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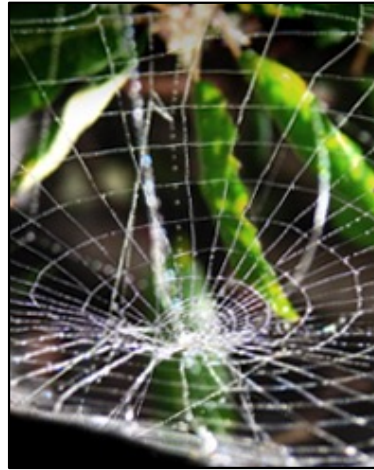
# The AI-driven future of biotechnology in NZ

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# The biodiscovery paradigm



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What if the paradigm has  
already shifted?

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Part I: Predicting biology

Part II: Designing biology

Use case: Proteins

# Dazzling array of functions

The molecules in cells that  
get stuff done

Illustration by David S. Goodsell, RCSB Protein Data Bank.



# The backbone of biotechnology



## INGREDIENTS

TO LIFT DIRT AND STAINS — Anionic and Nonionic Surfactants  
TO WHITEN AND BRIGHTEN — Optical Brighteners and Activated Oxygen Bleach  
**TO BREAK DOWN AND REMOVE STAINS — Enzymes**  
TO DISPERSE FATTY SOILS — Alkalis  
TO SUSPEND DIRT AND SOFTEN WATER — Sodium Carbonate and Sodium Sulphate, Sequestrant and Polymer  
TO CONTROL SUDS — Antifoam  
TO REMOVE ODOURS AND LEAVE LONG LASTING FRESHNESS — Perfume  
A small amount of colour is included  
For full ingredient list go to: [www.unilever.co.nz](http://www.unilever.co.nz)

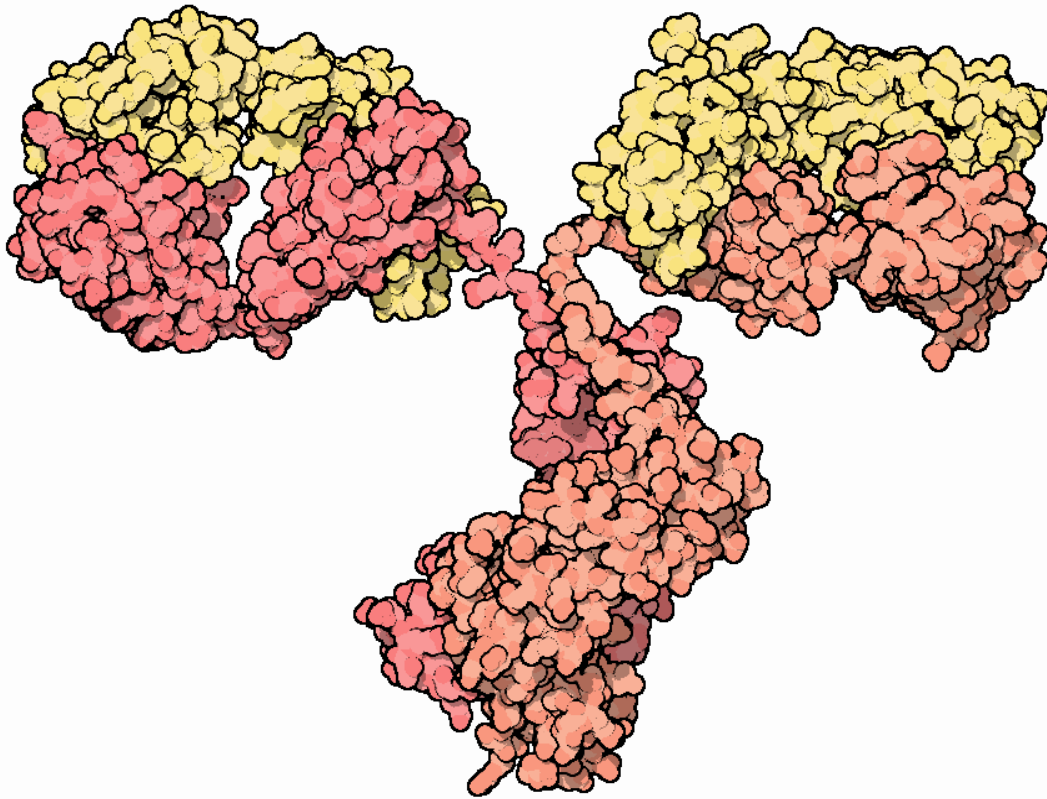


Wegovy 1.0mg  
FlexTouch Pen

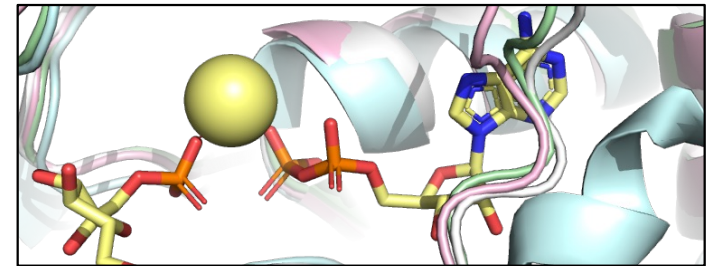
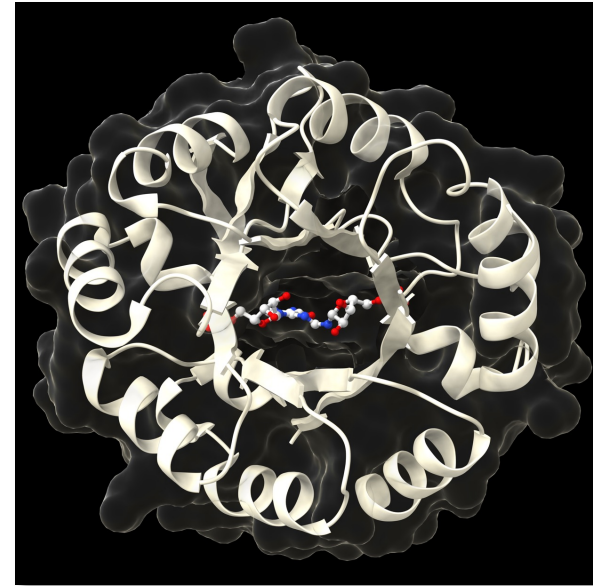
**\$459.99**

**BUY NOW**

# Function is determined by structure...



← ~0.00002 mm →

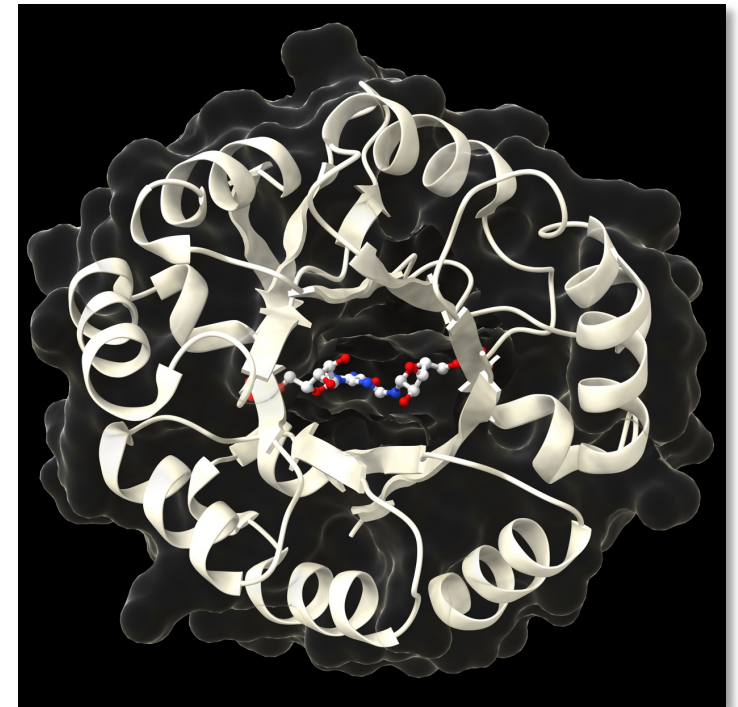


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# ...and structure is determined by sequence...

A typical sequence of amino acids:

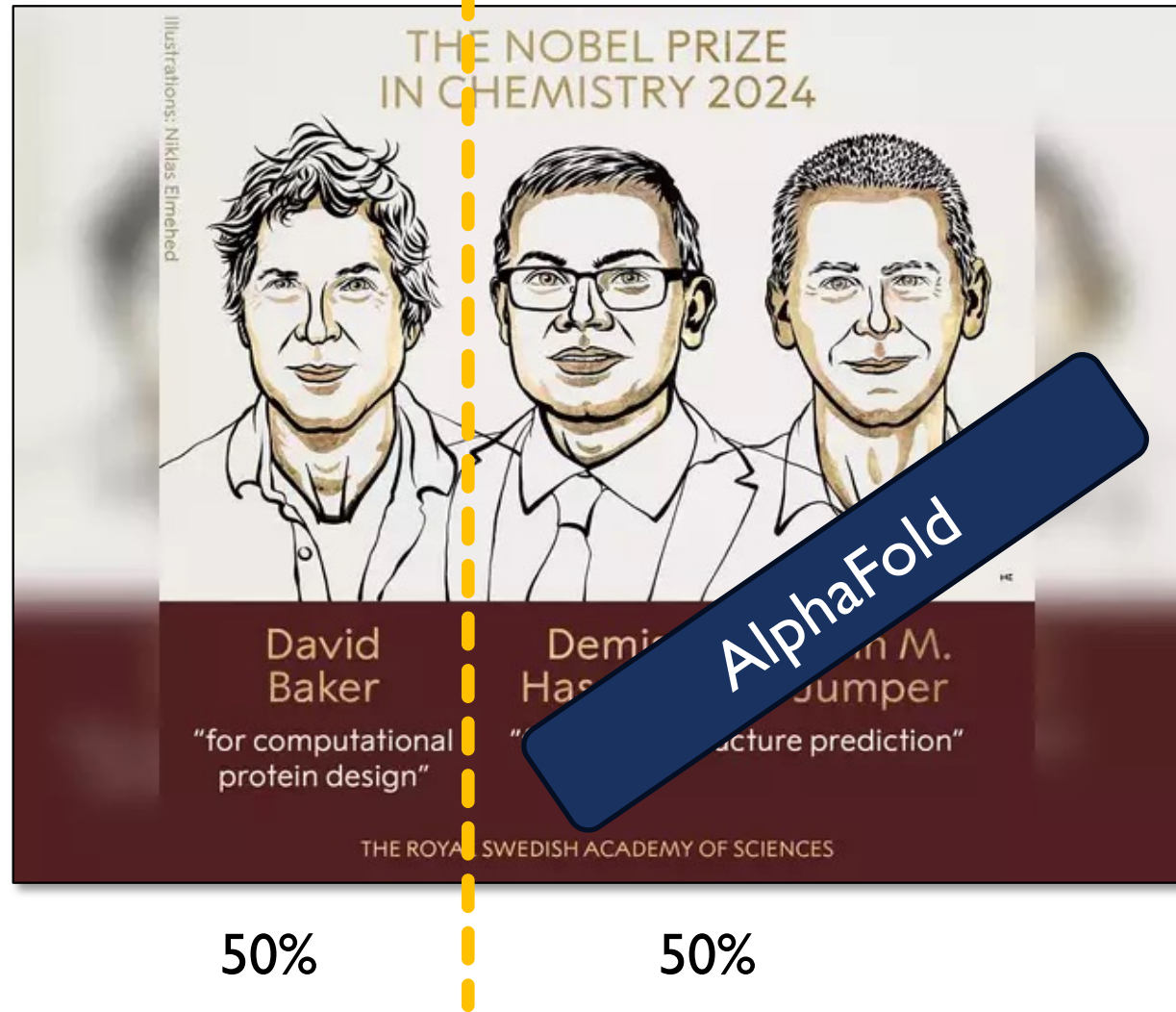
```
MIIPALDLIDGTVVRLHQGDYARQRDYGNDPL  
PRLQDYAAQGAGVLHLVDLTGAKDPAKRQIPL  
IKTLVAGVNVPVQVGGGVRTEEDVAALLKAGV  
ARVVIGSTAVKSPDVVKGWFERFGAQALVLAL  
DVRIDEHGTKQVAVSGWQENSGVSLEQLVETY  
LPVGLKHVLCTDISRDGTLAGSNVSLYEEVCA  
RYPQIAFQSSGGIGDIDDIAALRGTVRGVIV  
GRALLEGKFTVKEAIIQCWQNVK
```



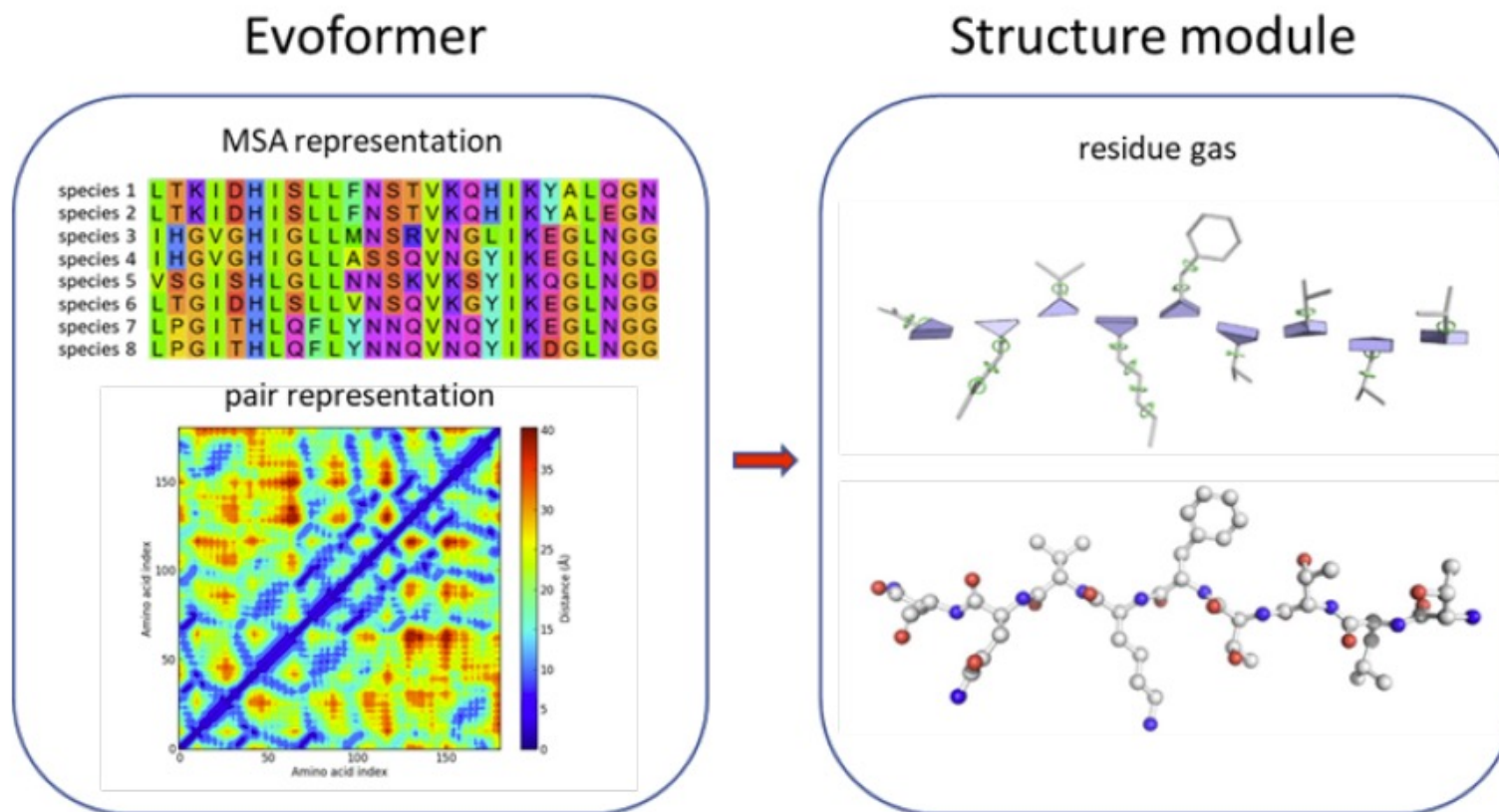
# ...so structure should be predictable, right?

Part I:

Prediction



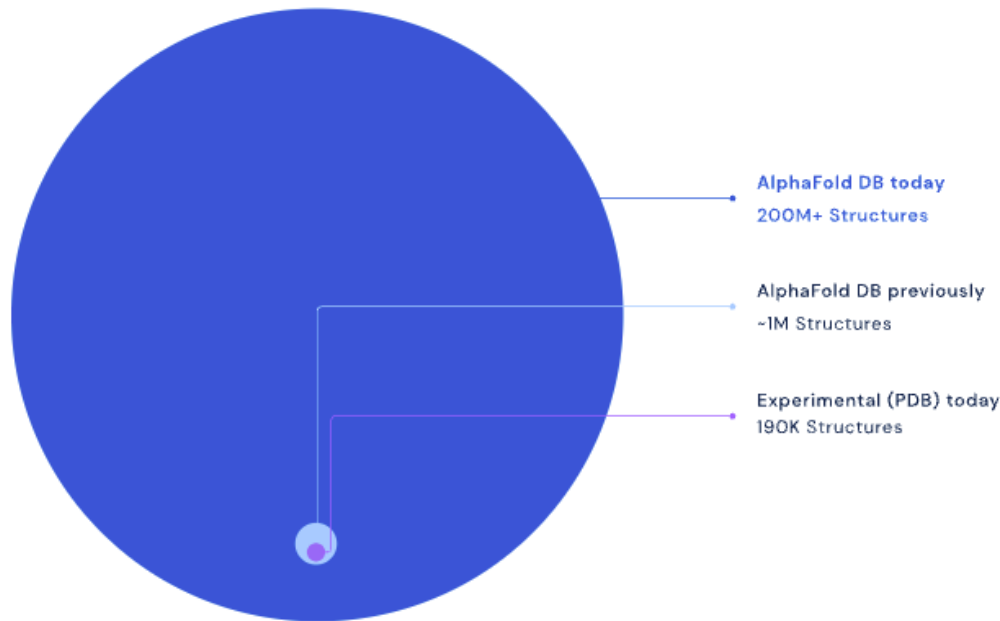
# “An ingenious piece of neural network engineering”



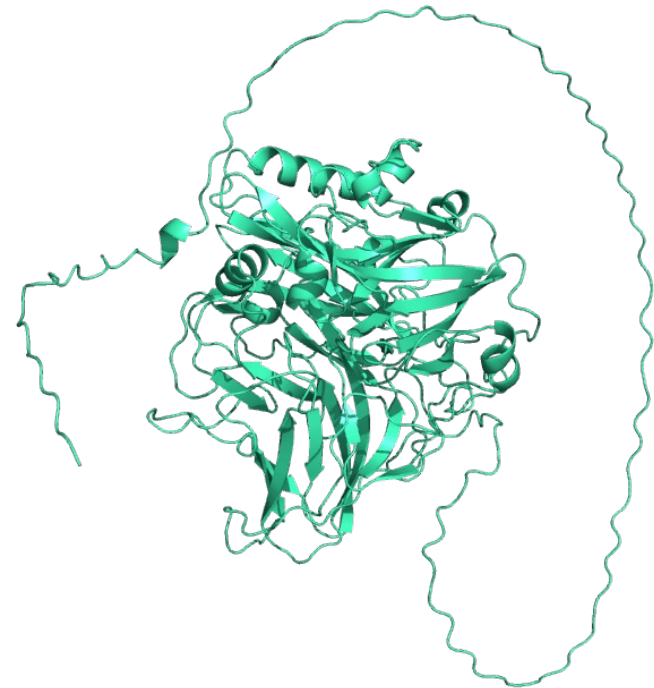
<https://www.nobelprize.org/uploads/2024/10/advanced-chemistryprize2024.pdf>

# “The structure of the protein universe”

Number of Protein Structures

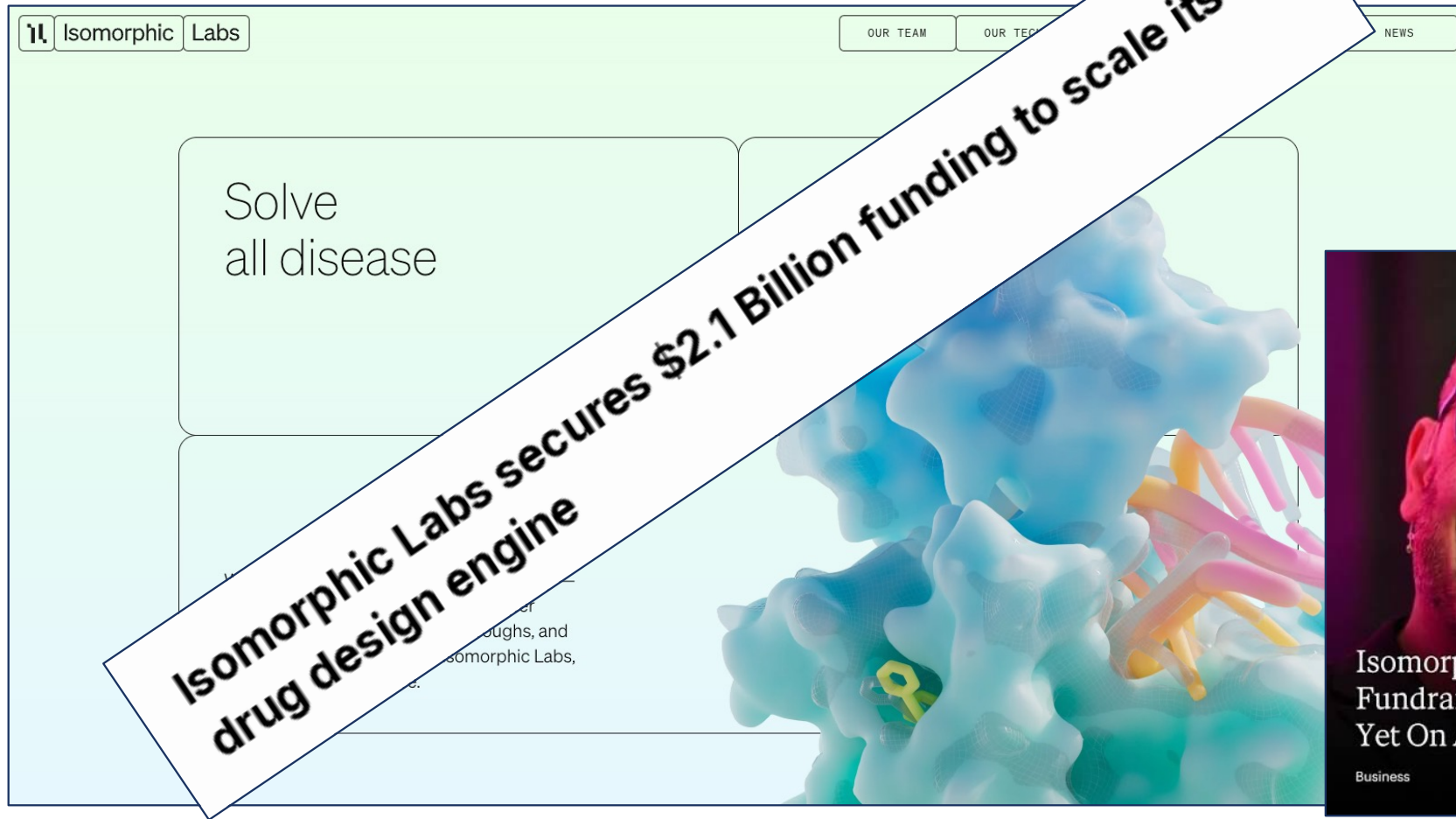


(Except when it isn't)



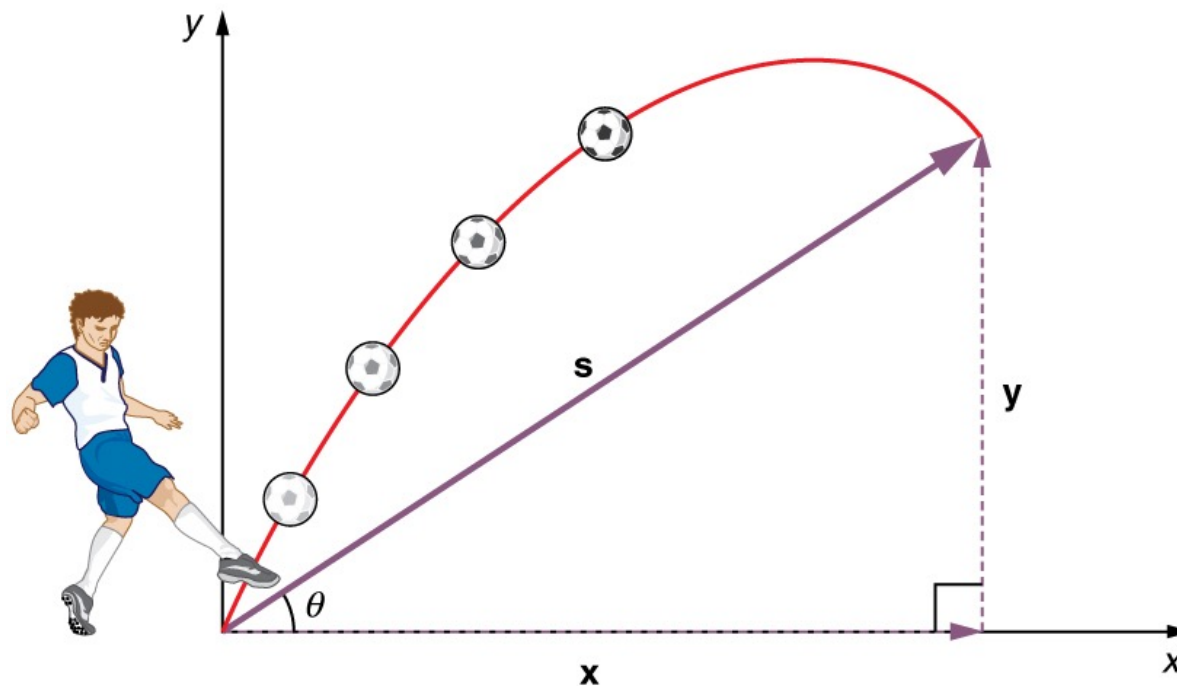
<https://deepmind.google/discover/blog/alphafold-reveals-the-structure-of-the-protein-universe/>

# Investors believe the hype



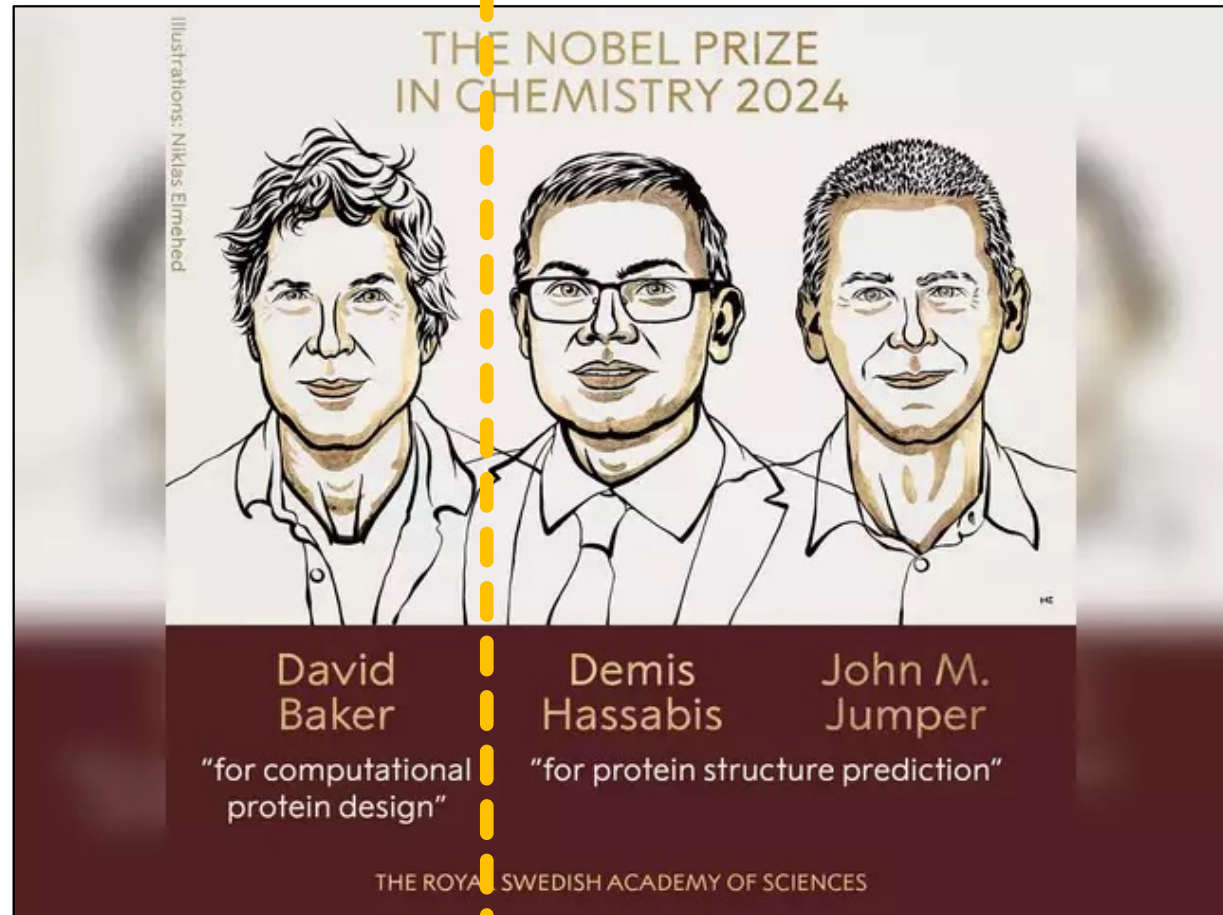
## But is it (bio)chemistry?

- AlphaFold is an unbelievably useful and user-friendly tool.
- Is it learning chemistry/biophysics, or solving the protein folding problem?



## Part II:

## Design

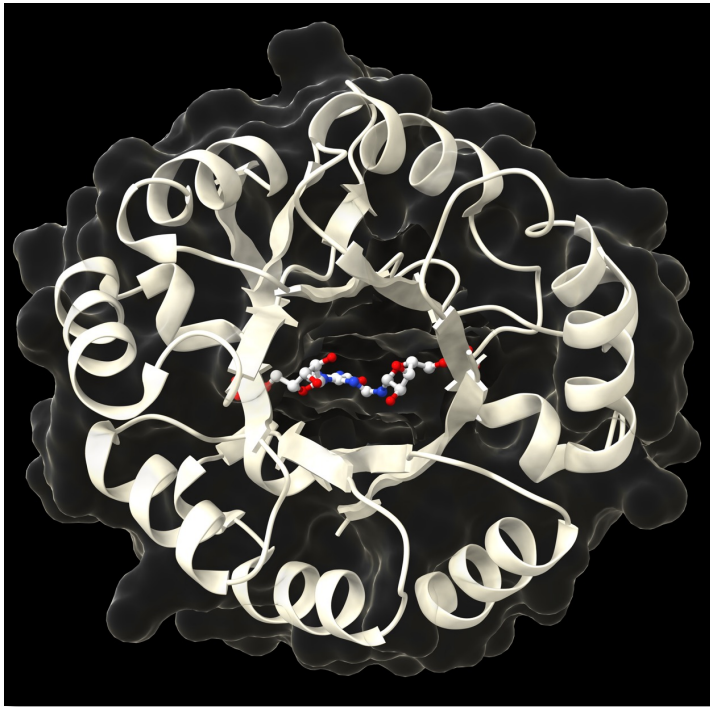


50%

50%

# Inverting the problem

If I tell you the structure I want, can you tell me the sequence that will fold into it?



The required sequence of amino acids:

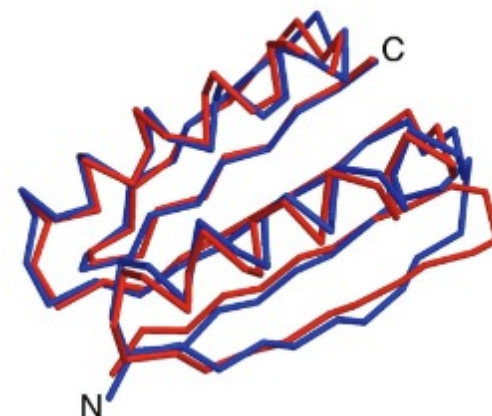
```
MIIPALDLIDGTVVRLHQGDYARQRDYGNDPL  
PRLQDYAAQGAGVLHLVDLTGAKDPAKRQIPL  
IKTLVAGVNVPVQVGGGV RTEEDVAALLKAGV  
ARVVIGSTAVKSPDVVKGWFERFGA QALVLAL  
DVRIDEHGTKQVAVSGWQENSGVSLEQLVETY  
LPVGLKHVLCTDISRDGTLAGSNVSLYEEVCA  
RYPQIAFQSSGGIGDIDDIAALRG TGVRGVIV  
GRALLEGKFTVKEAIQCWQNVK
```

# Prescient quotes in 2003

## Design of a Novel Globular Protein Fold with Atomic-Level Accuracy

Brian Kuhlman,<sup>1\*</sup>† Gautam Dantas,<sup>1\*</sup> Gregory C. Ireton,<sup>4</sup>  
Gabriele Varani,<sup>1,2</sup> Barry L. Stoddard,<sup>4</sup> David Baker<sup>1,3</sup>‡

mers per position). The search through the  $110^{71} \times 75^{22}$  ( $>10^{186}$ ) rotamer combinations took  $\sim 10$  min for each model on a Pentium III (Intel) processor.



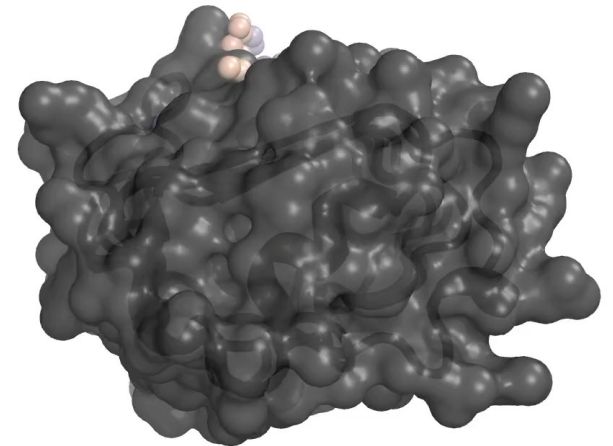
tational protein design (15). The protein therapeutics and molecular machines of the future should thus not be limited to the structures sampled by the biological evolutionary process. The methods used to design Top7 are, in principle, applicable to any globular protein structure and open the door to the exploration and use of a vast new world of protein structures and architectures.

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# RFdiffusion and ProteinMPNN

The new frontier: generative AI for *de novo* protein design:

- Specify the task you want to achieve, e.g. “bind the insulin receptor on this particular surface”.
- Get the sequence that folds into the structure that completes the task!



Movie source:  
<https://www.ipd.uw.edu/>

# Silicon Valley...or Protein Valley?

microsoft/**evodiff**

Generation of protein sequences and evolutionary alignments via discrete diffusion models



9 Contributors  
10 Used by  
682 Stars



## Proteina-Complexa

### How Claude is accelerating protein design and analytical chemistry

Aug 18, 2026



Nipah G  
K<sub>d</sub> 50 nM  
TREM2  
K<sub>d</sub> 4 nM  
TykA  
K<sub>d</sub> 340 nM  
IL-7Ra  
K<sub>d</sub> 3.6 nM  
IL-7Ra  
K<sub>d</sub> 500 nM  
EGFR  
K<sub>d</sub> 17 pM  
VEGF-A  
K<sub>d</sub> 5.6 pM  
TREM2  
K<sub>d</sub> 1.1 nM  
BHRF1  
K<sub>d</sub> 4.2 nM

Five of the most valuable companies in the world, each making the same move at the same time.

For years, biology was the specialist's corner, the thing generalist funds politely skipped because it felt too technical, too slow, too far from software.

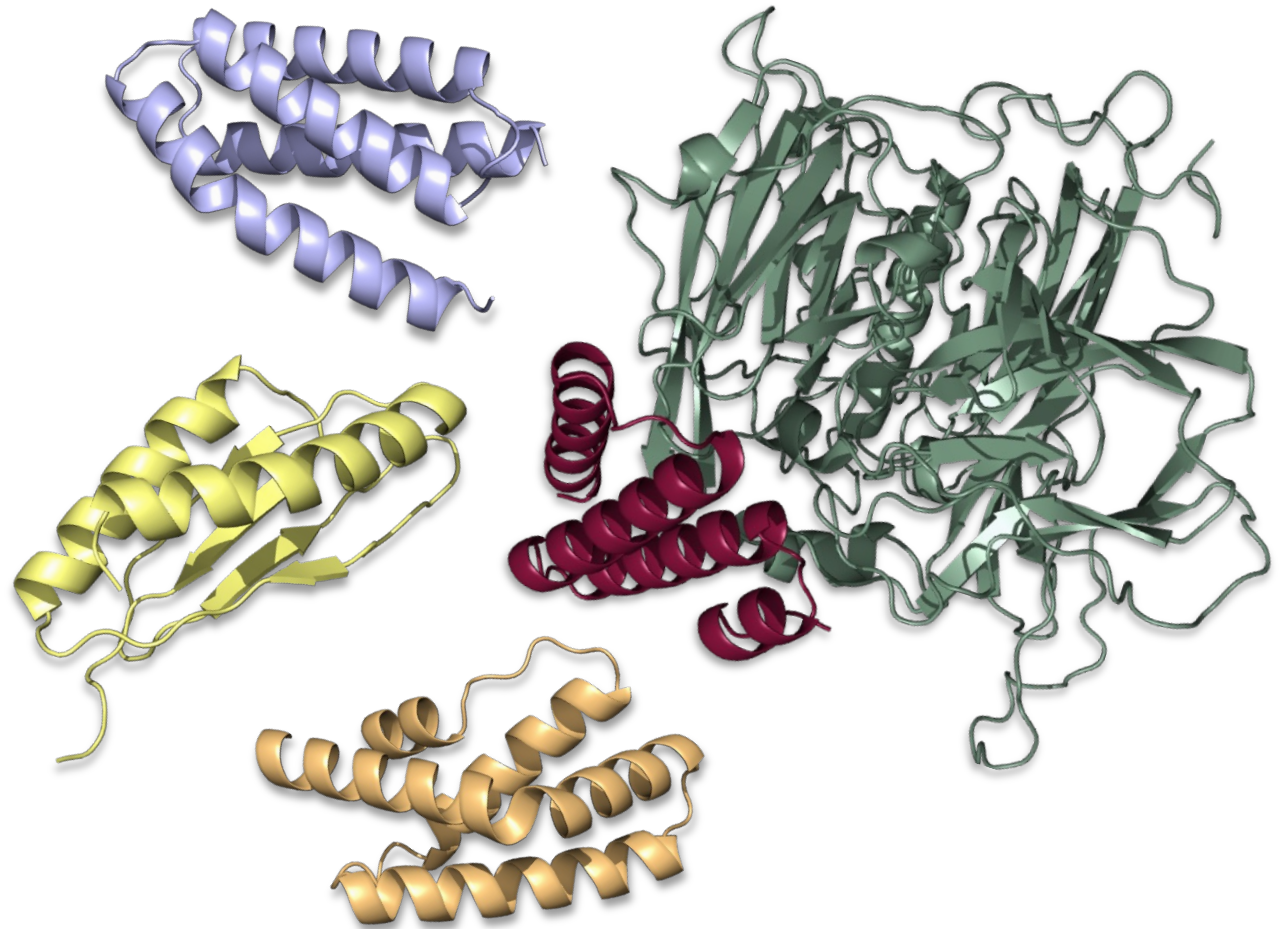
That era is over.

You can no longer build a serious view of the future of technology while treating biology as someone else's category.

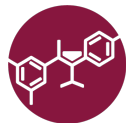
Software ate the world. Biology is next.



# VUW example 1: designing proteins for winemakers



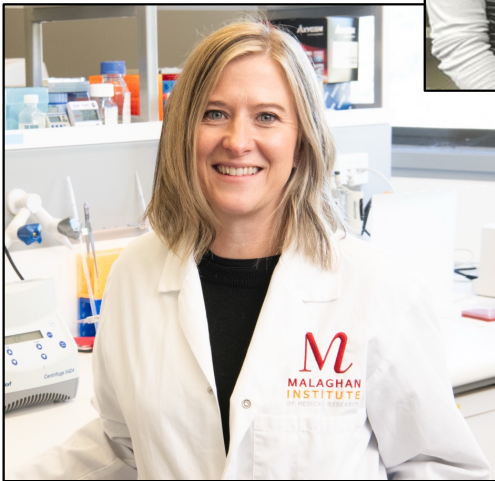
Lyle Cornish



**BRAGATO**  
RESEARCH INSTITUTE  
NEW ZEALAND GRAPE AND WINE RESEARCH

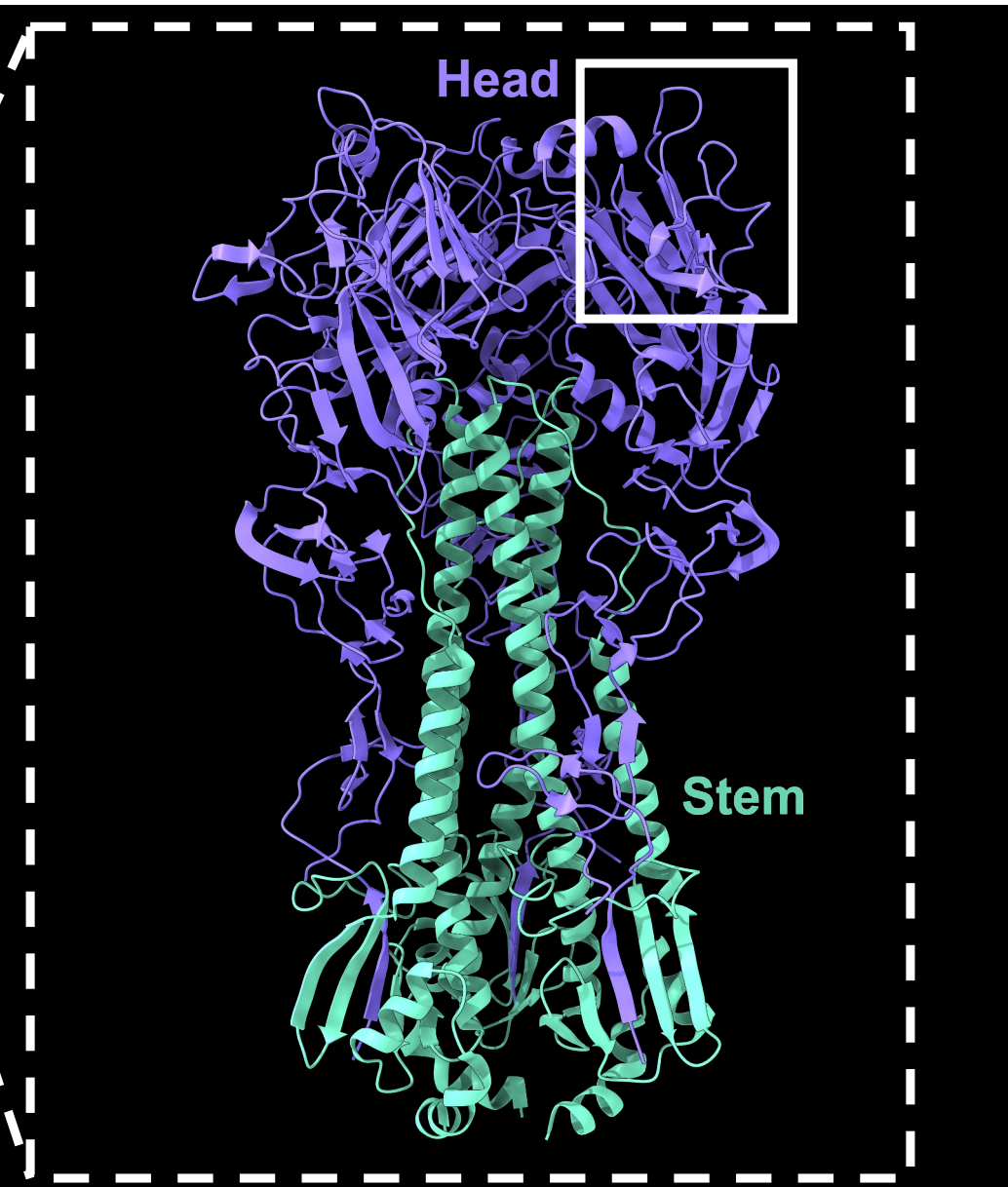
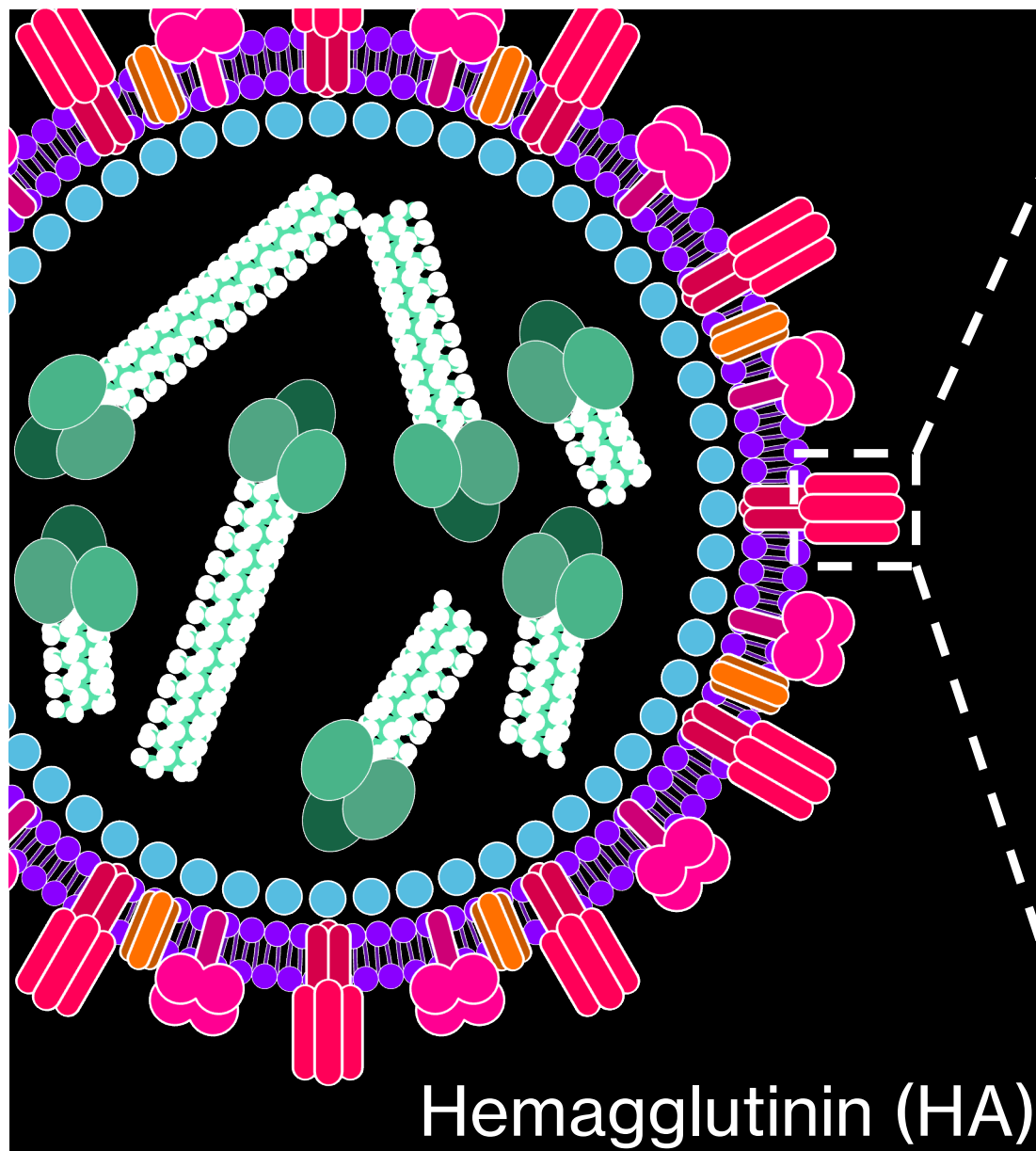
# VUW example 2: designing better 'flu vaccines

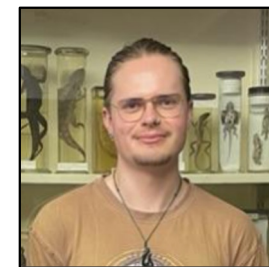
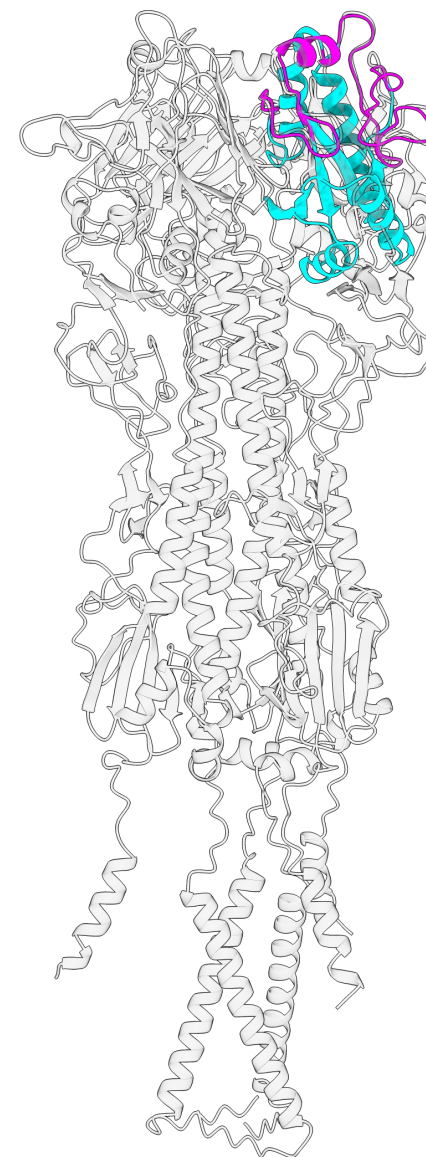
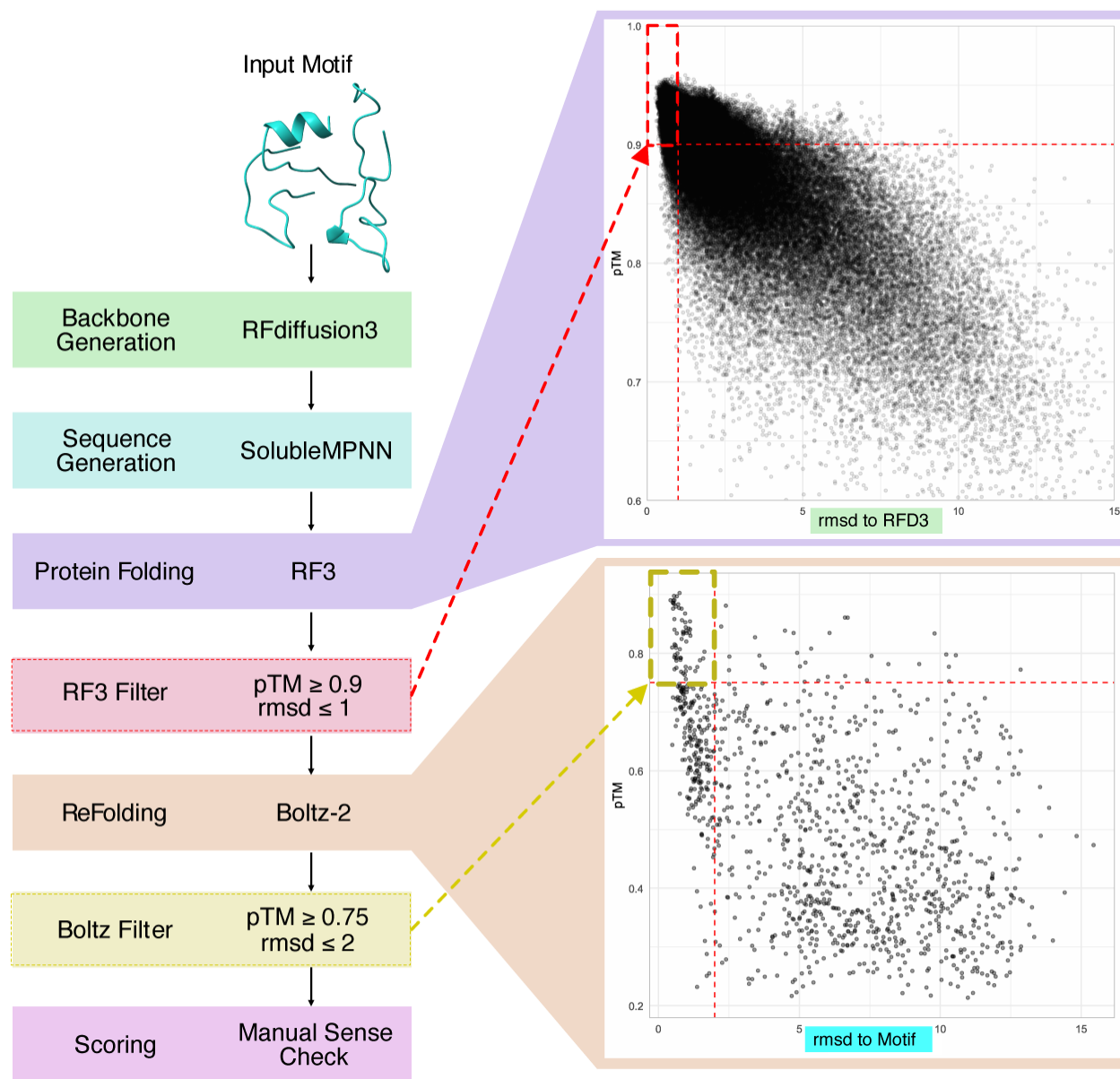
Dr Lisa  
Connor



Abby Martin  
Lydia White  
**Isaac Green**  
Jessica Cotterell  
Elise Pierson  
Tom Bird (not pictured)  
Monica Summers (not pictured)







# The NZ bioeconomy: current state

Protein



\$6,500 per tonne

Carbohydrate



\$320 per tonne

Water



\$2,800 per tonne

# FROM PROBLEM TO PROTEIN

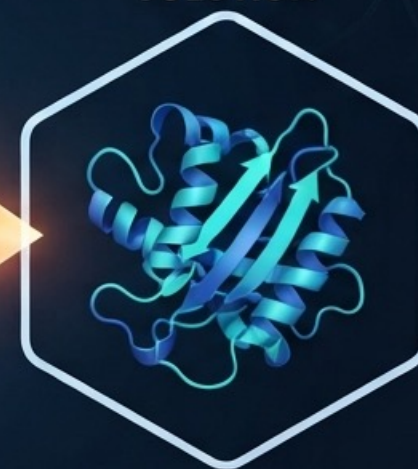
BIOLOGICAL  
PROBLEM



AI-DRIVEN  
DESIGN ENGINE



DE NOVO PROTEIN  
SOLUTION



AI-Driven Design of Custom Proteins for Future Biomolecular Solutions



# Future state: bio-design and bio-manufacturing



**Rotorua biofactory opens the way for a potential \$50 billion economic gain**



Roeland van den Bergh | SUNDAY STAR TIMES

September 28, 2025

➔ Share

# Are we ready?



## The use of AI in biotechnology is changing faster than the rules governing either technology

Published: August 18, 2026 12:11pm NZST

Just\_Super/Getty Images

 The recent announcement of novel, viable viruses created by artificial intelligence (AI) was celebrated as a major advance in the fight against antibiotic resistance. But it also raised urgent concerns about regulation.



Alongside precision gene-editing technologies such as CRISPR/Cas9 and synthetic biology, AI is now making it increasingly possible to design and alter entire biological systems.

**Author**

 **Chelsea R. Francek**  
PhD Candidate in Law, University of Waikato

**Disclosure statement**

Chelsea R. Francek does not work for, consult, own shares in or receive funding from any company or organisation that would benefit from this article, and has disclosed no relevant affiliations beyond their academic

*The Conversation, 18 August 2026*

*The Listener, 27 June 2026*

## AI FOR GOOD

Despite its broader promises, AI hasn't got us to Mars, cured cancer or solved climate change. But it has done considerable good – mostly, though not entirely, away from the clutches of Big Tech. A few examples from experts quoted in this story:

- A chatbot for women in Mauritania to talk about their experiences of genital mutilation that trauma and shame inhibit them from discussing with a human. – *Virginia Dignum*
- Medical imaging that can be used by trained radiologists in early detection of cancer and other diseases. – *Karen Hao*
- Use of cellphone technology to identify cervical cancer from pictures of the areas affected. – *Dignum*
- Development in sub-Saharan Africa of a locally focused AI that uses sustainable resources. – *Alan Blackwell*
- Research using AI to predict the structure of proteins, allowing pharmaceutical companies to come up with better drugs: work that won the 2024 Nobel Prize in chemistry. – *Enrique Dans*

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Alan B  
professor  
Cambridg  
Universit  
the feet of  
arrived fr  
“I thin  
Zealand’s  
Blackwell,

GETTY IMAGES

Collecti  
hallucin  
program

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## Are we ready?

- GPUs, GPUs, GPUs
- Pipeline of talent
- Regulatory framework
- Intellectual property
- Social licence, including te ao Māori