

## Relevance and problem

There is an urgent need for innovation and transform the way new drug targets are identified. The human genome project initiated the current wave of precision medicine using genetic information from individuals to identify a sub-population of patients who will benefit the most from therapeutic intervention. New developments in this field is gradually leading the pharmaceutical industry from a high throughput discovery process to a more targeted approach by leveraging individual genomic data. The cells and the proteins found in the human body are coated with sugars called glycans which play a crucial role in cellular communication and recognition and are critical in bacterial and viral infection, autoimmune diseases and inflammation. While genetic data gives the probability of certain disease biomarkers, glycans, on the other hand, are much more complex and are influenced by the environment, age and other external factors which we are yet to be fully understood. This complexity can be exploited for novel therapies and should be integrated into current drug discovery processes along with genomic data.

## Challenges of and Opportunities Glycomics in Drug Discovery

Glycosylation is the most common post-translational modification in cells and changes in the glycosylation pattern is invariably linked to various diseases, from a rare genetically linked congenital disease of glycosylation (CDG) to prognostic indicators in cancer.<sup>1</sup> Glycosylation also plays a crucial role in regulating protein, stability, folding and function. The complexity of the glycome has made it difficult to analyse and accurately quantify the subtle changes found in different diseases. This diversity also offers an incredible source of new data and access to novel therapeutic biomarkers which would otherwise be difficult to determine through genomic analysis. Glycans with specific sequences play an important role in cell recognition and immunity. For example, alterations in the glycan structure on the surface of antibodies (a protein used by the immune system to neutralize pathogen) has been observed in several autoimmune diseases including rheumatoid arthritis.<sup>2</sup> We identified five key areas which require urgent development to combat the rise of chronic and debilitating diseases.

- **The Glycome and its role in the human body**
- **Advance sequencing of glycans**
- **Bioinformatics and database / glycan standards**
- **Integrating glycomics in drug discovery**
- **New collaborative business models**

### Key terms

**Glycome:** The entirety of sugars found in the human body, on cells and proteins.

**Glycomics:** This is the comprehensive study of the glycome and its role in disease progression.

## Social and Economic Impact

The field of precision medicine has seen continued growth since the completion of the human genome project. Many biopharmaceutical companies are investing in developing targeted therapies guided by genetic biomarkers. There is, however, significant cost involved in developing precision medicine which is significantly higher than traditional approaches. While the initial investment is substantial, the true value of precision medicine is realized in the long-term with higher drug efficacy and reduced unwanted side-effect lowering hospital admission and related healthcare costs with billions saved over the patients lifetime.<sup>3</sup>

### References

1. Seeling, M.; Bruckner, C.; Nimmerjahn, F. *Nat. Rev. Rheumatol.* 2017, 13, 621-630.
2. Maverakis, E. et. al. *J. Autoimmune*, 2015, 0, 1-13.
3. Precision Medicine Could Have a Major Impact on Healthcare Outcomes and Costs: <https://hbr.org/sponsored/2018/12/precision-medicine-could-have-a-major-impact-on-healthcare-outcomes-and-costs>

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