

Annexe: National Centre for Engineering Biology digital backbone

Engineering biology generates enormous quantities of experimental data. NCEB's digital backbone is the set of platforms that turn that data into usable knowledge — standardising it so that results from different laboratories can be compared, and using it to train the AI models that propose the next round of designs. Key platforms that form the backbone include:

1. AI-Augmented Synthetic Biology Database (SynBioDB)

- A database for engineering biology. Laboratories record experiments in many different ways, which makes results hard to combine. SynBioDB stores and organises biological and experimental data in a common format across the research lifecycle, so findings from different laboratories can be compared and used to train AI models.
- It is open-source and will be available to partner institutions as standalone systems, so that collaborating laboratories can use it, contribute to its development and retain control of their own data. It is intended as a national resource for data sharing across Singapore's engineering biology ecosystem, while keeping research data secure.

2. Synthetic Biology AI Designer (SynDe)

- SynDe is an AI agent where the design work happens. It draws on AI models trained on biological data, which learn patterns in how biological systems function, and proposes new designs for laboratory testing.
- Researchers direct it through ordinary conversation rather than specialist code, and SynDe searches relevant resources, including knowledge databases, and selects and runs the appropriate computational tools on their behalf. Results returned from the laboratory are used to refine subsequent rounds of design, shortening the search for high-performing biological systems.

3. Enzyme Function Initiative Tools@NCEB (EFI@NCEB)

- Enzymes are catalysts that carry out the chemistry inside living cells. Finding a starting point for a new process means searching millions of protein sequences for those most likely to perform the desired reaction. EFI@NCEB is NCEB's platform for enzyme discovery, built on the EFI toolset used by researchers worldwide.
- NCEB runs the platform on its own infrastructure, alongside the Centre's other design tools, so enzyme searches feed directly into AI-guided design. The Centre extends the tools for its work on specialty chemicals and applies them to unpublished and commercially sensitive designs.

Used together, these platforms connect data, design and discovery in a single loop, supporting the development of new cellular designs for biomanufacturing.