



## Obituary



**Helmut Metzner (1925–1999)**

Helmut Metzner, who was born September 15, 1925, in Osnabrück, Germany, died September 20, 1999, in Tübingen, Germany. In 1943, he graduated from high school (Ratsgymnasium) in Osnabrück; he, then, began his studies of physics, chemistry and biology at the Technical and Veterinary College of Hannover. However, he had to interrupt his studies for military service (German Navy). After discharge from British captivity, he returned, in the winter of 1945, to study mathematics and physics, this time at the University of Münster. In 1946, he transferred to the University of Göttingen to study physics, chemistry, physical chemistry (Prof. A. Eucken), and biology. There he met his future wife, Barbara. In 1950, he received his doctorate in natural sciences (Dr rer. nat.) at the Institute of Botany (under the supervision of Prof. R. Harder). His thesis dealt with electrochemical aspects of plant cells. After a short interval as a researcher in a team at the Botanical Institute in Münster, he returned to Göttingen in 1951, where he became a scientific assistant at the Institute of Plant Physiology. At the age of 30, Metzner received his Habilitation in 1955 for botany and plant physiology. Soon thereafter, Melvin Calvin invited him as a Rockefeller Fellow to his laboratory in Berkeley, California, a rare chance for a young German scientist at that time. His wife, Dr Barbara Metzner, accompanied him. After his return

to Göttingen, he became a visiting lecturer and then a senior assistant at the Institute of Plant Physiology. In 1961, Metzner, who was by now an assistant professor, accepted a newly created chair for Chemical Plant Physiology (Department of Botany) at the University of Tübingen. In 1964, he became a full professor and the director of the Institute of Chemical Plant Physiology (ICP) (Faculty of Mathematics and Natural Sciences). During 1971–1972, he served as the Dean of the Faculty of Chemistry. He reached Emeritus status in 1993.

Metzner's contributions to science are numerous. He often focussed on concepts, and some of his ideas were controversial. His scientific interest ranged from molecular aspects of cell physiology to global ecological concerns. In 1952, he published experiments, using differential staining techniques, and concluded that chloroplasts contained extranuclear nucleic acids (DNA and RNA) (Metzner 1952). He studied enzymology of plastids, the biochemistry of photoperiodism, the occurrence of ascorbic acid in plant cells, to mention some. However, his work in Melvin Calvin and Andy Benson's lab on early CO<sub>2</sub> fixation products (Metzner et al. 1958) definitely turned his interest to photosynthesis. In Tübingen, his graduate students continued <sup>14</sup>C-fixation studies. In the 1960s, culturing of synchronized *Chlorella* cells

was initiated following the pioneering work of André Pirson (Metzner and Lorenzen 1961) and soon improved by Horst Senger (Metzner and Senger 1962). Algal cells served as favorite materials for  $^{14}\text{C}$  fixation and gas exchange studies as well as for isolation and purification of chlorophyll *a* (Metzner and Struss 1963), and for studies of absorption spectra of pigments *in vivo* (Metzner 1966) and *in vitro*. The above mentioned topics were investigated by his students for their diplomas, 'staats-examen', and doctoral theses. In addition, students studied pigment complexes and photosynthetic activities of isolated chloroplasts of higher plants.

Throughout his research career, Metzner's theoretical and practical work was influenced by bioelectrochemical aspects of living structures, especially of the photosynthetic apparatus (Metzner 1984). Already at the end of the 1960s, Metzner saw the necessity and possibility of using solar energy to power model systems of photosynthesis. He developed ideas as to how one can reproduce the basic energy converting processes of photosynthesis under simple laboratory conditions. In this context, and founded on theoretical considerations (Metzner 1975), he stressed that the observations of Warburg and Krippahl (1958 and 1960), where oxygen evolution *in vivo* was suggested to require the presence of  $\text{CO}_2/\text{HCO}_3^-$ , should not be neglected. To him, the question of the mechanism of water-splitting in photosynthetic oxygen evolution seemed to be more open than others thought. That is, he questioned whether oxygen is extracted from water directly (as is still generally believed), or from water bound to carbon-di-oxide, i.e., from bicarbonate. Experiments on light sensitive silver salts as models for this purpose were performed in his laboratory (Metzner et al. 1972). Later on Metzner obtained facilities for mass spectrometric  $^{18}\text{O}$  tracer studies using thylakoid membranes. However, due to financial restrictions, this work could not be continued then. There was only a hint, but no convincing evidence for a catalytic role of  $\text{CO}_2/\text{HCO}_3^-$  in photosynthetic  $\text{O}_2$  evolution (Metzner et al. 1982). We should keep these observations in mind until Warburg and Krippahl's observations are fully understood. During 1972–1999, the 'bicarbonate effect' of photosynthesis has been extensively studied by the research group of Govindjee (at the University of Illinois at Urbana, Illinois) and by his former Ph.D. student Alan Stemler (at the University of California at Davis). It is now clear that bicarbonate influences both the electron acceptor side (plastoquinone reduction side) and the

electron donor side (water oxidation side) of Photosystem II of plants, algae and cyanobacteria (see recent minireviews by Stemler (1998) and van Rensen et al. (1999)).

As expected from his communicative nature, one of Metzner's contributions to photosynthesis and the larger scientific community was his organization of many scientific meetings and congresses. In 1968, he brought together more than 400 scientists from all over the world, including the former Soviet Union, to the First International Congress on Photosynthesis Research held in Freudenstadt, in the Blackforest of Germany. He edited the resulting 'Progress in Photosynthesis Research' (Metzner 1969) and was rightfully proud that these efforts initiated a tradition. Metzner has authored several textbooks and dedicated his editorial skills as Founding and Managing Editor of *Photobiochemistry and Photobiophysics* (Amsterdam; 1980–1987), as a member of the editorial boards of *Photosynthetica*, and of *Bioelectrochemistry and Bioenergetics*. He personally liked to develop and foster relations with scientists all over the world by correspondence, visits and exchange of researchers. Scientists and students came from Switzerland (P. Schürmann; R. Strasser), Japan (Dr Kanai), Hungary (Drs Szabo and Szalay), Czechoslovakia (Dr Sestak), Russia (Drs Komissarov and Karapetyan), Romania (Dr N. Pristavu), Poland (Dr Zurzyski) and Egypt (Drs M. Ahmed Hamed, Farida El Hizzi, M. Osman and M. A. Shakeeb). These scientists contributed to the good and open minded working atmosphere the Institute of Chemical Plant Physiology had been known for. Metzner was not only concerned with photosynthesis, but also with ecological problems. Mass algal culturing, biomass production and the eutrophication of water were topics on which he initiated the Ph.D. theses of his students (see e.g., Metzner et al. (1983)).

Many of Metzner's lectures, discussions and publications were motivated by the necessity to encourage exchange of knowledge about environmental problems between scientists and administrators/political leaders. He also worked to make these ideas more understandable and acceptable to the general public. In 1986, he founded the European Academy of Environmental Affairs with status of a Consultant at the European Council in Strasbourg, France; Metzner served as the President of this Academy. The list of activities of the Academy included correspondence degree courses and the organization of three international congresses at Mannheim (1993), Leipzig

(1995) and Bonn (1997) on the anthropogenic effects on the Earth's climate development; this was done in collaboration with his US colleagues Drs F. Singer (Fairfax, New Jersey) and F. Seitz (Rockefeller University, New York). After the unification of the East and West Germany, Metzner was engaged in evaluation tasks for the improvement of the Department of Botany & Pharmacy, at the University of Jena. At the same time, Metzner initiated studies on microbial decontamination of oil-polluted soils, in close collaboration with Dr W. Fritsche at the Institute for Microbiology of the University in Jena. It is remarkable to note that in spite of political restrictions, Metzner had always tried to keep contact and friendship with scientists in East Germany (former DDR) including the eminent Prof. K. Mothes.

The list of his official honors include the Nicolau Medal of Romania (1964), a 1977 honorary doctorate from the University of Gent, Belgium, and the 1986 Medal of the European Federation of Biochemistry (Moscow). Metzner was also a member of the European Academy of Science and Arts in Salzburg (Austria), of the Academie Internationale de Philosophie des Sciences, Bruxelles (Belgium), and the Academy of Sciences of the Czech Republic at Prague.

The list of scientists who have worked with Metzner is long, some have been mentioned above. Metzner had supervised the work of many scientists including about 30 doctorate students. The following is a partial list (in alphabetical order, year of thesis in brackets): Margarethe Amann (1977); Wolfgang Becker (1972); Bettina Brommer (1972); Uta Brüstlein; Karin Fischer (1968); Georg Frank (1972); Rolf Friz (1974); Bernd Gerhardt; Karl Hermann Harms (1970); Volker Hermann (1975); Ilse Hofer (1973); Friedrich Jüttner (1971); Waldemar Klemke; Guenter Lazar (1979); Hanspeter Mühlbach; Eberhard Ries (1970); Dorothea Siefermann (1971); Günther Stoll; Sabine von Tasche (1985); Peter Urban (1988); late Brigitte Wagner (1969, Metzner's coworker at the Academy of Environmental Affairs); and Klaus Wegmann (1968).

Helmut Metzner will be best remembered for his creative, and sometimes controversial, farsighted ideas, derived from his broad and profound scientific knowledge, and for his amazing eloquence that captivated his students in the always well-attended lectures. He encouraged students and colleagues alike to reconsider knowledge that had been taken for granted. Most researchers will remember him for organizing the first international congress on photosynthesis re-

search in 1968 and for his friendship and open-mindedness towards those who were then behind the so-called 'Iron Curtain'. I came to know Metzner when I became a student at Tübingen in 1963, and stayed at the Institute of Chemical Plant Physiology until 1985. Those who have experienced Metzner's enlightened teaching and his enthusiastic and nearly inexhaustible commitment to science will always feel a sense of gratitude and will honor his memory.

Helmut Metzner is survived by his wife, Dr Barbara Metzner, who has been with him both in his private and public life for more than 50 years.

### Acknowledgements

The author thanks Barbara Metzner and Alan Stemler for valuable suggestions, Friedrich Jüttner for reading the obituary and adding names of some of Metzner's coworkers, and Govindjee for his extensive editing, in fact, for writing some of the text in this obituary.

### References

- Metzner H. 1952. Über den Nachweis von Nucleinsäuren in den Chloroplasten höherer Pflanzen. *Naturwissenschaften* 39: 64–65.
- Metzner H. 1966. Untersuchungen zur Chlorophyll-Absorption *in vivo*. *Naturwissenschaften* 53: 141–150.
- Metzner H. (ed.) 1969. Progress in Photosynthesis Research. Proceedings of First International Congress of Photosynthesis Research, held at Freudenstadt 1968, 3 volumes, sponsored by International Union of Biological Sciences, and printed by H Laupp jr, Tübingen.
- Metzner H. 1975. Water decomposition in photosynthesis? – a critical reconsideration. *J. Theor. Biol.* 51: 201–131.
- Metzner H. 1984. Bioelectrochemistry of photosynthesis: a theoretical approach. *Bioelectrochem. Bioenerg.* 13: 183–190.
- Metzner H. and Lorenzen H. 1961. Untersuchungen über den Photosynthese-Gaswechsel an vollsynchronen Chlorella-Kulturen. *Ber. Dtsch. Bot. Ges.* 73: 410–417.
- Metzner H. and Senger H. 1962. Beeinflussung synchroner Chlorella-Kulturen durch Streptomycin und Diphenylamin. *Vortr. Gesamtgeb. Bot. NF.* 1: 217–223.
- Metzner H. and Struss S. 1963. Gewinnung reiner Chlorophyll a-Präparate durch Gegenstromverteilung von Algenextrakten. *Z. Naturforsch.* 18b: 707–710.
- Metzner H., Metzner B. and Calvin M. 1958. Labile products of early carbon dioxide fixation in photosynthesis. *Arch. Biochem. Biophys.* 74: 1–6.
- Metzner H., Fischer K., Strasser R. and Schnell G. 1972. Electron exchange reactions on light sensitive silver salts. *Proc. IInd International Congress of Photosynthesis Research, Stresa 1971.* W Junk Publishers, The Hague.
- Metzner H., Fischer K. and Lupp G. 1975. Energy conservation in photosynthesis models. II. Salt effects on oxygen evolution. *Photosynthetica* 9: 327–330.

- Metzner H., Fischer K. and Bazlen O. 1982. Tracer studies on the oxygen evolution in photosynthesis. In: Schmidt H.L., Förstel H. and Heinzinger K. (eds), *Stable Isotopes*. Elsevier Sci. Publ., Amsterdam, pp. 517–527.
- Metzner H., Amann M.J., Binder K. and Jüttner F. 1983. Mass production of algae in closed cultivation. In: Metzner H. (ed.), *Photosynthesis and Plant Productivity*. Wiss. Verlagsges., Stuttgart, pp. 295–296.
- Stemler A. 1998. Bicarbonate and photosynthetic oxygen evolution: An unwelcome legacy of Otto Warburg. *Indian J. Exp. Biol.* 36: 841–848.
- van Rensen J.J.S., Xu C. and Govindjee 1999. Role of bicarbonate in photosystem II, the water-plastoquinone oxido-reductase of plant photosynthesis. *Physiol. Plant.* 105: 585–592.
- Warburg O. and Krippahl G. 1958. Hill Reaktion. *Z. Naturforsch.* 13b: 509–514.
- Warburg O. and Krippahl G. 1960. Notwendigkeit der Kohlensäure für die Chinon-und Ferricyanid-Reaktionen in grünen Grana. *Z. Naturforsch.* 15b: 367–369.

Karin Fischer-Zeh  
Hofmarkstrasse 34  
D-82152, Planegg  
Germany