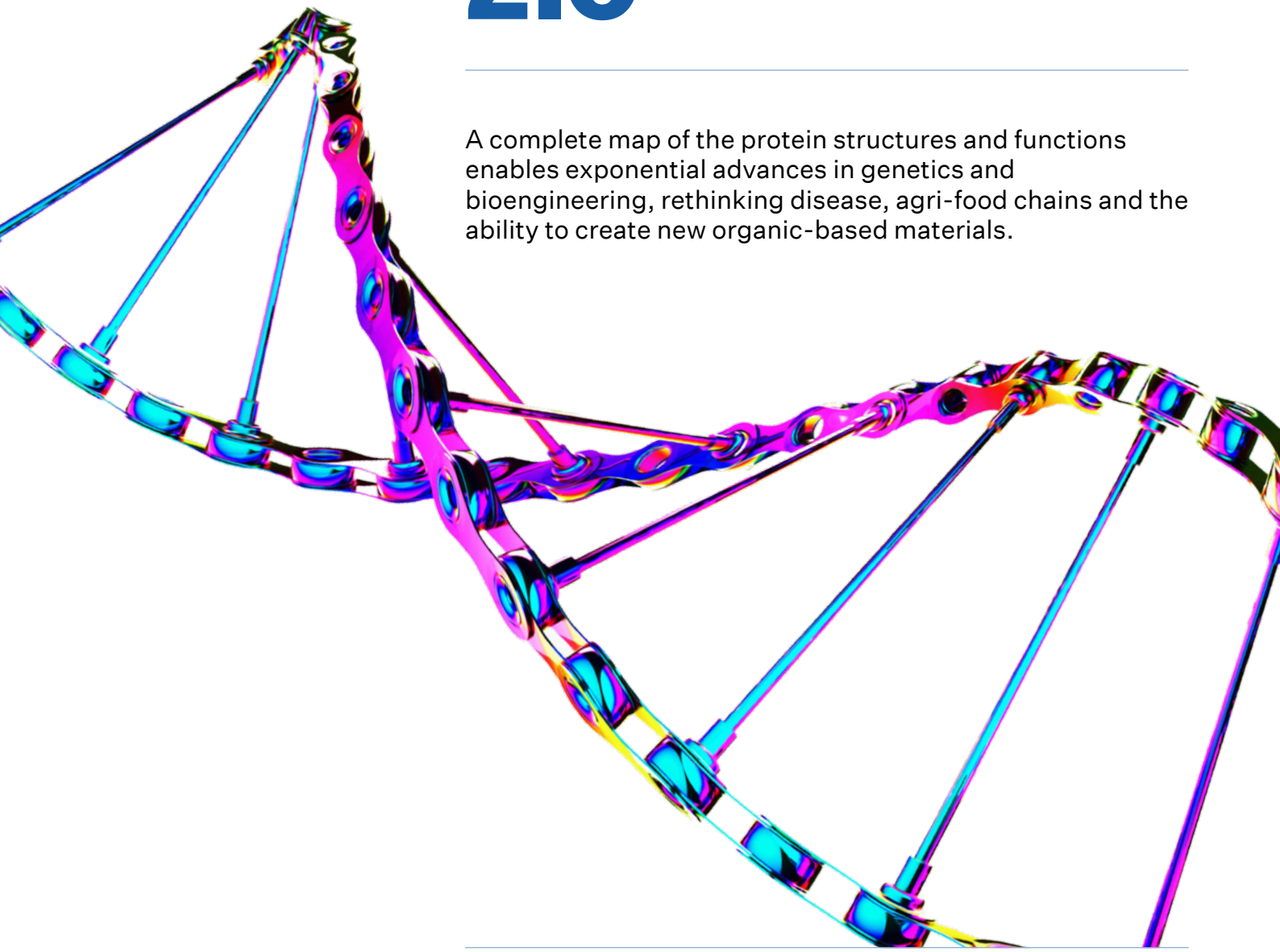
OPPORTUNITY #3

What if we could reprogramme proteins?

BIOHACKING 2.0

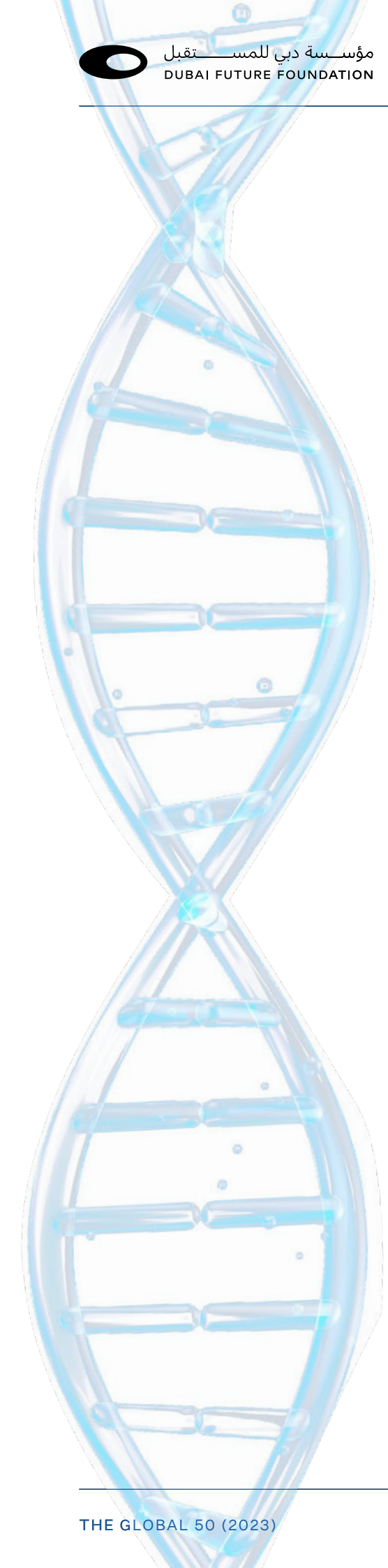
A complete map of the protein structures and functions enables exponential advances in genetics and bioengineering, rethinking disease, agri-food chains and the ability to create new organic-based materials.



MEGATREND
Advanced Health and Nutrition

TRENDS
Artificial Intelligence
Genomics
Proteomics

SECTORS AFFECTED
Agriculture & Food
Materials & Biotechnology
Health & Healthcare



WHY IT MATTERS TODAY

The Human Genome Project was seeded with $4 billion in public funds, which has been converted into $700 billion worth of new economic activity as a result of sequencing the human DNA.[195] The Human Proteome Organization, an international consortium of research, government and business organisations, has uncovered just over 93% of the human proteome.[196]

While the number of proteins found in the human body is a matter of debate, most scientists agree on 20,000 but there could be more.[197] Types of protein include antibodies, enzymes, hormonal proteins, storage proteins and transport proteins with their many functions[198] and only a third of all estimated human proteins have been experimentally uncovered.[199]

A subsidiary of Google, DeepMind Technologies' predictive Artificial Intelligence (AI) model AlphaFold has now predicted the structure of almost the entire known human proteome. It has also predicted large portions of the proteomes of other organisms, including mice, maize and the malaria parasite.[200, 201] As a result, over 350,000 possible protein structures are currently catalogued, and this is expected to grow to 130 million structures, giving the potential to revolutionise the life sciences.[202] The proteomics-based market was valued at $17.5 billion as of 2019 and is projected to increase to $30.6 billion by 2025.[203]

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THE OPPORTUNITY

Now that the human genome has been decoded, advanced machine intelligence will continue to enable mapping of the human proteome[205] resulting in a complete catalogue of the various functions and structures of proteins.[206] This, combined with advanced protein engineering and editing techniques, enables the re-engineering or application of proteins' natural characteristics to defend against viruses, neutralise bacterial infections and even attack cancer cells through a simple procedure.[207]

While AI-generated protein structures will need to be validated experimentally, [208] uncovering the underlying mechanisms of which blood is transported, disease is triggered and how other organisms evolve and respond to their environments would be significant. This enables ways to fight disease, rethink agri-food chains and create novel organic-based materials and processes.[209]

BENEFITS

Exponential improvements in a range of health treatment possibilities and outcomes.

RISKS

Unintended consequences of engineering proteins, including increasing pathogenicity of viruses and designer toxins.[204]

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