

Synthetic Biology

Engineering at the Subcellular Level

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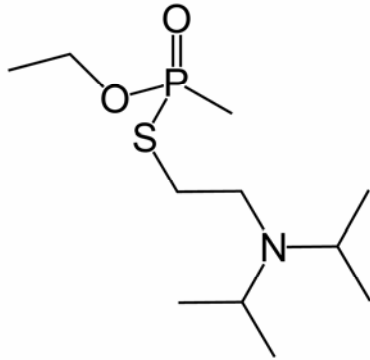
MITRE Sponsored Research



Problem

- **How do you know if a facility is producing chemical weapons?**
 - Existing methods for proving chemical weapons production are limited
- **Solution: Local monitoring of facility emissions with a remotely observable output**
 - Detect the presence of signature chemicals or suggestive combinations of chemicals

Background



Shifa Pharmaceutical Plant, Sudan



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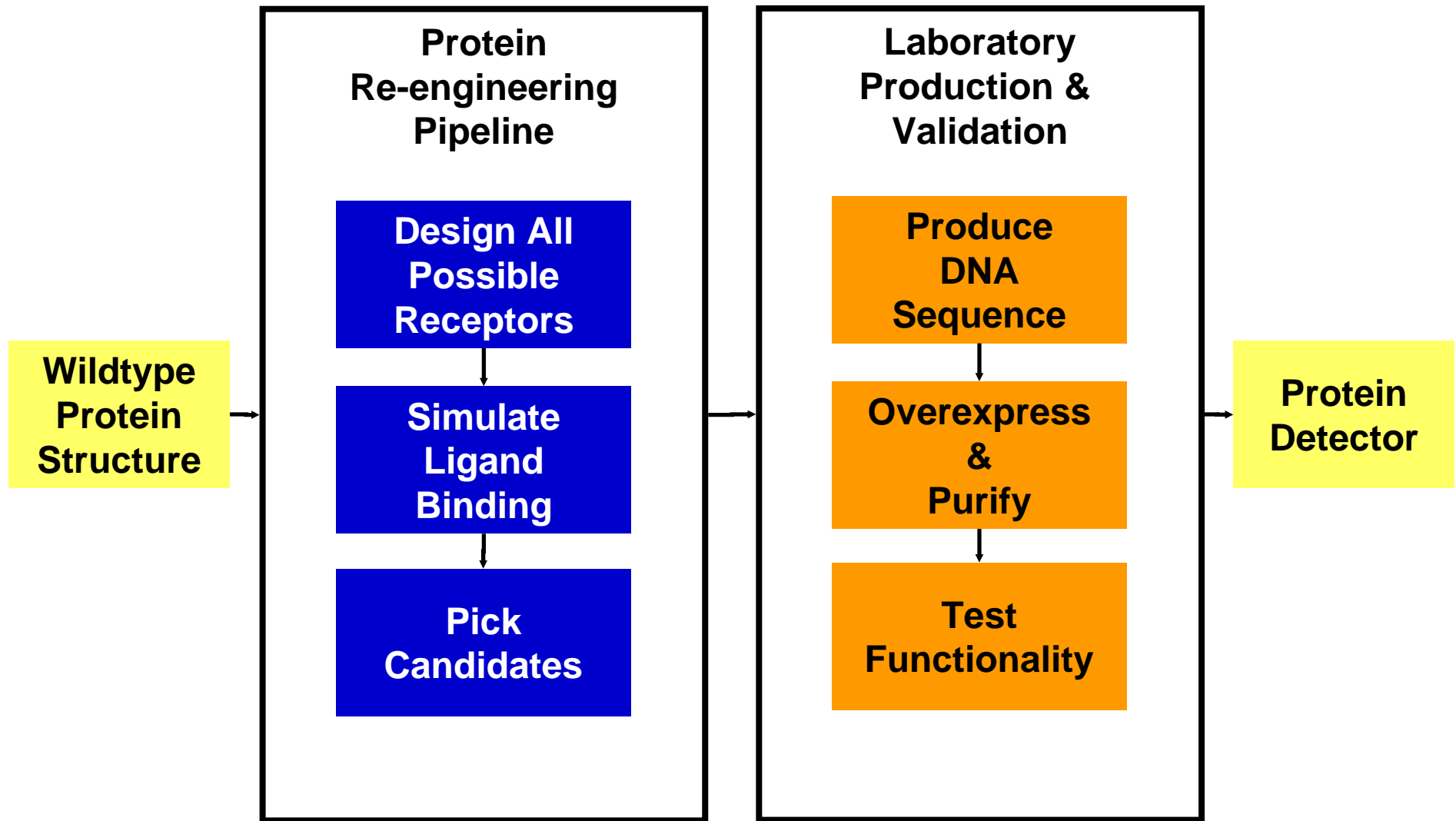
Objective

- Engineer a cell-based system that can detect a chemical signature suggestive of VX production and produce a remotely observable signal in response
- Specific activities
 - Designing protein-based detectors to serve as inputs
 - Implementing complex logical information processing circuitry in DNA (multiplexing and output)
 - Integrating protein and DNA elements into a single system

Activities

- **Develop a bioinformatics pipeline for designing protein-based detectors**
 - Design process improvement
 - Utilization of C2C Beowulf cluster
 - Proof-of-principle demonstration
 - Development of a design Web service
- **Design of detectors for VX and precursors**
 - Initial candidate list compiled
 - Laboratory validation of a detector for a precursor of VX

Highlight



Protein detector development cycle

Demonstration

Protein Design

Open Source Utility for Protein Design

Home
Links
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Protein Design Web Service

step 1 2 3 4 5 6 7 done

Select how the input files will be obtained:
 Example files
 User uploaded files

Paste the contents of your protein pdb file or enter pdb ID here:

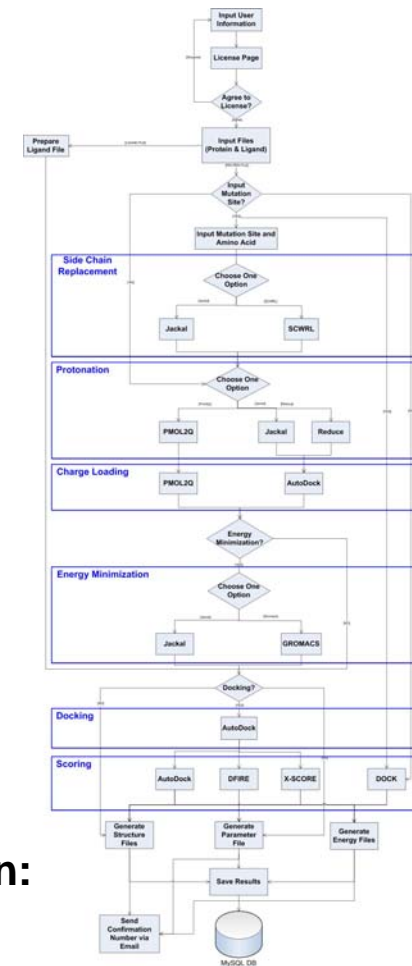
Paste the contents of your ligand pdb file here:

Paste the sites of the amino acid mutations here (e.g. 51, etc.):

Check box if you know the actual amino acid mutations desired

Search will be run against 17 amino acids, please provide email address to obtain results:

An open source Web service for rational protein design:
<http://glucose.mitre.org:8090/indexPage.jsp>



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Impacts

Internal

- Establishment of a new field of engineering at MITRE
- Integration of biotechnology into other MITRE work programs
- Extending existing MTP investments
- “Spin off” projects
 - DOTS: DNA Order Tracking System

External

- A solution to a hard sponsor problem
- A technology that is applicable to many sponsors and needs
- New sponsor relationships
 - USAMRICD
 - US Army System Performance Office

