

In Memoriam

Hans-Joachim Gabius 1955–2021

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Hans-Joachim Gabius (Fig. 1) passed away unexpectedly on August 2nd, less than two months before his official retirement. He was a remarkable person and scientist, and his lifetime achievements leave a wealth of knowledge and skill for the scientific community in the future.

Hans-Joachim Gabius was born in Bad Bevensen (Lower Saxony, Germany) on October 30th, 1955, and graduated from high school with distinction. He studied biochemistry in Hannover under his mentor Prof. Walter Lamprecht, a university teacher he admired throughout his life. As a highly gifted student, he gained a scholarship at the Studienstiftung des Deutschen Volks, and his early years were spent as a post-doctoral researcher in the laboratories of Fritz Cramer at the Max Planck Institute (MPI) in Göttingen working on t-RNA-synthetases. His scientific talent was clearly evident at this early stage of his career, resulting in the award of the Otto Hahn Medal for outstanding scientific achievements.

His future and lifelong research direction, the exploration of lectins and carbohydrates, was initiated with papers on the isolation of lectins from tumour tissue, carried out at the MPI (Gabius et al. 1984), and on the characterisation of a discoidin I receptor with Sam Barondes (Gabius et al. 1985). His interest in plant lectins was promoted by Harald Rüdiger, a lifelong friend at this time. He was intrigued

and inspired by electron micrographs of the glycocalyx and moved into histochemistry and cell biology as he recognised the great potential in selective visualisation of the molecular interaction between the lectins and their glycan (sugar) ligands. This idea formed the basis of his remarkable work for the future.

Together with Attila Bardosi and Klaus Kayser, he examined endogenous lectins and neoglycoproteins in his histochemical analyses. The chemical synthesis of neoglycoproteins featured throughout his scientific work and his links with eminent carbohydrate chemists, including Nicolai Bovin (Moscow, Russia), Claus-Wilhelm van der Lieth (Heidelberg, Germany), Hans Vliegthart (Utrecht, Netherlands), Paul Murphy (Galway, Ireland), Jesus Jiménez-Barbero (Derio, Spain), Stefan Oscarson (Dublin, Ireland) and others, was an essential part of his general research strategy.

Hans-Joachim Gabius used the term “reverse lectin histochemistry” to describe the use of labelled neoglycoconjugates in histology and histopathology. This approach is complementary to the application of purified and labelled tissue lectins. The culmination of many years of histochemical analysis and tumour pathology is published in two issues of *Progress in Histochemistry and Cytochemistry*, “Neoglycoproteins as tools in glycohistochemistry” (Gabius and Bardosi 1991) and “Graph theory and the entropy concept in histochemistry” (Kayser and Gabius 1997), part of a series of publications supervised by Professor W. Graumann.

In September 1993, after a brief period in Marburg as a Professor of Biochemistry, Hans-Joachim Gabius assumed the role as Chair of Physiological Chemistry at the Ludwig-Maximilians University in Munich, a position that he would hold for 28 years. The duties were demanding from the start. The teaching of chemistry and biochemistry had to be redesigned and restructured. Hans-Joachim was ideally suited for this task, as he was able to teach the entire scope of both subjects. He proved to be an energetic university professor, inspiring the students with lectures that spanned

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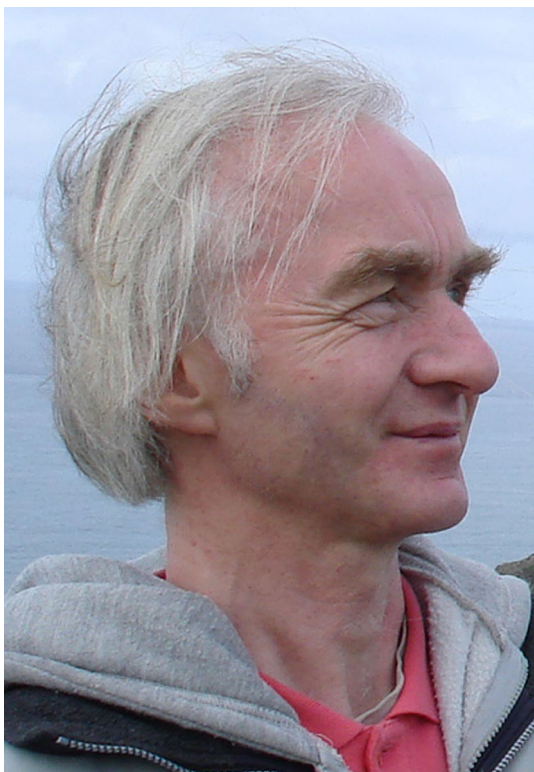


Fig. 1 Hans-Joachim Gabius

basic biochemical science through to their medical applications and relevance. He had a natural presence in the lecture theatre, where he gave his lessons with flair and full detail. He lectured fluently, without a slip of the tongue. With his sharp wit, considerable intelligence and knowledge of the field, which he maintained daily through diligent study of the literature, his involvement in the glycosciences was significant and outstanding.

There is no doubt that his scientific contributions guided glycoscience to its current status in research. Over 800 publications and five books manifest an amazing productivity. He was convinced that a comprehensive understanding of carbohydrate–lectin interactions would enable the development of new biotechnological approaches in the future.

The concept of the sugar code, the title of his last book, is inseparably linked with his persona. His passion for the sugar code was comprehensive and relentless; it came across in his lectures at scientific meetings, and he was an avid discussant both in the post-lecture queries, but also in the coffee breaks and mealtimes. There was always an opportunity for him to pursue the sugar code further. As a result, the international scientific community has enjoyed the benefit of his immense enthusiasm.

Hans-Joachim Gabius collaborated with top-class scientists from all over the world. They recognised and admired his creativity and profusion of ideas. Many of these

collaborations led to friendships that he fostered every day. He was a modest man in spite of his extensive achievements and successes. Scientific knowledge was always the driving force, and he regularly passed this on to the members of his research group, posing questions to motivate his team and looking for new aspects to adopt in the next round of experiments. For him, it was also imperative that everyone who contributed to the work was considered in publications.

Hans-Joachim Gabius was a great scientific visionary. Based on the “sugar code” concept, he developed a wide-ranging set of hypotheses and designed experiments to prove his concepts. He was a true master in organising, fostering and guiding scientific networks. One of his long-standing collaborations was with Jürgen Kopitz (Heidelberg, Germany). Their discussions brought about the idea that gangliosides might be functional counter receptors for galectins. The oligosaccharide chains of the glycolipids represent the letters of the code, while the lectins function as “readers” of the coded information. Using neuroblastoma cells as an experimental model in their first collaborative project proved that binding of galectin-1 to cell surface-presented ganglioside GM1 conveys growth control signals to the cells (Kopitz et al. 1998). By extending the experimental set-up, they identified other galectins as functional binding partners of glycolipids (Kopitz et al. 2003). Also, with Bob Ledeen (Newark, NJ, USA) and José Abad-Rodríguez (Toledo, Spain), they broadened the knowledge on galectin-ganglioside interactions, in particular in immunological and neurological disorders (Ledeen et al. 2018). Another research topic of Hans-Joachim Gabius’s collaboration with the Heidelberg group was the role of galectins in colon cancer (Gebert et al. 2012), especially the activity of galectin-4 as a tumour suppressor (Michalak et al. 2019). Altogether this cooperation yielded 50 publications in distinguished international journals.

Another of his main partners was the anatomist Karel Smetana Jr. from Prague. Their profound cooperation centred on the effects of stromal fibroblasts in skin tumours and the role of galectins in this context (Kideryová et al. 2009). As a result of his invaluable scientific input in this field of research, the Charles University, Prague, awarded him an honorary doctorate.

Hans-Joachim Gabius realised the aptitude of fixed tissue sections with cellular glycomes of normal and pathological origin as an *in vivo* assay platform to study molecular interactions between naturally occurring or engineered (ga) lectins and their respective ligands. This system could be further expanded to test the inhibitory capacity of potential therapeutic glycocompounds on these interactions (Ludwig et al. 2021).

A special issue of *Histochemistry and Cell Biology* that was initiated by Hans-Joachim Gabius, a long-time member of the Editorial Board of the journal, and published in 2017

was titled "In Focus: The Sugar Code" (Gabius and Roth 2017a). It covered the biological significance of lectin–glycan interactions occurring in different tissues under normal or disease-related conditions and was compiled with close friends. In this issue, "An introduction to the sugar code" written with Prof. Jürgen Roth (Gabius and Roth 2017b), another pioneer in the field of glycosciences, presents an inspiring review that describes the basic concepts of the sugar code, understandable even to the uninformed. This special issue symbolises a mission to continue where an outstanding career was abruptly and sadly cut short.

Hans-Joachim Gabius's untiring creative energy was driven by his passion for scientific knowledge and his fundamental belief that only sound, unbiased research can improve human welfare. He will be missed by family, friends and the scientific community.

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