies try to analyse the current situation and assess the potentially most successful pathway for Physiology in the future. For example, at its recent meeting in Oulu, the Scandinavian Physiologic Society organised a panel discussion entitled “Physiology 2008 –future directions and threats”. This was a very good move. While it was already clear that there is room to strengthen the profile of Physiology both in academia and in public opinion, it was acknowledged as a threat – and not only to physiology - that the career options for young scientists are insufficient. However, there were also very encouraging aspects. The speakers from pharmaceutical companies pointed out that the physiologic approach is very important in the development of new therapies and that trained physiologists still have good career chances. It was also confirmed that Physiology is not only an important discipline but also an indispensable method of approaching and interpreting the complexity of signalling and regulatory mechanisms in the living organism. Looked at like this, many more people could be considered physiologists than just those working in physiologic institutes. This represents a chance for physiology but also a threat because physiology

could be finally diluted down into the more amorphous “life sciences”. However, one could see that many participants were by heart physiologists and mainly through their science they are the ambassadors of Physiology worldwide. Together with the national societies, FEPS will support the efforts to strengthen the profile of Physiology against the other disciplines in natural sciences. At the European level, this means additional publicity for Physiology, the creation and maintenance of crystallisation points such as FEPS’s new teaching initiative, and of platforms such as conferences, workshops and training opportunities especially for the younger members wanting to network in European Physiology. This is a huge task and can hardly be performed merely by volunteers and with the current low budget. The time has come for us all to have to think about how we can increase the support for FEPS in its efforts to further promote the spirit and unique strengths of Physiology at the European level.

Ulrich Pohl
President of FEPS

Joint meeting of the Slovenian and Austrian Physiological Societies and FEPS in 2009

We are proud to announce that the next year the joint scientific meeting of the Slovenian Physiological Society, the Austrian Physiological Society and FEPS will be held in Ljubljana, Slovenia on November, 12-15, 2009.

The meeting is aiming to present a scientific platform for all other member societies of the Federation of the European Physiological Societies and our colleagues from other continents.

The meeting is organized around Scientific Symposia covering the whole field of Physiology. The meeting will also comprise the annual FEPS Physiology Teaching Symposium organized by the FEPS task force on teaching Physiology, and the annual EYPS (European Young Physiologists Symposium) organized by young physiologists.

Further information can be obtained from the provisional website : http://lnmcp.mf.uni-lj.si/

Carl Ludwig

by
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Curriculum vitae

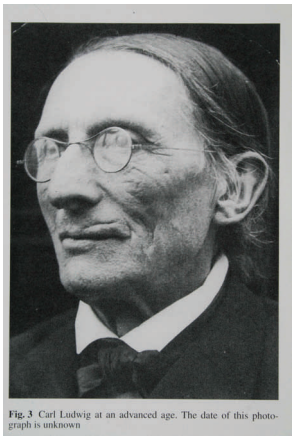

Fig. 3 Carl Ludwig at an advanced age. The date of this photograph is unknown

Carl Friedrich Wilhelm Ludwig was born December 29, 1816 as one of eight children in Witzenhausen, a small town south of Göttingen, Germany. His father had been an officer in the Napoleonic wars and then got a position in Hanau which is located near Frankfurt/ Main. Here Carl Ludwig finished high school in 1834. He started his medical studies at the University of Marburg. He was politically active, was relegated from the University and continued his medical education in Erlangen and at the School of Surgery in Bamberg. In 1839 he returned to Marburg where he devoted much of his time to his fraternity and to fencing, a sport that was cultivated there. The scar on his upper lip documented the result of these activities (photograph). In 1840, Carl Ludwig obtained his M.D. degree.

Until 1841, Carl Ludwig worked in the laboratory of Robert Bunsen. Then he got the position as second prosector at the Department of Anatomy of the University of Marburg through the influence of Ludwig Fick, the elder brother of Adolf Fick. When Ludwig Fick became chairman of the Anatomy Department, Carl Ludwig was promoted to the position of the first prosector and was appointed extraordinarius for Comparative Anatomy in 1846 (1). Already in 1842, he had published his habilitation on blood vessels in the kidney. In this paper (2) he described the function of the glomeruli correctly. In the same year, Carl Ludwig started his experiments on the physiology of circulation and on the methodology to measuring blood pressure. In 1847, he published the results he had obtained with the kymograph (3) with which it became possible to record physiological processes over time.

In 1849, he was appointed Professor and chairman of the Department of Anatomy and Physiology at the University of Zürich, Switzerland. His financial situation had improved so that he was able to marry in December of the year 1849. In 1851 a daughter was born, in 1854 a son followed who unfortunately died at an early age. The teaching load in Anatomy was huge. The writing of the Textbook of Physiology (4), a project he had started already in Marburg, required also much time and energy. So there was hardly time left for his experiments on diffusion, on the secretion of glands and on circulation and respiration physiology.

In 1855, Carl Ludwig was appointed Professor of Physiology and Zoology at the medical-surgical military academy, the so-called Josephs-Academy (Josephinum) in Vienna. Already since 1849, Ernst Brücke was at the Department of Physiology of the University of Vienna. During his 10 years in Vienna, Carl Ludwig invented the blood gas pump and elucidated the principal processes involved in gas exchange and in the origin and movement of the lymph. In addition, he discovered the medullary vasomotor center. Already during this period he had numerous foreign scholars, in particular from Russia. Obviously he did not like the military atmosphere in the Josephs Academy with its inherent bureaucracy and strict rules. Already at that time, Carl Ludwig was very popular among his students. When he got an offer to become chairman of the Department of Physiology at the University of Leipzig, he gladly and immediately accepted.

In Saxony a new era of science and medical education had started in 1853 with the appointment of Johann Paul Freiherr von Falkenstein as minister of culture and science. Immediately after von Falkensteins appointment, he reformed the study of medicine at the University of Leipzig to halt the steady decline in number of medical students. In the face of the limited budget for education, it was the aim of von Falkenstein to create excellence in science in few selected areas and to recruit the most competent men to cover a large area of the required integrated methodological approach. Already in December 1864, he had developed a plan to separate Anatomy from Physiology. Since 1821 Ernst Heinrich Weber was chairman of the Department of Anatomy. From 1840, he also gave lectures in Physiology. Von Falkenstein proposed that a new Institute of Physiology should be built and he suggested that the designated physiologist should be involved in the process of planning and organizing the new Institute. The candidate who seemed most competent to him to achieve these goals was Carl Ludwig. To him he was

the only one who was able to cover a wide area of interests and methodology and to devote Physiology to the service of medicine. Ernst Heinrich Weber, already 70 years old, confined himself to Anatomy, and Carl Ludwig took over the chair of Physiology on May 1,1865 with a lecture on „The physiological performance of blood pressure“. (5)

The new institute was opened on April 26, 1869. The general outline of the institute reflected the integrated methodological approach of Carl Ludwig. In two papers (6, 7) published in 1870, H.P. Bowditch described the new institute and the working conditions. The house had the shape of the capital letter E. The lecture hall for about 100 students was in the middle. In one wing was the Histology Department, in the other one the Chemical Department. They were connected by the laboratories in which Experimental Physiology was housed. This design served as a model for many laboratories in Germany and abroad. The building was destroyed in World War II.

Carl Ludwig worked in this institute for more than 25 years. The experiments on the regulation of circulation and respiratory gas transport were continued here. Other areas included viability studies of isolated and perfused organs such as heart, kidney, and liver, the secretion of glands, the physiology of blood, lymph and muscle also from a histological and biochemical point of view. As an academic teacher he fulfilled entirely the expectations of von Falkenstein: The number of medical students increased linearly over time since Ludwig’s appointment in Leipzig. Carl Ludwig was the first Secretary of the mathematic-physic class of the Royal-Saxonian Academy of Sciences (Königlich-Sächsische Akademie der Wissenschaften) from 1883 to 1893. He received numerous honours. He died from bronchitis on April 23, 1895 at the age of 79.

The organic physicists

Carl Ludwig was involved in the foundation of a new direction in physiological research. There was a small group of young, highly talented and dynamic physiologists who fought against the concepts of natural philosophy and vitalism as determining factor in Physiology. These young energetic physiologists were convinced that in the organism no other forces are active than the common physico-chemical ones. The ultimate aim was to describe nature in a mathematical manner. These were the characteristics of the reductionistic approach propagated by this group. They named themselves „organic physicists“. Carl Ludwig was the senior among them. He had written the Textbook of Physiology as the program of this new direction and had devoted it to his friends Ernst Brücke, Emil du Bois-Reymond, and Hermann Helmholtz, the other members of the “organic physicists”.

Historical background

Carl Ludwig was born three years after the defeat of Napoleon in 1813 at Leipzig and one year after the Vienna Congress through which the political interests and forces in Europe were newly determined in 1815. The fight against Napoleon was viewed by the young Germans, in particular by the students, as a liberation war, and it generated a desire to establish a unified national state. The most important political event was the revolution of 1848 with the opening of the first German National Assembly in the Paulskirche in Frankfurt. Carl Ludwig and also du Bois-Reymond welcomed the aspirations and goals of this revolution, which were national self-determination and unification. However, these hopes were not fulfilled. Later, Ludwig was not politically active quite in contrast to du Bois-Reymond who supported the politics of Bismarck, and the German-French war of 1870.

The 19th century is characterized by the industrialization which occurred in all western countries at about the same time. There was a steady increase in the population with a shift from the agricultural to the industrialized areas, from east to west, from the mountains to the valleys. As a result, the population of the German cities grew during the entire 19th century. This reflected the improvement in the overall social conditions, in hygiene and in medical care. Nevertheless, there were some periods of famine and epidemics such as the famine typhus in Upper Silesia and the cholera epidemic in 1849. There was a period of famine in the northern part of Bavaria in 1852. It was therefore the political aim to increase agricultural production to prevent such events and ,hence, political unrest. In this situation, it was convenient and necessary to use chemistry for the sake of agricultural needs. This was the program which Justus Liebig had developed and advocated. With this practical goal in mind, science was supported by the state. In addition, there was another, more general aspect. Du Bois-Reymond and Virchow argued that science would influence the way people think and act. Science, therefore, was envisaged as an element of culture that would determine the future of Germany. This view was attractive to the politicians. They acknowledged that political power is dependent on industry, and that industry, in turn, is dependent on the development of natural sciences. In view of this political, economic and social situation there were exceptionally good conditions for medical and

physiological research during the entire professional lifetime of Carl Ludwig. As a result, German science and Physiology in particular flourished. The 19 independent German universities maintained by the kings or princes of the numerous small states constituting Germany guaranteed decentralization. Therefore, every state competed for the best scientists they could afford and attract. And these, in turn, could determine or negotiate their conditions in terms of laboratory space, equipment, personnel, and financial situation. Another factor was the structure of the German University system. Scientists in Germany became full-time researchers. After obtaining particular specialization, they could start an academic career and they were paid for their job by the respective state. This created a new scientific professionalism that developed its own standards of qualification and quality control. A particular qualification procedure was the "habilitation", the submission of a high-level scientific work based on original research. A "habilitation" was necessary to get the licence to lecture and to obtain academic promotion and appointment. Quality control was exerted and maintained by the requirement that the results of scientific research is published.

The impact of Carl Ludwigs work

Carl Ludwig has had an enormous influence. He was the representative of the organic physicists and he had written the scientific program of this group of young physiologists. His Textbook of Physiology was a shock to the conservatives, and it was considered to be definitely premature. On the other hand, it was a breakthrough, though difficult to understand (4), for the young scholars, medical students and physicians.

His newly built institute in Leipzig also exerted a great influence. It was unique at that time and was considered as one of the most productive biomedical research departments (8). There was a steady flow of publications from the Institute starting in 1866. They appeared as „Berichte über die Verhandlungen der Königlich-Sächsischen Gesellschaft der Wissenschaften zu Leipzig" in 10 volumes. These volumes contained the results of the experimental research of Carl Ludwig and his numerous pupils. It has been estimated that the Institute housed between 200 and 300 students and collaborators from Germany and from abroad (1).

In the table below, Carl Ludwig´s major inventions and discoveries are summarized as well as the most important topics and physiological processes he investigated. The inventions and discoveries of Carl Ludwig became so familiar to his contemporaries that they belonged immediately to the anonymous body of scientific knowledge of the time without mentioning his name. It was characteristic of Carl Ludwig that he seldom appeared as (co-)author the papers he had written und submitted to the Royal-Saxonian Academy of Sciences. For instance, the „Treppe" or staircase phenomenon is exclusively attributed to Bowditch, although this paper was the result of his experimental work in Leipzig (9). This may explain why in later years Carl Ludwig has not been well known among German physiologists after his disciples and scholars had died. In fact, there is no award or lecture in German Physiology that carries his name.

Adolf Fick was one of his first students. Carl Ludwig had met him in Marburg where he worked in the Institute of his elder brother Ludwig Fick. Adolf Fick became chairman of the department of Physiology at the University of Würzburg. One of Carl Ludwig´s last German students was Otto Frank. He became chairman of Department of Physiology at the University of Munich.

Bowditch was one of Carl Ludwig´s first American students who came to visit the new physiological Institute in Leipzig. He continued his physiological work at Harvard Medical School and was a founding member of the American Physiological Society. Three of the four professors of the Johns Hopkins School of Medicine at Baltimore which was opened in 1893 were pupils of Carl Ludwig: William H. Welch in Pathology, Franklin P. Mall in Anatomy, and John J. Abel in Pharmacology. They transferred the German university system with the full-time faculty positions and supported research to the USA. As to Russian physiology, Elias Cyon, Iwan Michailowitsch Setchenow and Iwan Petrowitsch Pavlow, the first physiologist who received the Nobel Prize in Physiology and Medicine in 1904, were among his coworkers. The Scandinavian countries were represented by Christian Bohr and August Tigerstedt.

Carl Ludwig had a great influence on the medical students who attended his lectures. He was not a brilliant rhetoric, but he fascinated the students by his characteristic attitude, his unorthodox didactic methods, his humour, and the experimental demonstrations (10).

Table: Some important inventions and discoveries of Carl Ludwig as well as physiological processes that he elucidated or worked on

Inventions and discoveries	Physiological processes
Kymograph (recording manometer)	Filtration theory of urine formation (glomeruli)
“Stromuhr” (flowmeter)	Localization of the medullary vasomotor center
Mercury blood gas pump	Depressorreflex
Viability of isolated, perfused organs (e.g. heart, Liver, Kidney)	Vegetative innervation of the vessels
Function of the cardiac valves	Gland secretion, secretory nerves
Non-tetanizability of the heart	formation and movement of the lymph
“All-or-non” law of the heart	Capillary permeability
Absolute refractory period of the heart	Respiratory gas exchange
“Treppe” (staircase) phenomenon	Morphology of regional peripheral circuits
Injection methods for vessel visualization	Absorption and metabolism of sugar, fat, proteins

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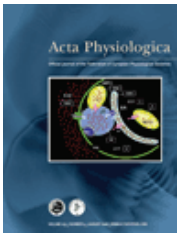

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