Los Alamos Molecular Recognition Alliance

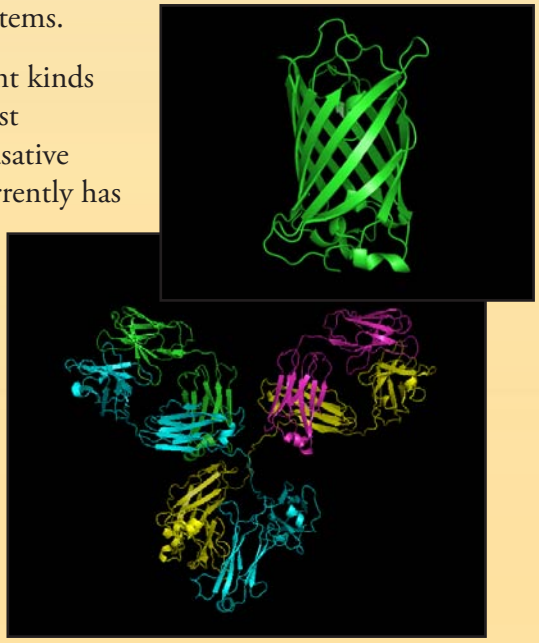
Molecular Recognition

Molecular recognition is the underlying mechanism governing life. In fact, the body's distinction between 'self' and 'nonself' is the basis of the immune system and has been harnessed by man for therapeutic, diagnostic and research purposes. Antibodies, usually derived by the immunization of animals, are the archetypal recognition molecules. However, other molecules, generically termed "affinity reagents" or "antibody substitutes", with similar properties have also been developed that have the capacity to recognize and bind to targets of interest, and are widely used to detect the presence of a recognized target.

Almost all detection platforms rely on affinity reagents to detect bio- or chemical threat targets (or their specific products) and distinguish them from similar non-harmful contaminants. While much work has been undertaken on detection platform hardware, less work has been carried out on the underlying affinity reagents, with many platforms relying on commercially available antibodies derived by immunization. Novel affinity reagents are essential in the chemical and biological detection that is at the heart of the Los Alamos National Laboratory's mission in threat reduction, as well as being at the interface between many fundamental and applied Los Alamos research programs.

Affinity reagent technologies at Los Alamos National Laboratory (LANL) are among the most advanced worldwide, with a wide range of different technologies focused on molecular recognition and the generation of affinity reagents both developed and under development. These include different affinity reagents (antibodies, fluorescent proteins, peptides, peptoids, carbohydrates, and oligonucleotides), and different selection and screening systems.

Affinity reagents of different kinds have been developed against numerous diseases and causative agents and Los Alamos currently has several funded programs in the area of affinity reagent technology development and use, for both biological and chemical threat agents.



Pictured to the right: (top) the structure of a green fluorescent protein (GFP), and (bottom) the structure of an antibody.

Some diseases against which affinity reagents have been developed at LANL include:

cholera
plague
anthrax
ricin
influenza
botulinum toxin
hantavirus
shigatoxin

Los Alamos National Laboratory

LAMRA Capability Areas

Affinity Reagent Scaffolds

- Antibody fragments
- Fluorobodies (based on novel fluorescent proteins)
- Peptides
- Synthetic biopolymers
- Carbohydrates
- Peptoids
- Aptamers (nucleic acid based)

Selection, Screening and Expression Platforms for Affinity Reagents

- Phage display
- Bacterial display
- In vitro display systems
- Micro x-ray fluorescence
- Flow cytometry
- High throughput protein production
- SELEX (*in vitro* evolution of aptamers)

Theory, Modeling and Simulations

- Classified computing and lab space
- BSL-2 and BSL-3
- Advanced computing resources

LAMRA members include:

Andrew Bradbury (B-9) <amb@lanl.gov>
S. Gnanakaran (T-10) <gnana@lanl.gov>
Csaba Kiss (B-9) <csakis@lanl.gov>
Jen Martinez (MPA-CINT) <jenm@lanl.gov>
Peter Pavlik (B-9) <pavlik@lanl.gov>
Jurgen G. Schmidt (B-9) <jschmidt@lanl.gov>
Basil Swanson (C-PCS) <basil@lanl.gov>
Momchilo Vuyisich (B-7) <vuyisich@lanl.gov>
Cyndi Wells (IAT-1) <wells@lanl.gov>

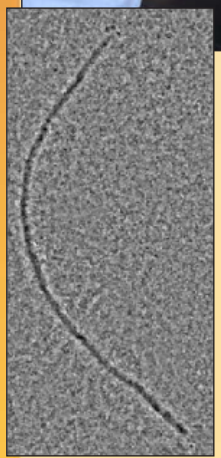
Los Alamos Molecular Recognition Alliance (LAMRA)

"The Los Alamos Molecular Recognition Alliance (LAMRA)" was created to bring together the strengths and innovations in molecular recognition at LANL in order to serve the Laboratory as well as the entire scientific community. LAMRA is a virtual institute organized to:

1. Facilitate collaboration and discussion between the different groups using these technologies;
2. Educate LANL program managers and their cognizant funding agencies of the resident LANL expertise in this area, and
3. Provide a national resource for customers interested in these technologies.

The scientists involved in this initiative are currently found in five different divisions across the Laboratory (Bioscience, Chemistry, Theoretical, Materials Physics and Applications and International and Applied Technology) and potential users are even more broadly distributed across the Institution as well as the scientific community.

LAMRA is poised to be a unique user resource in this area due to the multi-disciplinary nature of research in the affinity reagent field carried out at LANL. The Alliance is a virtual space where visiting investigators can find experts in numerous affinity reagent techniques as well as a world-class environment in which to work.



(above) Bacterial samples are loaded into the Protein Purification System robot—an extraordinary machine can purify the equivilent of 96 1-liter cultures of protein per day. (left) An electromicrograph of a phage used in phage display.

To learn more about LAMRA, contact:
Andrew Bradbury, amb@lanl.gov or 505-665-0281

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