**Development of Biology at the University of Karlsruhe 1832 – 2010**

[Polytechnische Schule: 1825 – 1885; Technische Hochschule: 1885 – 1967; Universität (TH): 1968 – 2009; Karlsruher Institut für Technologie (KIT): since 2009]

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## Early Developments of Botany and Genetics in Karlsruhe 1715 - 1832

When margrave Karl Wilhelm (1679 – 1738) of Baden with his interest in Botany and exotic plants had founded the Karlsruhe Palace (*Schloß*) in 1715, he had large amounts of trees from foreign countries planted in the Palace Gardens (*Schloßgarten*). In addition, numerous herbaceous and exotic plant rarities were cultivated in the palace greenhouses. As a passionate gardener he introduced 5000 different types of tulips that were bred, proliferated, and also painted in Karlsruhe (*Karlsruher Tulpenbuch* of 1730). In 1731 his gardener Christian Thran was sent on a 2-year excursion to Tunisia. He returned with seeds and seedlings from African plants which were cultivated in the Karlsruhe Palace Gardens and distributed to many other European courts. With princess Caroline Luise (1723 – 1783), as the spouse of margrave Karl Friedrich (1727 - 1811), a well known excellent botanist came to the court of Baden in 1751. She corresponded extensively with the famous botanist Carl von Linné, cultivated numerous local and foreign plants in the Karlsruhe Schloßgarten, had these plants painted and also engraved on copper plates for a planned book edition of all existing plants. In addition, she saw to it that all the local and foreign trees and plants of the Karlsruhe palace gardens were botanically correctly determined and catalogued according to the plant system of Linné. For this purpose Joseph Gottlieb Kölreuter (1733 – 1806) was appointed curator (*Direktor*) of the Botanical Palace Gardens at Karlsruhe in 1764 and also professor of Natural History to take care of her large natural science collections (*Naturalienkabinett*). At the beginning of 1760 Kölreuter had published a series of papers on sex in plants, and in Karlsruhe he continued and extended his classical crossbreeding experiments (e.g. with two tobacco species). He demonstrated that the characteristic features (*Merkmale*) of the resulting tobacco hybrids were of maternal and paternal origin. In fact, many years before Gregor Mendel he detected the laws of genetic inheritance in plants, which today are known as “Mendel Rules of Genetics”. Mendel's famous experiments were an extension of Kölreuter’s crossbreeding results and Mendel admitted this in the publication of his results. Thus, the pioneer and actual founder of genetics is Johann Gottlieb Kölreuter. In 1784 the botanist Professor Carl Christian Gmelin (1762 – 1837) took over the management of the Karlsruhe Botanical Gardens as well as the natural science collections, later known as State Collection and Museum of Natural History (*Staatliches Naturkundemuseum*). In 1805 Gmelin edited the first flora of Baden and Alsace (*Flora Badensis Alsatica*) and, together with court gardener Michael Schweyckert, he took various trips to foreign countries collecting plants and seeds and considerably enlarging the plant population of the Karlsruhe Botanical Garden. Thus, essential impulses for the study of plants and early research in botany and genetics came from the Court of Baden in Karlsruhe.

When Caroline Luise's second son Ludwig, influenced by his mother's botanical, chemical, technical and science studies, was Grand Duke of Baden, he was well prepared to found the Polytechnical School of Karlsruhe in 1825.

**The Years 1832 - 1945**

When a School of Forest Science was founded in the Grand Duchy of Baden in 1832, it was incorporated into the Polytechnical School (*Polytechnuische Schule*) of Karlsruhe. The newly created Chair of Botany was filled by Alexander Braun (1833 – 1846) who lectured both botany and zoology and was well known for his research in plant morphology, and was also appointed director of the State Collections of Natural History. His successor, the botanist Moritz Seubert (1846 – 1878), known for his excellent botanical text books and excursion flora, also taught both subjects to the students of forestry science and to those of biology. M. Seubert was also appointed director of the State Collections of Natural History (1870) and librarian of the Court and State Library of Baden. In 1872 the study course of pharmacy was introduced at the Polytechnical School (1872 – 1925) and M. Seubert also started teaching pharmacognosy. After his death in 1878 botany, including pharmacognosy on one hand and zoology on the other hand, were separated into two independent teaching units and institutes.

***Botany***: Already in 1877 a separate Chair of Plant Physiology and Agricultural Chemistry had been created and was filled by Leopold Just (1877 – 1891). When M. Seubert died, the Chair of L. Just was combined with that of Botany. L. Just taught botany and pharmacognosy, expanded the botanical institute and the collections, and under his guidance a botanical garden (1.5 hectar) with green houses and other buildings was established in the former court kitchen garden of the Grand Duchy of Baden. In fact, the polytechnical school with all its buildings was located in one section of the Karlsruhe Palace Gardens (*Karlsruher Schloss*). Ludwig Klein (1892-1925), well known for his natural history of forest trees and his nicely illustrated pocket books on wild plants and fungi, took over the Botany Chair from L. Just. Twice (1903 and 1913) he was appointed director (*Rektor*) of the polytechnical school that had been renamed "*Technische Hochschule (TH)*" in 1885. Under L. Klein's guidance a separate building for botany was set up at Kaiserstrasse 2 (today Botany 1) and was inaugurated in 1899. Walter Migula (1893 – 1904), a pioneer in bacterial systematics, was habilitated in 1890 for botany at the TH Karlsruhe and served several years as a professor while working as a member of the Bacteriology Department of the Food Research Institute that was also located at the TH Karlsruhe. Today he is known to microbiologists by his 1895 description of the ecologically, clinically and biotechnologically important genus *Pseudomonas*.
***Zoology***: Already in 1876 the soon-to-be well known zoologist Otto Bütschli obtained his habilitation in Karlsruhe and taught here for two years. The first Chair of Zoology was filled by Otto Nüßlin (1878 – 1914), a forest entomologist and fish breeder. He was succeeded by

Karl Escherich (1914 – 1915), Reinhard Demoll (1916 – 1918), and finally by the hydrobiologist Robert Lauterborn (1918 – 1920).

**1920 – 1945**: After the political decision in 1920 to transfer the Forest Science Faculty to the University of Freiburg, the Chair and Institute of Zoology moved to Freiburg. However, the Botanical Institute with L. Klein remained in Karlsruhe. After L. Klein's retirement in 1925, that position was no longer filled. The study course of pharmacy was discontinued in Karlsruhe and concentrated in Heidelberg due to financial problems of the newly formed State of Baden. Yet, the Botanical Institute continued teaching and its research in botany as well as in general microbiology and food microbiology and was taken over by Wilhelm Schwartz (1928 – 1945), a state government botanist (*Regierungsbotaniker*) of the Agricultural Research Station Augustenberg in Karlsruhe-Durlach. The teaching of zoology was pursued by two professors of the State Collection of Natural History (*Landessammlungen für Naturkunde*): Walter May (1920 – 1926) and Max Auerbach (1928 – 1936). In 1940 Hans Kühlwein was appointed as a lecturer of Botany and Microbiology.

**The Years 1945 - 2000**

After World War II in 1946 the study course of pharmacy was reestablished in Karlsruhe. The Botanical Institute had reopened in the fall of 1945 with Hans Kühlwein as the provisional head on W. Schwartz's former *Regierungsbotaniker* position. In 1948 a new Chair of Botany and Pharmacognosy was created and filled by Ulrich Weber (1949 – 1954), the editor of the famous textbook of pharmacognosy. After his early death the chair was refilled by Hans Kühlwein (1956 – 1980) who initiated the establishment of the new botanical garden „*Am Fasanengarten*", completed in 1958. H. Kühlwein ran the well-known meeting of the German Botanical Society (Deutsche Botanische Gesellschaft, DBG) in Karlsruhe in 1962. In his teaching of pharmacognosy he was complemented by Privatdozent Ewald Sprecher (1959 – 1968), later professor of pharmacognosy in Hamburg. Teaching of zoology was restarted in 1948 by the school director Franz Mutscheller (1948 – 1972), and in 1962 a new Chair of Zoology was created and filled by Gerolf Steiner (1962 – 1973). In addition, in 1962 a Chair of Radiation Biology (Alexander Catsch, 1962 – 1976) was established in cooperation with the Karlsruhe Nuclear Research Center (Kernforschungszentrum KarlsruheKfK) and became internationally renowned for its research on the decorporation of radioisotopes of transuranium elements and heavy metals.

**Biology Karlsruhe within the new "Faculty of Life and Earth Sciences 1969 – 2001".**
With the reorientation of the Technische Hochschule and its renaming to "University of Karlsruhe" in 1967/1968 the university senate and the government of Baden-Württemberg decided to establish several new chairs in biology in order to guarantee complete education

and research in modern experimental biology. As a result of that restructuring the old Faculty for Sciences (*Fakultät für Naturwissenschaften II*) was divided into smaller faculties and the new Faculty of Life and Earth Sciences (*Bio- und Geowissenschaften*) was established in 1969 with Hans Kühlwein as first dean (1969-1971). Separate chairs were created, first for Plant Physiology, Biochemistry and Pharmacognosy, known as Botany 2, (Hartmut Lichtenthaler, 1970 – 2001), then for Zoophysiology, known as Zoology 2, (Wilfried Hanke, 1971 – 1997), and later for Microbiology (Walter Zumft, 1982 – 2005). All three chairs were located in the Chemistry Center (*Chemieturm I*, Fritz-Haber-Weg 4) of the university campus. After the early death of A. Catsch in 1976 the Chair of Radiation Biology was transferred to the Chair of Genetics (Peter Herrlich, 1977 – 2003). H. Lichtenthaler, later well-known for the detection of the chloroplast-bound isoprenoid biosynthesis (DOXP/MEP pathway), initiated the construction of an experimental greenhouse for reproductive plant growth (*Versuchsgewächshaus*) with laboratories and phytochambers in the Botanical Garden. It was completed in 1978. In addition to the new chairs of biology, several associate professorships were established for biophysics (Georg Schoffa, 1971 – 1988), biological electron microscopy (Wilhelm Schmidt-Lorenz, 1971 – 1973), botanical cytology (Hans Heumann, 1974 – 2002), plant morphology (Gerhard Jurzitza, 1973 – 1992), plant physiology (Manfred Tevini, 1974 – 2002), zoology (Konrad Schmidt, 1975 – 1999, Norbert Rieder, 1980 – 2007), applied microbiology (Andreas Kuhn, 1990 – 1997), ecology (Horst Taraschewski, since 1993), and applied genetics (Margot Zöller, 1994 – 2008). Successors to the Chair of Zoology 1 were Georg Kümmel (1974 – 1988), and later Reinhard Paulsen (1989 – 2004); whereas the Chair of Botany 1 was refilled by Manfred Weisenseel (1980 - 2002). The new Faculty of Life and Earth Sciences (*Fakultät für Bio- und Geowissenschaften*) being formed during the restructuring of the Karlsruhe University in 1969 existed until 2001, when the State Government of Baden-Württemberg decided again for larger faculties.

Originally, lectures, courses and examinations took place for the students of biology (*Biologie Lehramt*, first only *Nebenfach*, since 1968 also *Hauptfach*), pharmacy and food chemistry. In 1973/1974 the study course of pharmacy was discontinued in Karlsruhe by a governmental decision and, as before in 1925, transferred to Heidelberg. In 1978, after the establishment of new chairs of biology, a new study course for modern experimental biology (*Diplomstudiengang Biologie*) with H. Lichtenthaler as first chairman (*Prüfungsausschuss-Vorsitzender*) was initiated which most biology students enroll in. Several chairs (located at other faculties) on special biological topics contribute to the course of study in biology. These are the Chairs of Biochemistry (Janos Retey, 1973 – 2002), Engineering Biology and Biotechnology of Waste Water (*Ingenieurbiologie und Biotechnologie des Abwassers*) (Ludwig Hartmann, 1971 – 1992, and Josef Winter, since 1993) and Biocybernetics and Biomedical Techniques (Gerhard Vossius, 1969 – 1994).
The teaching staff in biology was complemented by biologists from federal and state research institutions in the Karlsruhe area. In fact, the Karlsruhe biology has obtained its high

reputation in basic and applied research also as a result of its continuous, close cooperation in teaching and research with various non-university research institutions, such as the Federal Food Research Institute (*Bundesforschungsanstalt für Ernährung*: BfE), Karlsruhe (Prof. Wilhelm Holzapfel), the Federal Research Institute of Viticulture (*Bundesforschungsanstalt für Rebenzüchtung*), Geilweilerhof (Prof. Günther Staudt, Prof. Rolf Blaich), the State Museum of Natural Sciences (*Staatliches Museum für Naturkunde*) in Karlsruhe (professors Ludwig Beck, Gerhard Lang, Georg Philippi, Ulrich Roesler), the State Institute of Agricultural Research (*Landwirtschaftliche Untersuchungs- und Forschungsanstalt*) LUFA-Augustenberg (prof. Norbert Leist), and the Institute of Genetics at the Karlsruhe Research Center (*Forschungszentrum Karlsruhe*) (professors Ulrich Hagen, Gerhart Hotz, Helmut Ponta, Hans Rahmsdorf, Arnulf Seidel and Vladimir Volf).

**The New Millennium, changes since 2000**

**Successions in Professor Positions:** At the beginning of the new millennium various professors of Biology retired, and a new generation of experimental biologists filled the positions. In 2001 Doris Wedlich took over the Zoology Chair (Animal Physiology, later on Cell and Developmental Biology) at the Zoological Institute and was vice-rector (*Prorektorin*) for research from 2002 – 2005. In 2002 Holger Puchta succeeded H. Lichtenthaler to the former Chair of Botany 2, now Molecular Biology and Biochemistry of Plants. Peter Nick was appointed professor (Plant Molecular Cell Biology) in 2003, became the dean for Student Affairs (*Studiendekan*) in Biology and followed M. Weisenseel to the former Chair of Botany 1 in 2005. In 2004 Reinhard Fischer became a professor (Applied Microbiology) in Karlsruhe and in 2006 he succeeded W. Zumft to the Chair of Microbiology. In 2004 Martin Bastmeyer followed R. Paulsen taking over the Chair Cell- and Neurobiology at the Zoological Institute. In 2007 professor Tilman Lampater (General Botany) joined the Botanical Institute and in 2005 Natalia Requena (Symbiosis between Plants and Mycorrhizal Fungi) who, in 2008 became a Heisenberg professor (Plant – Microbe Interactions), i.e. a foundation professorship that will be inherited by KIT. In 2007 Jörg Kämper was appointed professor of Genetics (succeeding Margot Zöller) and Ulrich Schwarz professor of Theoretical Biophysics (2008 – 2009) within the Zoology Department. In January 2005 a merger of the institutes of Food Chemistry (M. Metzler, D. Marko) and Microbiology (W. Zumft, R. Fischer) took place and resulted in the new Institute for Applied Life Sciences (*Institut für Angewandte Biowissenschaften*). The Chair of Genetics (Jörg Kämper) was incorporated into this new merger. This voluntary association was meant to foster the scientific cooperation and teaching in the new Faculty of Chemistry and Biological Sciences, also in view of guaranteeing a good performance of the new study course of Chemical Biology (*Chemische Biologie*). Teaching and research in Biology is further promoted by university assistant professors (*Privatdozenten*), such as Claus Buschmann (plant ecophysiology), Dietmar Gradl

(embryology), Frank Hartung (plant molecular biology, bioinformatics). The teaching of various special topics of biology is complemented by habilitated lecturers (*Privatdozenten*) and professors of non-university institutions, such as Christine Blattner, prof. Andrew Cato, and Véronique Orian-Rousseau from the Institute of Toxicology and Genetics of the Karlsruhe Research Center, prof. Eberhard Frey from the State Museum of Natural History, prof. Rolf Geisen and Clemens Franz, both from the Federal Max-Rubner Institute for Nutrition and Food, Karlsruhe, and prof. Eva Zyprian, from the Federal Institute of Viticulture, Geilweilerhof.

**New Faculty for Chemistry and Biological Sciences** (*Fakultät für Chemie und Biowissenschaften)*: When the Ministry of Sciences of Baden-Württemberg once again opted for somewhat larger faculties, the biologists and chemists decided in 2000 on a joint Faculty of Chemistry and Biological Sciences (*Chemie und Biowissenschaften*) that started in the winter semester 2001/2002. Since chemistry plays a major role in biology and many Karlsruhe biologists had scientifically cooperated and published with chemists, merging chemistry and biology into one faculty was a logical decision. In general the dean's position is alternating filled by a biologist and a chemist. He is supported by two vice-deans (*Prodekane*, one each for biology and chemistry, and two deans for student affairs (*Studiendekane* für *Biologie* und für *Chemie*). The first deans of the new faculty were Manfred Metzler (2001 - 2003), Manfred Kappes (2003 – 2005), Holger Puchta (2005 – 2007), and Stefan Bräse (since 2007).

## The Study Programs in Biology

***Biology Bachelor and Master****:* Due to the European Bologna Process, which started in 1999 with the aim of adapting the study courses of different European universities to the same level, the well established, successful Karlsruhe study program *Diplombiologie* (including the *Vordiplom* after 4 semesters) was changed by governmental decision to the Bachelor and Master Degree program. 90 students per year are admitted to this study program. The last students admitted for Diplombiologie will receive their diploma in 2012.
***Biology Lehramt****:* As before, 10 students per year are admitted to the particular Biology study program for high school teachers.
***Chemical Biology****:* Before merging to one faculty chemists and biologists had already discussed and planned a new joint study course "Chemical Biology" (*Chemische Biologi*e) which could successively be developed in the common faculty. This study course, providing education in basic biology and in particular chemical and physicochemical methods to be applied in biology, was finally established in 2009. This new course of studies is offered with Bachelor and Master Degree programs and started with the admission of 30 students per year.
***Applied Biology****:* Another course of study "Applied Biology" (*Angewandte Biologie*) is going to start in 2010 with the admission of 30 students per year. The students will be educated in

microbiology, physiology, genetics and biochemistry of industrially important microorganisms (White Biotechnology).

**The Karlsruhe Institute of Technology, KIT**

In October 2006 the University of Karlsruhe was elected Elite University (*Elite-Universität*), together with the two universities of Munich, by the Federal Government of Germany, Berlin, after a national contest and evaluation of German universities. One basis, among others, for winning this contest was the planned merger of the University of Karlsruhe (an institution of the State of Baden-Württemberg) and the Federal Research Center Karlsruhe (*Forschungszentrum Karlsruhe*), a research institution of the Helmholtz-Gemeinschaft. After a step-by-step integration the official merger into the new Karlsruhe Institute of Technology (KIT), *Karlsruhe Institut für Technologie (KIT)*, took place on October 1, 2009. KIT specializes in research, teaching and innovation.

With the establishment as German Elite University in 2006 the Karlsruhe University has been receiving strong federal financial support that will continue for five years. A part of these funds is used to advance teaching and to establish independent research groups of promising young scientists. In this context several junior research groups were initiated in biology, these are Daniela Kobbe (biochemistry of RecQ helicases), Jan Maisch (plant pattern formation), Michael Riemann (jasmonate biology), Lars Wegner (plant bioelectrics), Almut Köhler (neural crest migration), Jubin Kashef (biofunctionalization).

In July 2001 the Center for Functional Nanostructures (CFN) was established at the Karlsruhe Research Center in close cooperation with the University and the German Research Council (*DFG*) in order to enhance interdisciplinary research in the field of nanotechnology. Several working groups of the Karlsruhe Biology participate in nanobiology research with the aim to modify cell properties by the inclusion of nanoparticles. In addition, there exists one independent CFN nanobiology young investigator research group led by Clemens Franz. Nanotechnology, including nanobiology, is one major research topic of the joint Karlsruhe Institute of Technology (KIT).

Hartmut K. Lichtenthaler, Karlsruhe, January 2010