CUSTOMBIOTECH

Roche

Take control of glycosylation

Discover *in vitro* glycoengineering

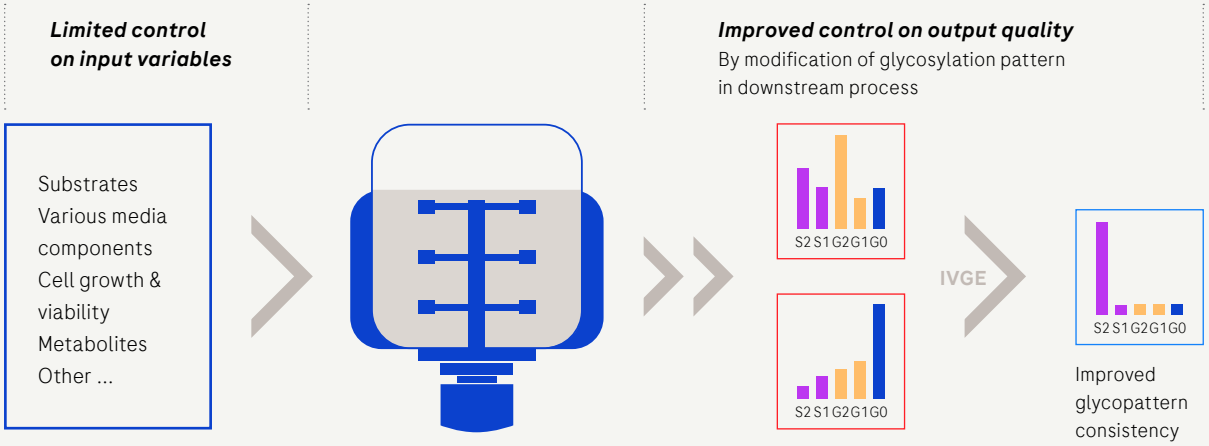
Take control of glycosylation – discover *in vitro* glycoengineering

Optimized and faster

Variation in glycosylation can impact the safety and efficacy profiles of a therapeutic protein. Therefore, continuous monitoring of glycosylation patterns is essential in biopharmaceutical development and manufacturing. With the right tools, glycosylation management can be uncoupled from the entangled processes of fermentation. Isolating glycosylation management from fermentation separates strategies to optimize glycosylation and yield, granting greater control over each. Instead, certain glycoforms can be enriched in downstream processing using discrete enzymatic reactions with clear kinetics and predictable outcomes. No more resources wasted on uncertain tweaking of the bioprocess, leading to faster development as well as improved control of the manufacturing process. Take control with *in vitro* glycoengineering.

Gains from in vitro glycoengineering

- Time- and cost-saving generation of glycan variants to develop improved drugs
- Optimized glycosylation without compromising other CQAs or product yield
- Improved lot-to-lot consistency to reduce risk of product quality variation and resulting delays
- Generation of glycoprofiles which may not otherwise be generated
- Streamlined analytics in comparability studies



In vitro glycoengineering (IVGE) can improve control on quality of therapeutic proteins.

Enhanced engineering of glycan variants

Glycosylation has the potential to make or break the successful market entry of a drug. Unlike the limited manipulation during fermentation, *in vitro* glycoengineering enables the creation of high levels of galactosylation or sialylation to unambiguously select and implement the structure with the best therapeutic and pharmacokinetic profile. With *in vitro* glycoengineering, generating different glycan variants of a protein is selective, fast, and efficient since enzymatic treatments alter only targeted sugar residues, enabling creation of glycoprofiles which may not otherwise be synthesized. Results are no longer hindered by compromises inherent to glycan optimization using different expression systems, fermentation conditions, or media composition.

No compromises in critical quality attributes

Glycosylation is a Critical Quality Attribute (CQA) that often conflicts with other properties of biopharmaceuticals. Balancing these important production outcomes consumes time and resources. Optimizing expression systems and fermentation conditions during bioprocess development can drive CQAs out of specification range and force compromises or delay projects. Not if glycosylation is done directly. With a toolbox of enzymes and substrates, the glycan structure is systematically optimized after fermentation. The key advantage is controlled and direct manipulation of glycans, which saves time and effort commonly invested in difficult optimizations on the way to production scales.

Controlled glycosylation from beginning to end

The quality of a therapeutic protein should emerge from profound knowledge of both bioprocess and product (Quality by Design, QbD). The reduced complexity of *in vitro* glycoengineering grants greater control over glycosylation at all project steps. The improved control simplifies technology transfers and lessens the risk of lot-to-lot variability and required corrective action. Thus, *in vitro* glycoengineering supports QbD by alleviating translation of protocols from early development to the same results at large manufacturing scales.

The glycoengineering toolbox is developed in partnership with Roche Pharma

- Highly active enzymes to change glycosylation fast and efficiently
- Glycosyltransferases optimized for each drug development phase
- Milligram to kilogram scale and GMP quality upon request to integrate into manufacturing workflows

Ordering information

Glycosyltransferases for research	Pack size	Animal-free*	Catalog Number
α-2,3-Sialyltransferase, rec.	Custom fill	✓	07 429 916 103
Glycotransferases for drug development	**Pack size**	**Animal-free***	**Catalog Number**
α-2,6 Sialyltransferase	7.5 mg	✓	08 098 174 101
β-1,4 Galactosyltransferase	1.5 mg	✓	08 098 182 101
α-2,6-Sialyltransferase, rec. EQ	Custom fill	✓	08 098 174 103
β-1,4-Galactosyltransferase, rec. EQ	Custom fill	✓	08 098 182 103
Activated sugars	**Pack size**	**Animal-free***	**Catalog Number**
UDP-Galactose animal-free	Custom fill	✓	07 703 562 103
CMP-N-Acetylneuraminic acid	Custom fill	✓	05 974 003 103
UDP-N-Acetylglucosamine	Custom fill	✓	11 787 900 103
UDP-N-Acetylgalactosamine	Custom fill	✓	06 369 855 103
Related products	**Pack size**	**Animal-free***	**Catalog Number**
Alkaline Phosphatase	Custom fill	✓	03 137 031 103
N-Glycosidase F	500U/vial		06 538 355 103
Neuraminidase	Custom fill		11 087 096 103
Residual Protein α-2,6-Sialyltransferase Kit	96 tests		08 011 478 001
Residual Protein β-1,4-Galactosyltransferase Kit	96 tests		08 182 990 001

* No animal-derived materials were used in fermentation, purification, and final formulation.

Regulatory Disclaimer
α-2,3-Sialyltransferase is: For life science research only and not for use in diagnostic procedures. α-2,6-Sialyltransferase, rec. EQ, β-1,4-Galacto-syltransferase, rec. EQ, activated sugars, Alkaline Phosphatase, N-Glycosidase F and Neuraminidase are: For further processing only. Residual Protein α-2,6-Sialyltransferase Kit and Residual Protein β-1,4 Galactosyltransferase Kit are: For use in quality control/manufacturing process only.

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