



BIOTECHNOLOGY  
IN NORTH RHINE  
WESTPHALIA

alter the hereditary information of FDH, greatly increasing its robustness. This was the clinching factor in making it economically viable.

Maria-Regina Kula founded the Institute of Enzyme Technology in 1978, subsequently joining forces with professors Christian Wandrey and Hermann Sahn to launch biotechnology in NRW. Wandrey's research focus was bioprocess development, with special emphasis on enzyme and fermentation technology, while Sahn concentrated on the extraction of amino acids, vitamins, and organic acids from microbes, using metabolic engineering to achieve systematic strain improvement. Many collaborative ventures still in existence today go back to these scientists, among them a 20-year collaboration with Degussa (now Evonik). The Degussa enzyme membrane reactor went into operation back in the 1980s, largely masterminded by Wandrey and Kula. The reactor is used to produce the L-methionine amino acid employed in infusion solutions.

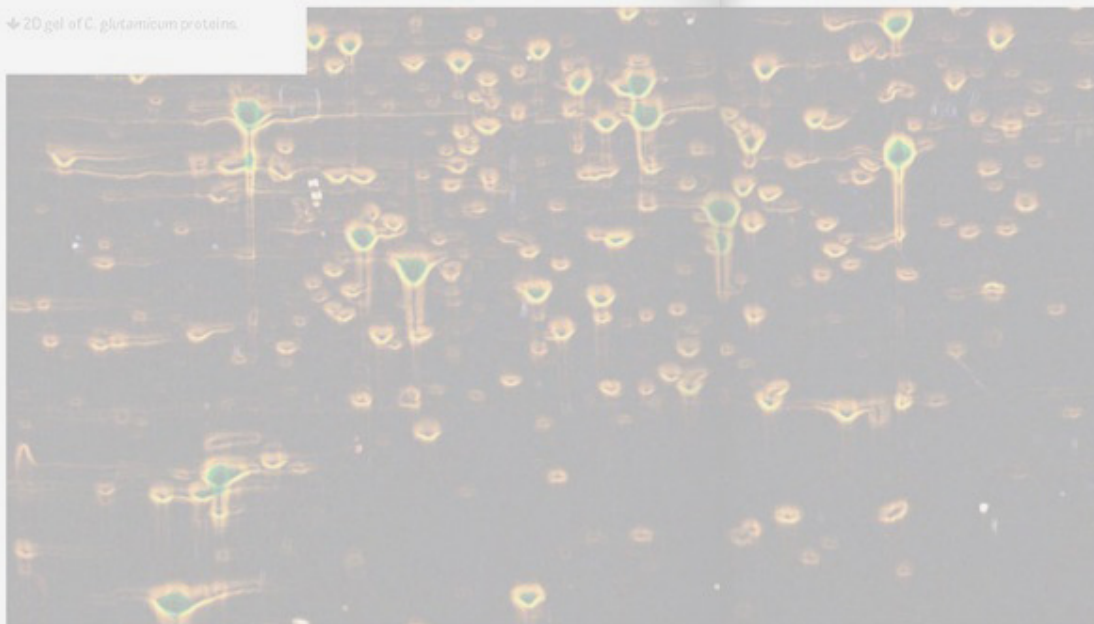
Another feather in the cap of the Jülich scientists was the development of L-lysine, an amino acid used in animal fodder. "Two grams per kilo are enough to double the nutrition value of the fodder," says Wandrey. "It's good for the cows and profitable for the farmers. And fodder like that is also good for the environment." Today 800,000 tons of it are produced per year and used in 75 percent of the fodder produced worldwide. This, in turn, saves about 20 million hectares of arable land.

#### GENERATING NEW COMPANIES

The ZMB also has numerous spin-offs to its name, including X-Zyme, dedicated to the development of enzymes and enzymatic processes. Another successful offshoot is Jülich Fine Chemicals (JFC), a supplier of special enzymes (biocatalysts) for organic synthesis and of chiral components for pharmaceutical and chemical enterprises. JFC was bought by Redwood City, Calif.-based Codexis in 2005.

DASGIP, another spin-off started up in 1991 is now an international leader in the development and production of parallel bioreactor systems for the cul-

← 2D gel of *C. glutamicum* proteins.



**"Our aim is to understand all the processes taking place in a cell. This would enable us to teach it how to produce a designated protein."**

tivation of bacterial, mammalian, and human cells. Celonic can also look back on 10 years experience in the cultivation of eukaryotic cells. The Research Center spin-off is located in Jülich and now employs a staff of ten.

Evocatol started up only two years ago and can already point to long-term cooperative ventures with companies like Henkel. Last year, the young team was nominated for the Evonik European Science-to-Business Award after developing a fluorescent protein that, unlike conventional varieties, requires no oxygen. This

opens the way for novel applications in industrial biotechnology and biomedicine. But the core competency of Evocatol, located at the Life Science Center in Düsseldorf, is the development of high-performance biocatalysts. The team is working on new or improved enzymes for chemical syntheses and intends to market its own enzyme-based processes and products. Evocatol founder Thorsten Eggert and his staff are developing new screening procedures and plan to optimize enzyme properties using molecular-biological engineering with support

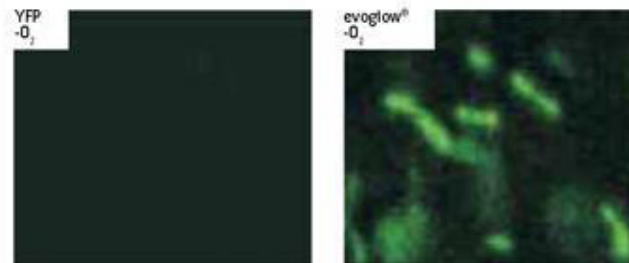
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COURTESY OF EVOCATOL

also markets its own biocatalysts and fine chemicals. This strategy was quick to find support. Detlev Riesner, a cofounder of Qiagen, joined Evocatol as a partner in 2007. Today the start-up company has a staff of 12 and its premises have increased from an initial 180 m<sup>2</sup> to the present 320 m<sup>2</sup>, with further expansion envisaged in the near future.

Cognis, Lanxess, and Artes Biotechnology) decided to join forces. The aim of the competition was to find the best strategy for the development of white biotechnology. The NRW strategy—CLIB2021—won first prize, bagging €20 of the €60 million available in the framework of the federal government's high-tech strategy for the next five years.

← Evoglow in vivo fluorescence can do things that even the Nobel-Prize-winning protein GFP cannot: it glows under conditions of limited or no oxygen. This is relevant to many fields of research, such as hypoxia and the infection mechanisms of certain anaerobic pathogens.



#### NEW STRUCTURES MAKE THINGS EASIER

The countless patents and spin-offs, awards, and well-known products developed is a formidable legacy that Jaeger and his colleague Bott have inherited from their predecessors Kula, Wandrey, and Sahn, all now retired. Jaeger and Bott are aware but undaunted by this even as times have changed. "Today it is increasingly difficult to make a name for yourself on your own," says Bott. "We form integrated research associations to pool resources and stay competitive on an international scale."

One such association is the cluster for industrial biotechnology (CLIB2021). Encouraged by the Federal Education and Research Ministry's competition BioIndustry 2021, academic institutions and companies (including the Universities of Münster, Bielefeld, Dortmund, Düsseldorf, and Fraunhofer Institute for Molecular Biology and Applied Ecology in Aachen; and industry leaders Bayer,

The central objective of the research and development ventures planned is the use of renewable resources like sugar beet, rapeseed, maize, or wood as the basis for the production of basic chemicals, intermediate products, and ultimately plastics that are presently derived from petrochemicals. Molecular-biological methods are being employed to design new enzymes and equip microorganisms with new properties.

CLIB2021 has assembled many white-technology experts in NRW. One of them is Karl-Heinz Maurer, head of Henkel's enzyme technology research platform since 2001. "Of course physical proximity is not absolutely essential," says Maurer, when asked about the advantages of the NRW biotechnology network, "but it certainly makes things a lot easier." At Henkel Maurer is in charge of 14 labs, where he and his staff of 30 have been deriving enzymes from microorganisms since the early 1970s for use in detergents and cleaning agents. Within the CLIB2021 cluster Maurer intends to