THE POWER OF

PROTEIN DESIGN

A NEW WORLD OF PROTEINS TO ADDRESS 21ST CENTURY CHALLENGES

IMAGINE TAKING THE BUILDING BLOCKS OF LIFE — PROTEINS — AND RE-DESIGNING THEM TO "FIX" MAJOR PROBLEMS IN MEDICINE, SUCH AS CANCER, ALZHEIMER'S OR THE FLU. UW MEDICINE SCIENTIST DAVID BAKER, PH.D., THE LEADING ARCHITECT OF PROTEIN DESIGN, AND THE INSTITUTE FOR PROTEIN DESIGN (IPD) ARE DOING JUST THAT.

PROTEINS

WHAT ARE THEY?

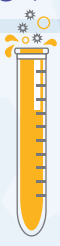
PROTEINS ARE THE BODY'S WORKHORSES, RESPONSIBLE FOR EVERYTHING FROM DIGESTING FOOD TO BUILDING TISSUE. THEY DO NEARLY EVERY JOB WITHIN THE BODY AND RESPOND TO THE NEEDS OF CELLS.

20 Amino acids link together to make a protein.

A chain of amino acids fold together into a protein with a specific shape.

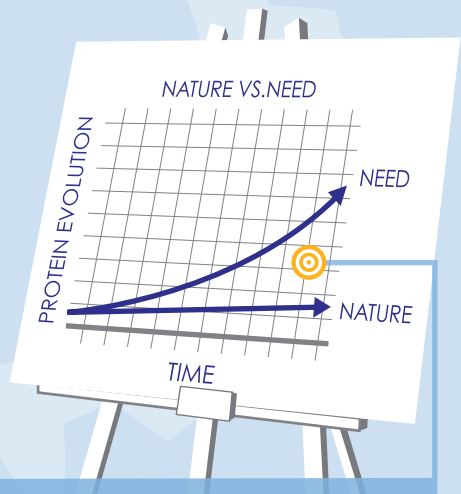
The shape of a protein determines its function. Proteins can be many things, including...

Engines



Enzymes

Target Binders

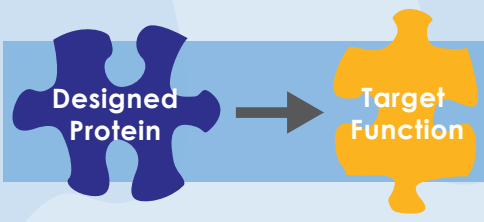


Evolution has given humans 30,000 different proteins, but our needs are evolving faster than proteins can naturally occur. Protein design opens the door to the design of new proteins to face 21st century challenges in medicine, energy and technology.

PROTEIN DESIGN

WHAT IS IT?

IPD SCIENTISTS HAVE FIGURED OUT THE RULES THAT GOVERN PROTEIN STRUCTURES. THEY HAVE TRANSLATED THESE RULES INTO A COMPUTER PROGRAM, ROSETTA. CRACKING THE PROTEIN FOLDING CODE ENABLES SCIENTISTS TO MODEL PROTEIN STRUCTURES AND DESIGN NEW PROTEINS WITH USEFUL FUNCTIONS.



By predicting the folding pattern of a protein needed for a specific function, the IPD scientists can **REVERSE ENGINEER** and customize a protein to fit current needs.

ATG,ATA,GCG,TCC...CAG,TAA

NATURAL GENE

NATURAL AMINO ACID SEQUENCE

NATURAL PROTEIN STRUCTURE

SYNTHETIC GENE

ATG,CAG,TCC,GCG...TCC,TAA

DESIGNED AMINO ACID SEQUENCE

DESIGNED PROTEIN STRUCTURE

TIMELINE OF DESIGN

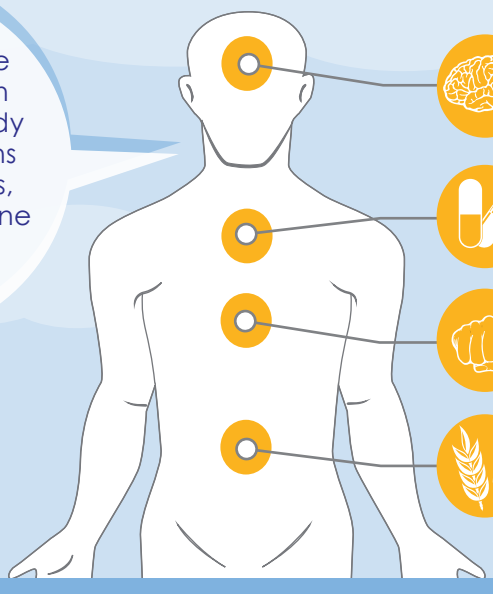
- 2000 — Pre-: 1st structure prediction
- 2003: 1st design of a novel protein; 1st design of a novel protein-protein interaction
- 2006: 1st design of a novel enzyme
- 2008: 1st design of a protein to block flu
- 2010: 1st design of protein nanostructure
- 2012
- 2013: 1st design of protein binding to small molecule; Developed "rules" to design proteins from scratch

BENEFITS OF PROTEIN DESIGN

WHY IS IT IMPORTANT?

DESIGNED PROTEINS ARE NOT FOUND IN NATURE, AND ARE THUS CHEAP AND FAST TO GENERATE. ENGINEERING SYNTHETIC PROTEINS WILL OPEN UP FAR-REACHING POSSIBILITIES — AND THE SKY IS THE LIMIT.

Researchers at the Institute for Protein Design have already developed proteins with new functions, including HIV vaccine candidates and flu inhibitors.



- **Prevention of Alzheimer's disease**
- **Anti-flu therapeutics**
- **Destruction of cancer cells**
- **Treating Celiac disease**

1 IN 133 PEOPLE
SUFFER FROM CELIAC DISEASE

THE MARKET WILL REACH
$8 BILLION BY 2019

CURRENT TREATMENT IS A GLUTEN FREE DIET

IPD IS WORKING TO DEVELOP
KUMAMAX
A NOVEL GLUTEN-DEGRADING ORAL ENZYME THERAPY TO TREAT CELIAC DISEASE

It takes a community to solve disease. You can help by playing Foldit and running Rosetta@Home, and know that every day you are contributing in some way to revolutionizing protein design for medicine. Visit **www.depts.washington.edu/ipd/participate/** to lean more.

fold it
Solve Puzzles for Science

Rosetta@home
Protein Folding, Design, and Docking