YUMAB GmbH
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Fully human antibodies by YUMAB: a winning therapeutic strategy

YUMAB offers fully human antibody development from target discovery to lead. Building on 30 years of successful research and development by its founders and six years in the market, the company is looking for additional partners interested in customized business and research service solutions for the development of antibody therapeutics.

On 3 October 2018, the Royal Swedish Academy of Sciences announced the award of the Nobel Prize in Chemistry jointly to George P. Smith and Gregory P. Winter, recognizing the impact of their work developing phage display of peptides and antibodies and its impact on biotech and clinical applications.

Smith's 1985 breakthrough paper on phage display of peptides was followed in 1988 by its adapted use to produce libraries of millions of clones for biopanning[1,2]. In December 1990, Winter published a paper demonstrating his use of the technique to express antibody single-chain variable regions that retained their original binding profiles[3].

This work launched a race to refine phage display to express even more complex and human-like antibodies, leading in 2002 to the US Food and Drug Administration approval of the first fully human monoclonal antibody (mAb) drug—AbbVie's Humira for rheumatoid arthritis. Humira became the world's best-selling drug in 2012, and more than half of all marketed mAbs today are fully human. The success of fully human immunotherapeutic mAbs has resulted in an increased need for optimized start-to-end antibody development strategies.

In January 1991, Stefan Dübel and Frank Breitling, working at the German Cancer Research Center in Heidelberg, described a phagemid-based variant that served as the foundation for more advanced phage-display technologies[4]. In 2001, they published their research on Hyperphage, a landmark invention that helped increase phage-display panning success rates by orders of magnitude[5].

In 2012, Dübel and coworkers founded YUMAB, a company that offers a sophisticated antibody development platform, capable of selecting fully human mAbs from ultradiverse naive antibody libraries and of delivering mAbs with the closest-to-germline sequences on the market (**Fig. 1**).

According to Stefan Dübel, "it is great to see how some of our early work helped fuel the explosion of therapeutic antibody approvals we have seen in the past two years. With its 'closest-to-germline' philosophy, zero-mutation affinity maturation strategies and very short timelines, I think that YUMAB represents the best of what we have learned in the past 30 years about making effective and well-tolerable human antibodies."

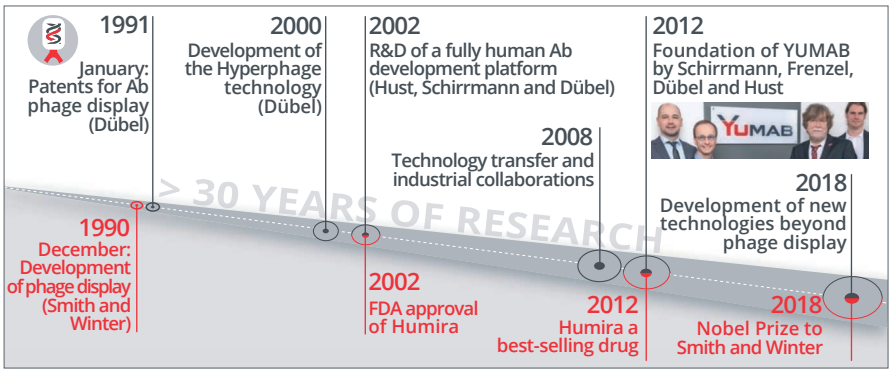

Fig. 1 | Advancing phage display. 30 years ago, YUMAB's founders began refining the phage display technology. Image shows Stefan Dübel (founder of YUMAB; professor at the University of Braunschweig (TUBS)), Michael Hust (founder of YUMAB; professor at TUBS), Thomas Schirrmann (CEO of YUMAB) and André Frenzel (CSO of YUMAB). Ab, antibody; FDA, US Food and Drug Administration; R&D, research and development.

Fully human candidates within weeks

Since 2013, YUMAB has set up a versatile platform for ultrafast human mAb discovery and efficient lead development that enables the isolation of fully human antibodies, either from the company's universal libraries (diversity of 10^{11}) or from patient-derived libraries. Both can be applied to any type of antigen, including virus particles or whole cells, delivering fully human mAbs with broad ranges of specificities and minimal immunogenicity.

YUMAB uses close-to-germline but highly diverse antigen-binding libraries that represent the entire natural human antibody repertoire for the initial in vitro screening. The in vitro discovery process takes only four to eight weeks in total. The YUMAB platform also comprises advanced on-cell-selection technologies for the identification of mAbs against rare or difficult antigens, such as multispanning transmembrane receptors, including G protein-coupled receptors and ion channels.

The resulting antibodies are maximally derisked with respect to immunogenicity, as every sequence derived from the naive libraries has previously been expressed in the human body. In combination with the early derisking of potential developability issues through stability and productivity testing, YUMAB's antibodies quickly travel from research through to clinical translation.

Flexible partnering for successful projects

Propelled by many partnerships and YUMAB's relocation to the Science Campus Braunschweig-Süd, one of Germany's biotech R&D hotspots, the company is growing rapidly.

"The YUMAB team is very competent and cooperative," said Roland Kontermann, deputy head of the Institute for Biomedical Engineering at the University of Stuttgart. "We are very satisfied with the collaboration, which resulted already in a panel of highly specific and effective antibodies for our applications."

The company offers three partnering options: a contract-research-organization-type option for biopharma companies, customized deals with low entry costs for academic laboratories and biotech startups and the outlicensing of YUMAB's internal pipeline of fully human mAbs, mainly in the oncology space. YUMAB's versatile platform and flexible partnering approach make it the partner of choice for developing human mAbs for any mAb development program.

1. Smith, G. P. *Science* **228**, 1315–1317 (1985).
2. Parmley, S. F. & Smith, G. P. *Gene* **73**, 305–318 (1988).
3. McCafferty, J. et al. *Nature* **348**, 552–554 (1990).
4. Breitling, F. et al. *Gene* **104**, 147–153 (1991).
5. Rondot, S. et al. *Nat. Biotechnol.* **19**, 75–78 (2001).

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