Xenobiology – The ultimate biosafety tool?

By Sofie Klem, Line Vevle, and Jacob Wilhelmsen

SCAN ME

Xenobiology is a field of synthetic biology that attempts to design an «alien» life form that is not based on the molecular biology from the central dogma

How can it be used?

- **Produce unnatural molecules**, eventually creating xenobiological systems that cannot interact with naturally existing biological systems.
- **Build synthetic cells** that perform similar actions as cells, but which are built up with the help of technology and are not found naturally.

XNA

Attempts have been made to **replace the backbone of DNA** with a different chemical chain in order to produce a genetic material termed XNA.

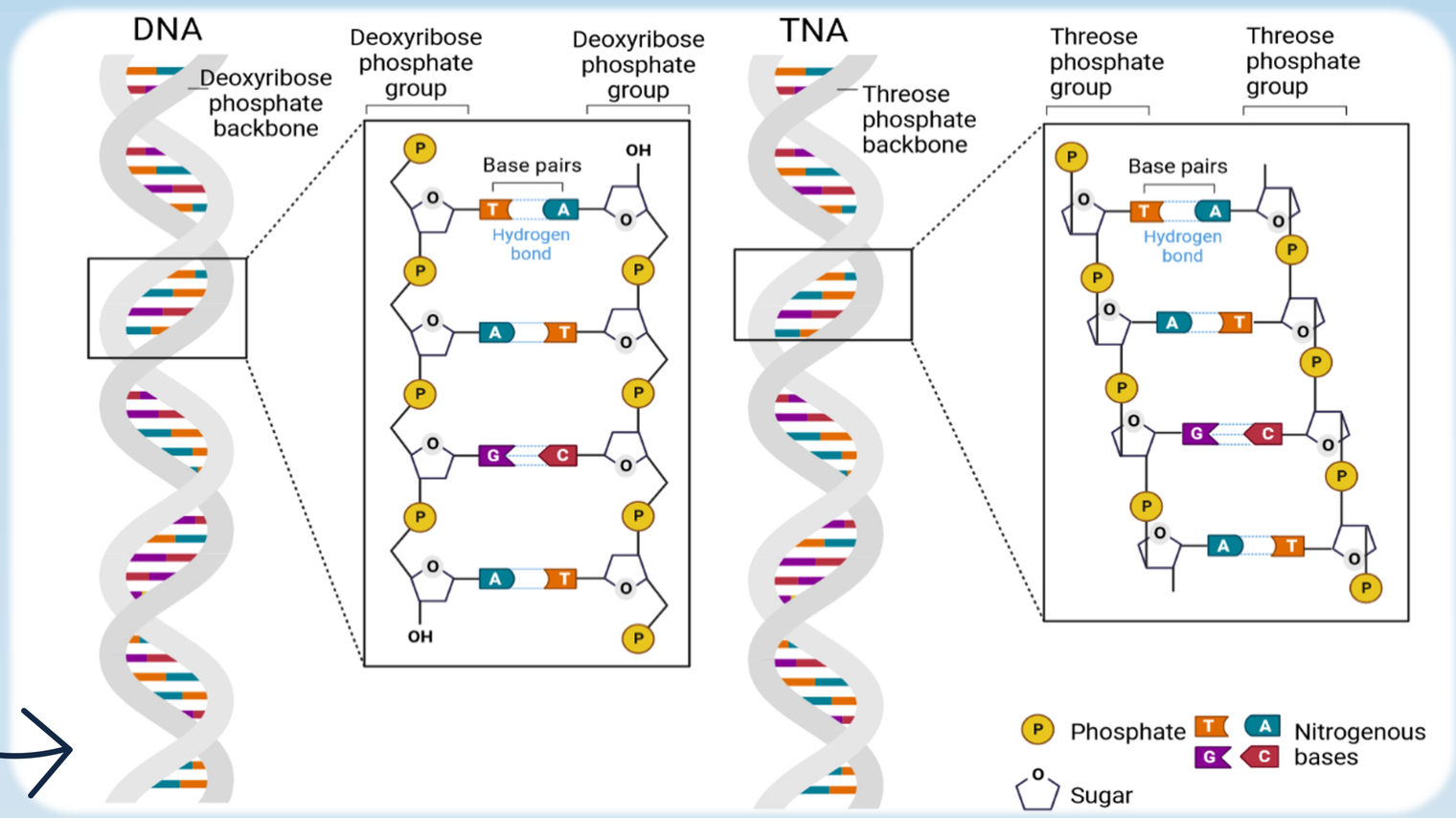

Figure 1. ***Comparison of DNA and TNA.*** *Threose nucleic acid (TNA) is an unnatural genetic polymer composed of repeating threofuranosyl sugars linked by 2’ and 3’ phosphodiester bonds.*

PROS

- Xenobiological systems are **assumed incompatible with the organisms we already know**, avoiding exchange of genetic information with nature
- Increase in **genetic variation** with the creation of new nucleotides
- Expand our capabilities to **provide safer biotechnology tools**

CONS

- The **precautionary principle** – can we be sure it is safe?
- What if xenobiology is not as **incompatible** with the natural world as we think?
- Xenobiology could be used with **malicious intent**

What do you think?

How does this impact the fundamental question: What is life?

How should use of xenobiology and XNA be regulated?

Who should own intellectual properties? Should it be freely available?

Sources

Dunn, M.R. and Chaput, J.C. (2014) ‘An In Vitro Selection Protocol for Threose Nucleic Acid (TNA) Using DNA Display’, *Current Protocols in Nucleic Acid Chemistry*, 57, p. 9.8.1-19. Available at: https://doi.org/10.1002/0471142700.nc0908s57.

Schmidt, M. (2010) ‘Xenobiology: A new form of life as the ultimate biosafety tool’, *BioEssays*, 32(4), pp. 322–331. Available at: https://doi.org/10.1002/bies.200900147.

‘Syntetisk biologi’ (no date) *Bioteknologirådet*. Available at: https://www.bioteknologiradet.no/temaer/syntetisk-biologi/ (Accessed: 25 April 2023).