

## **Gäu, a smile and a story to tell by many plant pathologists 29 years after his death Prof. Dr. Ernst Albert Gäumann 1893-1963**

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### **The facts**

Ernst Albert was born 1893 in Lyss, citizen of Tägertschi, a small village of the Canton Bern in Switzerland. His father was a federal employee and the family lived in a rural environment in the German-speaking part of the Canton, bordering the French part. This environment gave him a profound sense of the rural traditions combined with an open mindedness from the meeting point of two cultures. He studied botany at the university of Bern, taking his PhD degree in 1917 under Eduard Fischer (a student of Anton DeBary). He completed his studies with a postdoctorate at Uppsala (Sweden) followed, in 1918-19, by extensive travelling in the USA, Philippines and Indonesia. From 1919 to 1922 he was the Director of the Plant Pathology Section at the Department of Agronomy in Buitenzorg, Java. These three years had a profound influence on Gäumann and, in social gatherings, he often talked about the culture and problems so different from his own environment. It was probably this experience that led to his exceptional support of all the underprivileged and to his view of the internationality of the scientific community during the difficult years preceding and during the second world war.

From 1922-1925 he was the Botanist at the Agricultural Research Station in Zürich. In 1925-1927 he was teacher and researcher at the Swiss Federal Institute of Technology (ETH) and from 1927 until his death, Professor of Special Botany at the same institution and Director of the Institute of Special Botany. He published four major books and one as co-author with Fischer. He was author of 135 publications, 98 as first author and 23 as co-author. He supervised 82 PhD-students and lectured for 37 years in plant pathology, botany and mycology in Zürich, including lectures in many foreign universities. Later in life, his work was recognised with the degree of honorary doctor by the Sorbonne in Paris (1953) and by the universities of Bonn (1956), Montpellier (1959) and Bordeaux (1961). And there were many other honours.

### **The scientist and teacher**

Early in his career Gäumann worked and published on the genus *Peronospora*. He not only identified new *Peronospora* species, but developed one of the earliest works on geographical distribution of plant pathogens (1919). His interests and the profound knowledge of the genus *Peronospora* led to a monograph (1923). His first general book was dedicated to the morphology of fungi and again we see an unconventional approach. Instead of the traditional description of single species, genera, families etc. Gäumann pointed to the similarities and differences between the systematic groups (1926, German version; 1928, Comparative Morphology of Fungi, 701. Translated by Dodge, C.W., McGraw-Hill Book Co., New York). Development, life cycles and sexual stages take a large part of the text. Evolution theories leading to the different taxonomic groups form a 'red thread' through the whole book, written in his typical style. Although this book is older than 67 years and systematic names have changed, it is still topical and a source of interesting information for all teachers in fungal systematics and plant pathology.

The collaboration with Eduard Fischer (University of Bern), his mentor and teacher, resulted in the book "Biology of Plant-Inhibiting Parasitic Fungi" (E. Fischer and E. Gäumann, 1929: "Biologie der pflanzenbewohnenden parasitischen Pilze", 428 pp., Verlag G. Fischer, Jena). The

authors dedicated the book to Anton de Bary, the “father” of plant pathology, who was Fischer’s teacher and mentor. Part I of this book is about the conditions necessary for occurrence of parasitic interactions such as the disposition of the plant in a changing environment, and aggressivity of the pathogen regulated by external and internal factors. Part II treats the process of the parasitic interaction during time from all points of view, changes in the host, in the pathogen and in their interaction. This book can be recommended to all of us who teach or write on this subject. It starts with classifying and defining all typical “plant pathologists expressions” which everybody understands but finally has his or her own intuitive definition.

Parallel to the birth of this book, two new areas can be regarded as having been developed by Gäumann. As a title for his introductory lecture as Professor for Special Botany (1928) at the Swiss Federal Institute of Technology, as successor of the famous botanist, Carl Schroeter, he chose “The problem of immunity in the plant kingdom” and dedicated part of this to immunisation of plants, a topic that was picked up 40 years later as induced resistance from other famous scholars such as Joseph Kuc. Although we use a different classification today, this topic led to the discovery of Orchinol and Hircinol in the bulbs of *Orchis militaris* and other *Orchis* species, produced as an effect of infection by *Rhizoctonia repens*, several other root fungi and by mechanical injury (1950). It is a unique case. Orchinol is not found in intact bulbs, and its induction is not specific. Pathogenic fungi e.g. *Rhizoctonia solani*, rapidly destroy Orchinol or a fast growing fungus, e.g. *Fusarium solani*, invades the still unprotected tissue so quickly that there may insufficient time for its synthesis (see Nüesch 1963). Its concentration increases exponentially with time reaching a maximum of almost 0.1% in the immediate surroundings of the infection (bulbs of *Orchis militaris* infected by *Rhizoctonia repens*) after 8 days and decreasing with distance where its maximum is reached later (Gäumann and Hohl 1960). These phytoalexins are the only ones produced in the whole tissue; they protect the bulbs from further fungal attacks for months, whilst allowing macorrhizal associations to develop. The isolation and chemical identification, first of Orchinol (Boller et al., 1957) then of Hircinol, can be regarded as the start of the long history of isolation and identification of phytoalexins.

As usual in research, one thing leads to the next. Together with his collaborators, Gäumann initiated research on the wilt diseases (1954, 1957), from 1945 onwards, discovering toxins such as enniatin, lycomarasmin, fusaric acid, vasinufuscarin and diaporthin. In collaboration with other interdisciplinary research groups he tried to identify and characterise antibiotic metabolites produced by *Actinomycetes* (1955, and onwards), for example, with the group of V Prelog, who later won the Nobel Prize). As if this were not enough for a distinguished scientific accomplishment, Gäumann never lost interest in the systematics, evolution and life cycles of the rust fungi that he had started to study as a young professor. This interest culminated in the book “The Rust Fungi of Central Europe” (1959, Die Rostpilze Mitteleuropas), that is still unique and still used as a reference by all concerned with rust fungi.

Gäumann and his collaborators discovered the “plant Fever”; e.g. that an infection by a parasite induces a local increase in temperature of a few tenths of a degree Celsius (1930).

Less known and today mostly forgotten are many (15) publications on wood quality and preservation, e.g. in relation to the altitude at which trees grow (1948), or on techniques to increase the life span of electricity and telegraph poles (1950).

Being a gifted teacher, Gäumann was able to combine the knowledge of his time with new concepts, and sometimes unconventional ideas, into general text books. His famous and successful book, “The Principles of Plant Infection”, which appeared first in 1946 in German as “Pflanzliche Infektionslehre” (2<sup>nd</sup> edition 1951), was later translated into English (1950), Polish (1959), Russian (1954) and Chinese (1958), which documents its importance and popularity. Indeed, this may have been the most popular plant pathology book of all time, reaching the

greatest proportion of readers interested in the subject. Second in popularity was "The Fungi" (English translation 1952) published first in German (1949, 2<sup>nd</sup> expanded edition, 1964) where Gäumann developed further the topic of fungal evolution and morphology already treated in comparative morphology of fungi. James G. Horsfall gave it the highest compliment possible "Gäumann's book elevated plant pathology to the level of a real science, not just an aggregation of facts".

### **The friend and "father"**

For his 70 birthday, Gäumann's students and friends published a small booklet with very personal contributions, which gives an excellent picture of Gäu. After his death soon afterwards, articles appeared in many scientific journals, which describe Gäu as a person (Blumer 1964, Brian 1967, Landolt 1963, Kalyanasundaram 1964, Kern 1985) so I will give just a short description.

The several thousand printed pages that he wrote could lead to the assumption that Gäumann was always retired in a studio, writing. This assumption is refuted by all who knew him and by the fact that he was a member of many scientific associations. He arrived at his office at half past seven every morning and refused to be disturbed for the first two hours. After the coffee break (still a tradition of almost obligatory social gathering even today), he distributed the work and commented on the progress of his assistants and students, sometimes using harsh terms which cannot be translated from his original Bernese dialect, but always encouraging when necessary and quick in giving decisive advice. He was not easy to work with, since he expected much from all of his collaborators, but he left much freedom and was open to new, but well-defended ideas. In daily laboratory business he was meticulous; in other areas he was generous. Refugees were sure to find material help and, even more important, the weight of his authority on their side when dealing with the Swiss administration. From his old lecture notes and from the stories of former students we detect with the horror of today's teacher that Gäu was not much interested in teaching facts, but he liked to talk about his practical experience, about the principles of biology and evolution and his views on new concepts and new ideas that he had read. Amusing stories about excursions with students and assistants are innumerable, and his profound knowledge of local cultures and traditions made a journey with Gäumann a souvenir for life. Being handicapped since youth, he himself had to walk with a stick but, nevertheless, he was one of the hardest botanists and collectors of specimens.

His musical interest led to a singing group formed by his assistants. Discussions with him must have been rewarding for open-minded people, but frustrating for people trying to impose a not well-argued point. For his seventieth birthday his students and collaborators dedicated a booklet with essays on him. A situation made by Gäu and commented on by L. Zobrist may still be true today. Once Zobrist complained of not having enough time; Gäu replied "divide what is important from what is unimportant. What is unimportant has to be solved with the left hand; but for what is important, take all the time you need". An unknown student he motivated by saying "If, in the control of plant disease, we want to get over the stage of spraying and beating to death, then we must enter into the essence of the plant diseases". He could frustrate administrators by his absolute lack on any feeling of inferiority. When the President of the University suggested that he should sign important letters more formally than by his G., he answered "Napoleon signed his letters with N, I can sign my letters with G". His wit and pointed remarks were feared and famous. It could happen that a long letter would come back to the writer with just one word of comment "nonsense".

A unique character like Gäumann, being a universal plant pathologist, mycologist and botanist is not possible anymore today, but will still be an example that true greatness can only be found in

a person with an extremely large interest and deep human knowledge and comprehension. He influenced many of today's leaders of science in his country and abroad.

His school includes distinguished scientists and teachers such as Profs. L. Ettliger, R. Corbaz, E. Müller, H. Kern, E. Landolt, H. Hess, H. Hohl, G. Défago, Diener and H. Zähler and leaders (Profs. Hütter, Nüesch) in Switzerland and many others also abroad (E. Leppik, R. Kalyanasundaram, W. Löffler).

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