

RISING ABOVE
THE GATHERING
STORM

*Energizing and
Employing America
for a Brighter
Economic Future*

NATIONAL ACADEMY OF SCIENCES,
NATIONAL ACADEMY OF ENGINEERING, AND
INSTITUTE OF MEDICINE

OF THE NATIONAL ACADEMIES

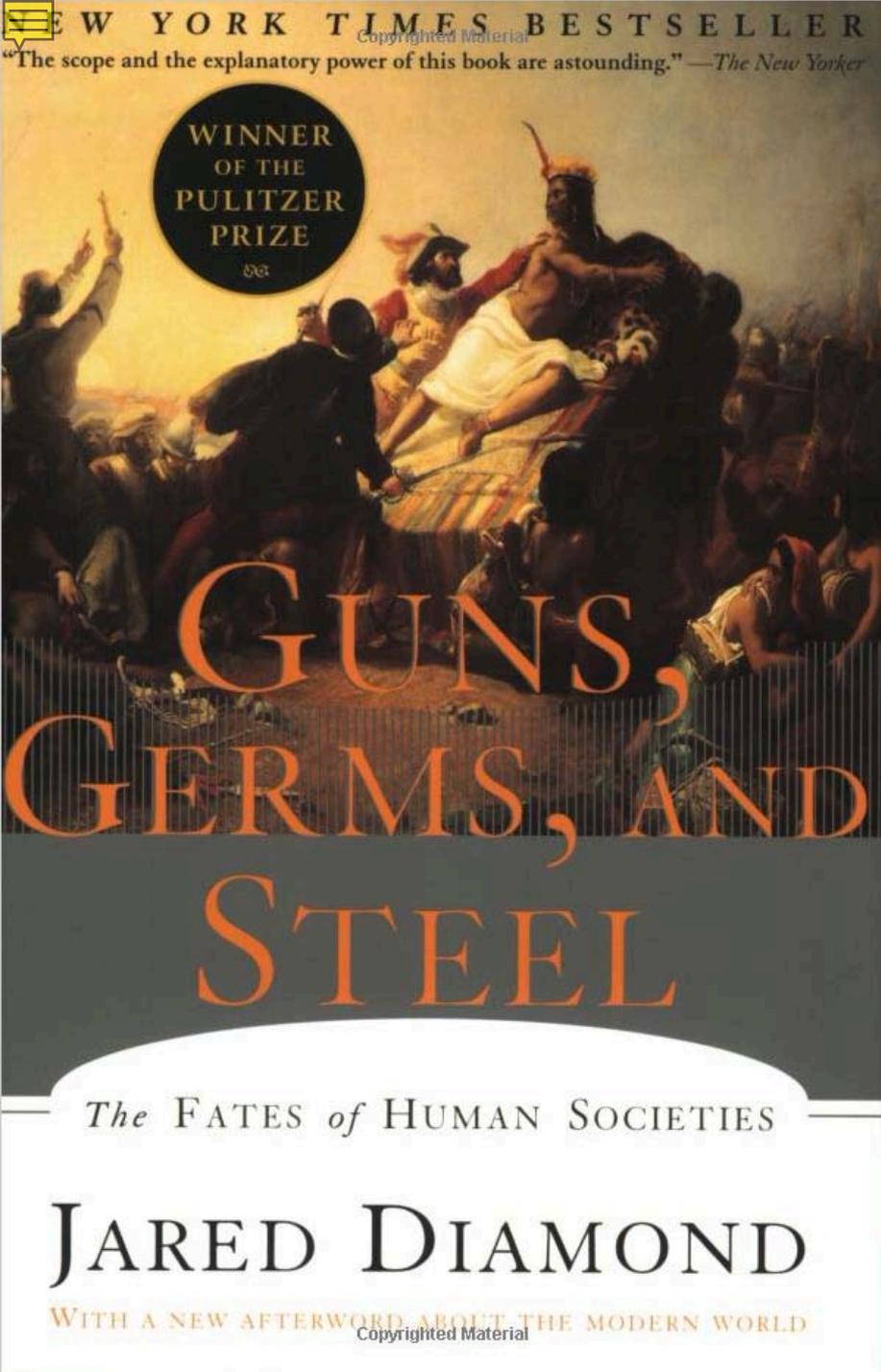
Research in the Interest of National Security

Steven Beckwith
University of California

NEW YORK TIMES BESTSELLER

"The scope and the explanatory power of this book are astounding."—*The New Yorker*

WINNER
OF THE
PULITZER
PRIZE



GUNS, GERMS, AND STEEL

The FATES of HUMAN SOCIETIES

JARED DIAMOND

WITH A NEW AFTERWORD ABOUT THE MODERN WORLD

Wealth & Power

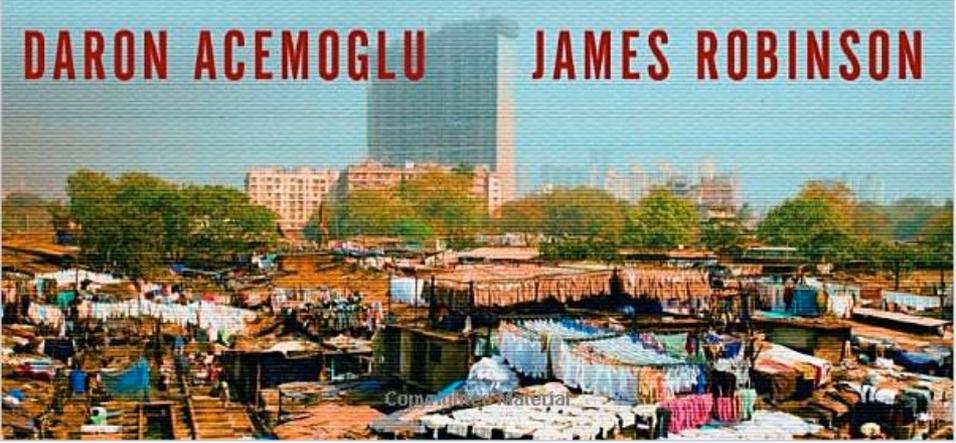
- Production (cultivation) of food => specialized labor
- Specialization led to innovation:
 - Tools, materials, weapons
 - Writing (knowledge)
- Food production allowed cities & dense populations
 - Societal organization
 - Disease

The advantages in technology & organization allowed world dominance by a few societies that developed them early

THE ORIGINS OF
POWER, PROSPERITY, AND POVERTY

WHY NATIONS FAIL

DARON ACEMOGLU JAMES ROBINSON

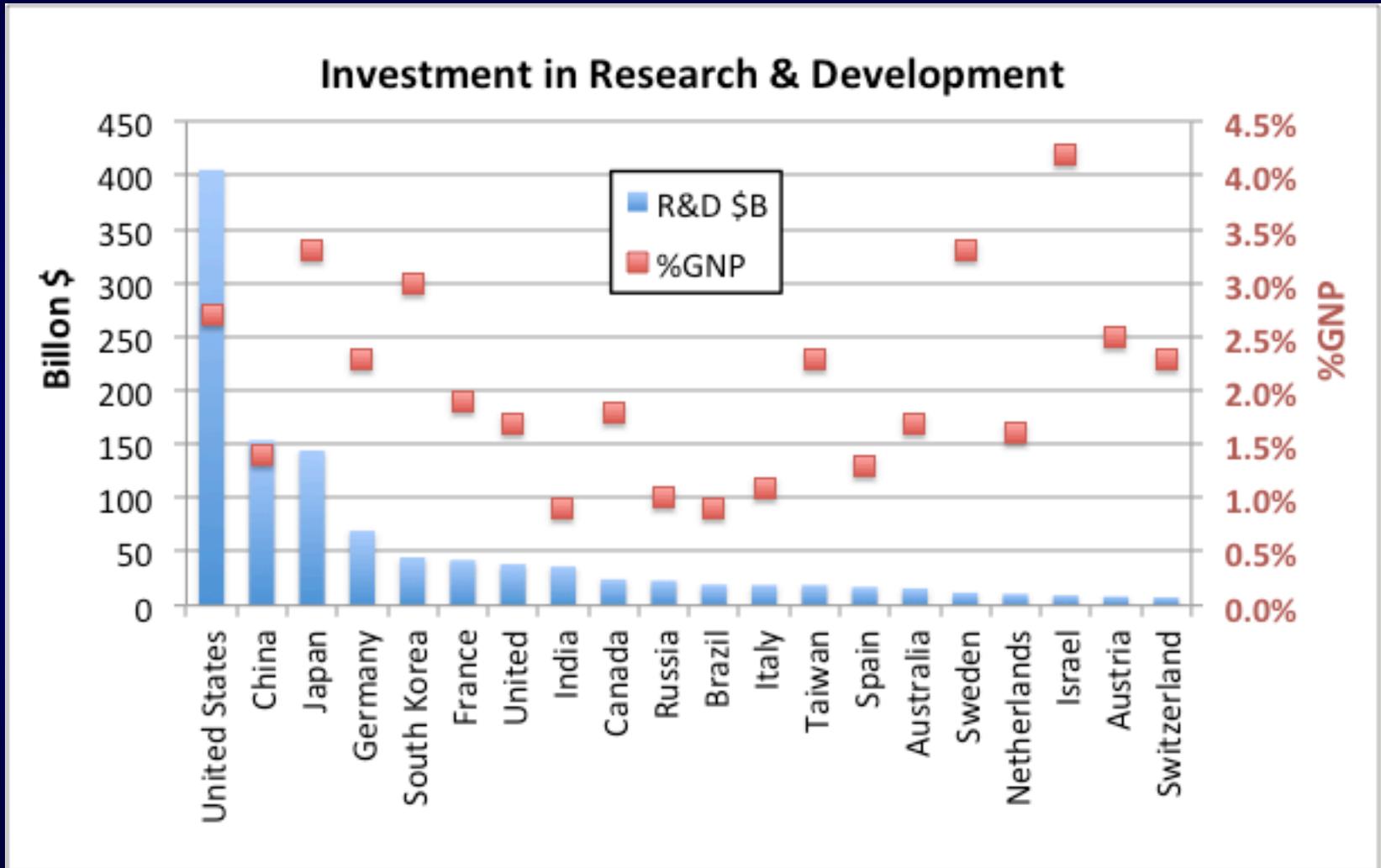


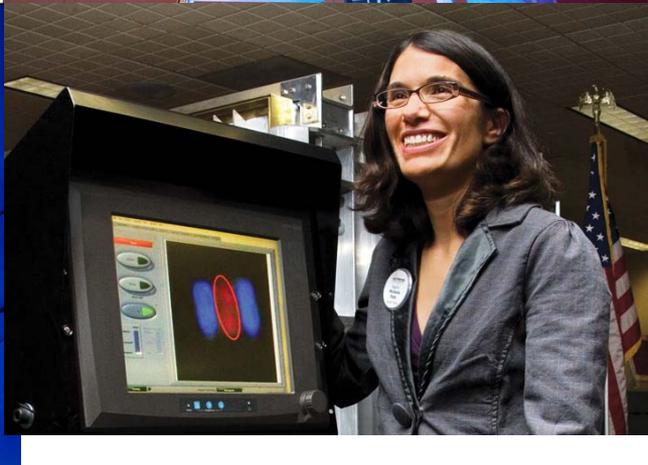
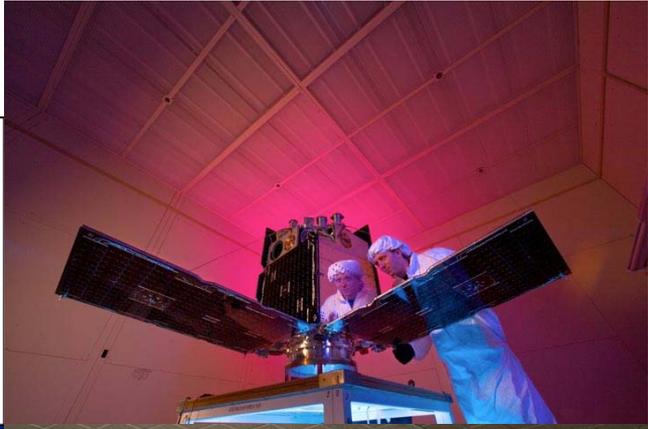
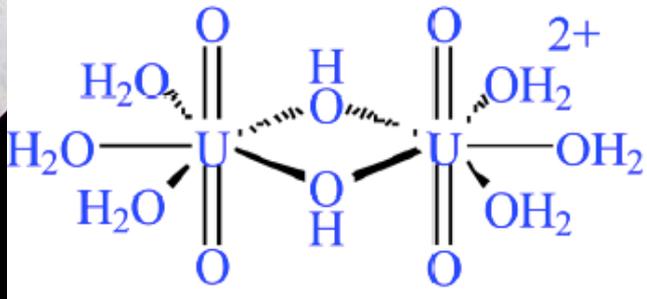
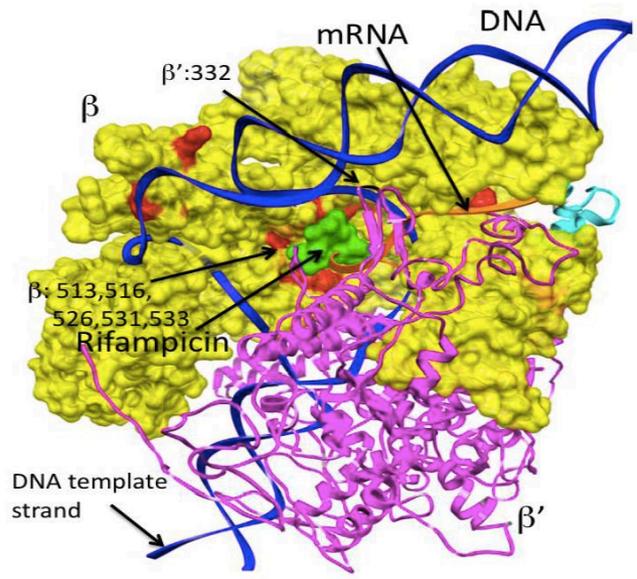
Successful Societies

- Innovation occurs from many individuals:
 - Competition to succeed
 - Opportunities to invent
 - Protection of the rewards
- Top-down extractive societies fail; bottom-up rights-based societies succeed
 - USSR vs. USA
 - Monarchies vs. democracies

Social organization drives innovation in technology which creates great disparities in wealth & power

Wealth & Investment

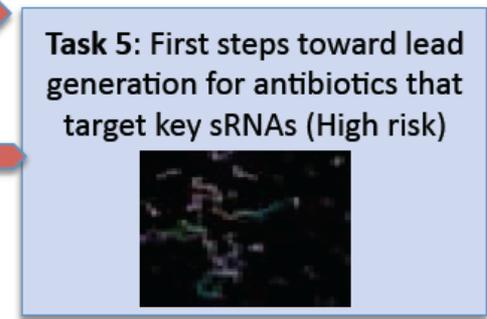
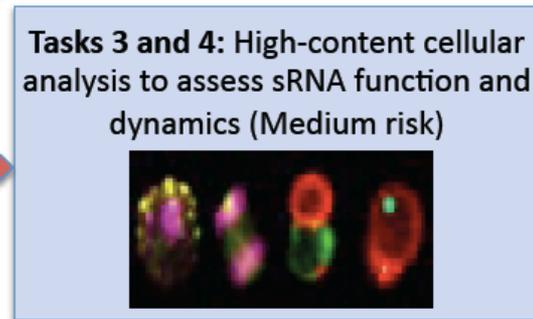
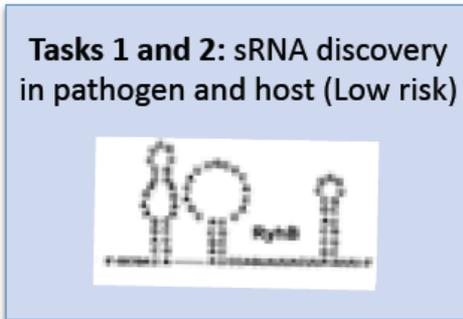
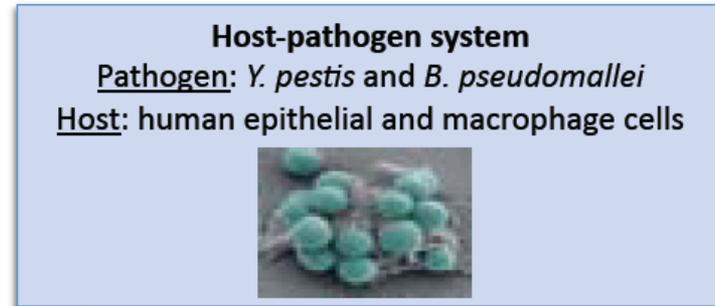




Illuminating the Dark Matter of the Genome: Small RNAs as Novel Targets for Bioterrorism Countermeasures

Elizabeth Hong-Geller
20110051DR

Elizabeth Hong-Geller



Specialized and unique capabilities at LANL

B Division:

Ultra-high-throughput sequencing
Select Agent and BSL-3 labs
Luminex miRNA profiling
Advanced tools in bioinformatics

B Division: Imaging flow cytometry

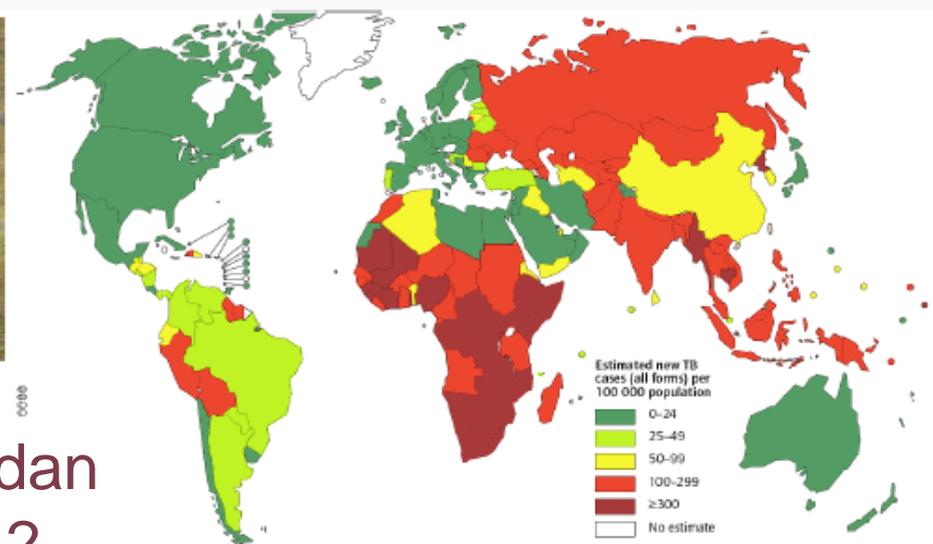
MPA-CINT: Single molecule detection

C Division: Automated confocal microscopy

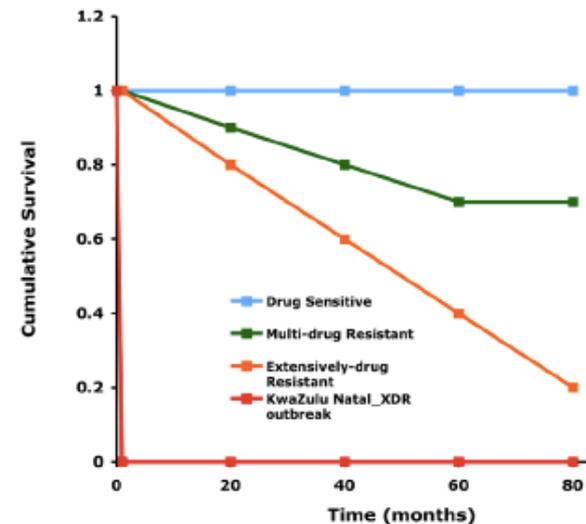
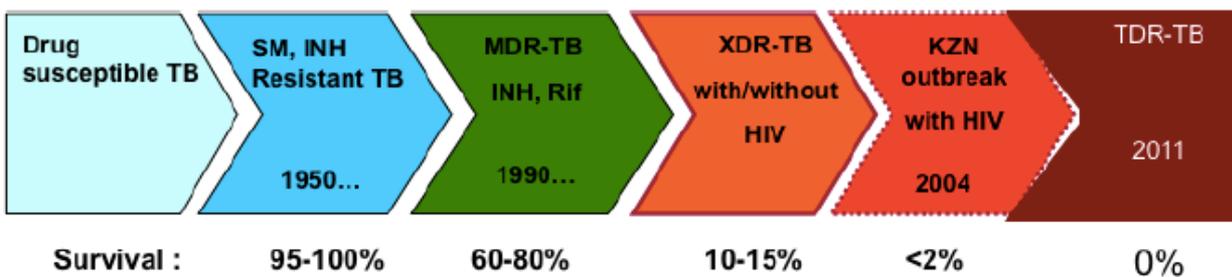
T Division:

High performance computing
RNA molecular modeling
SHAPE chemical probing

Tuberculosis: A Re-emerging Scourge



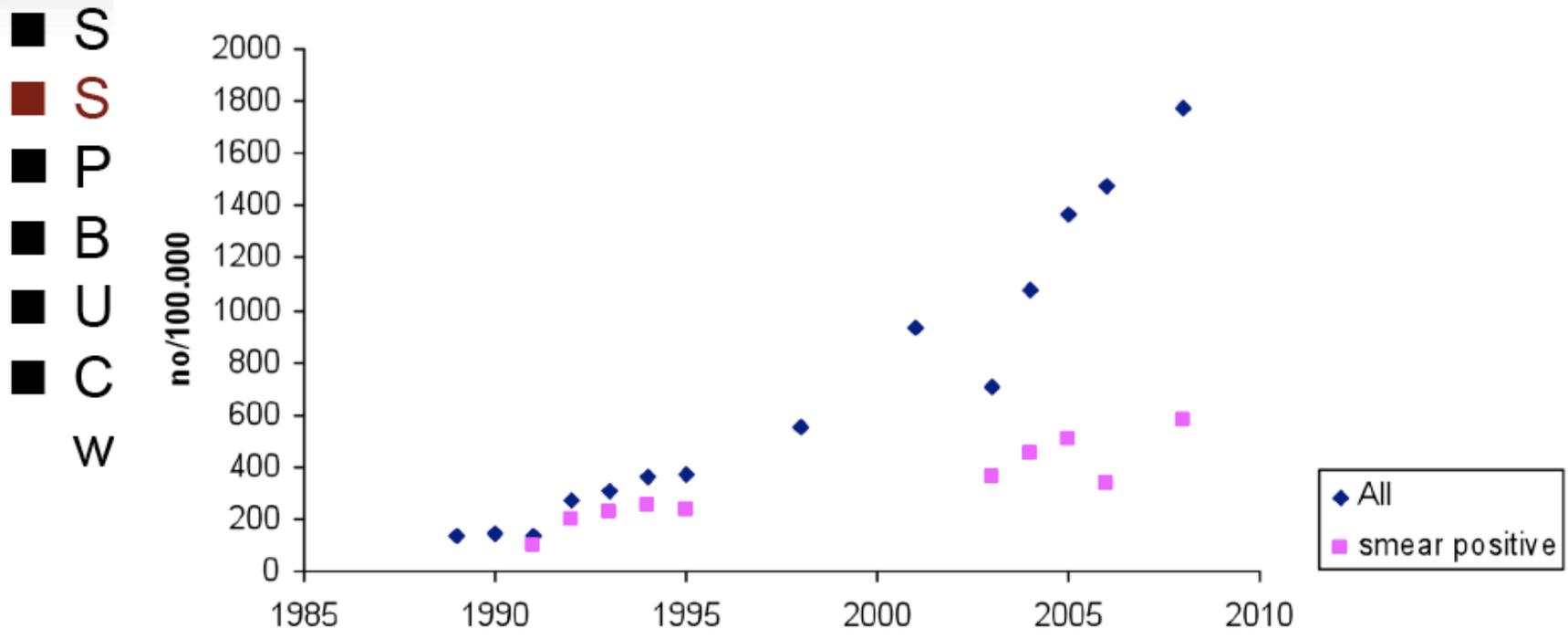
Harshini Mukundan
October 19, 2012



First XDR-TB Outbreak in Tugella Ferry

53/54 admitted dead within 16 days of a positive sputum smear

Current Diagnosis of Tuberculosis

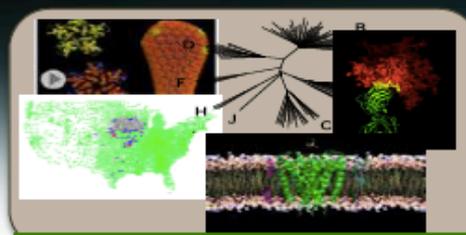


There are no reliable methods for the prevention, detection or treatment of drug-resistant tuberculosis

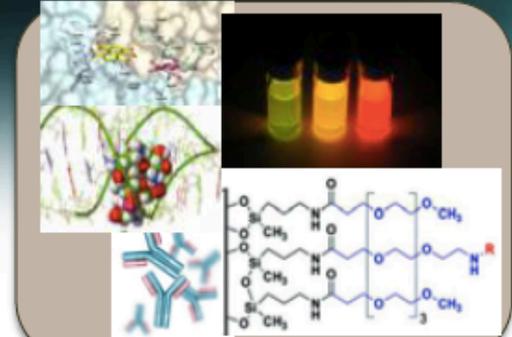




**Biomarker
Discovery**



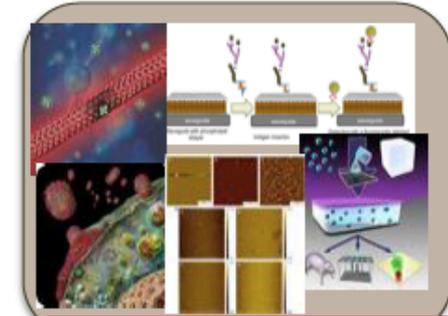
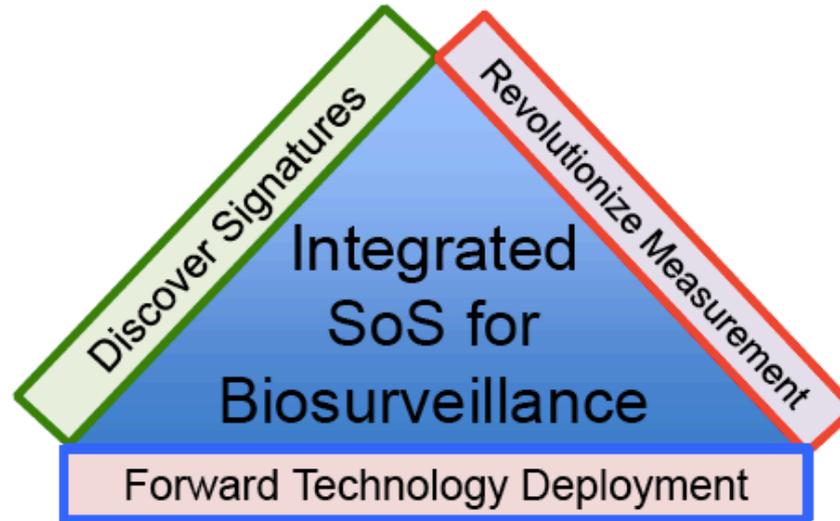
**Theoretical and
Epidemiological
Modeling**



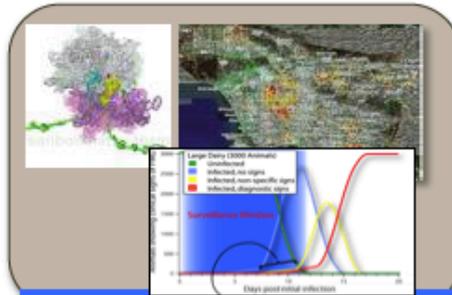
Ligands and Reporters



**Engineering
Sensors**



Assay Development



**Predicative Systems
Data Reduction**



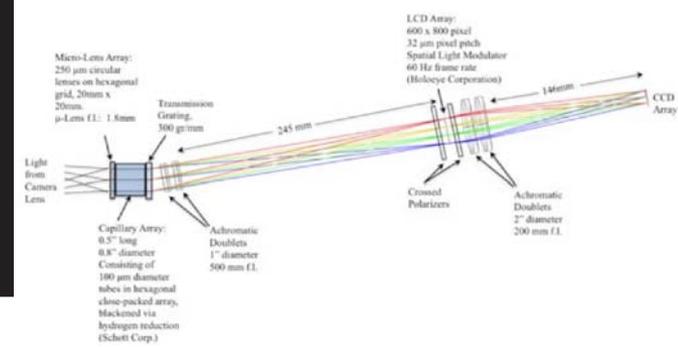
**Bioinformatics
Data Interpretation**



Next Gen Sequencing

Technology

Exploratory Research
Continuing Project

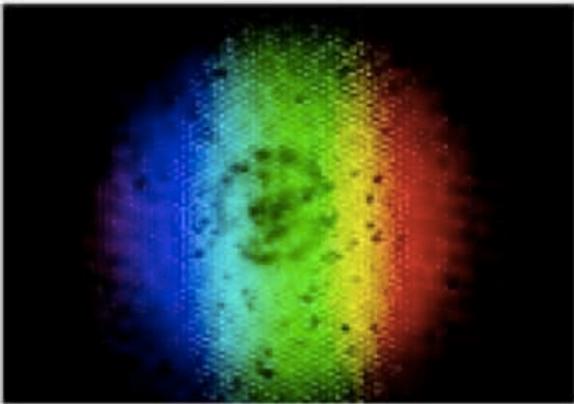


Full-Frame Programmable Spectral Imagers Based on Micro-Mirror Arrays

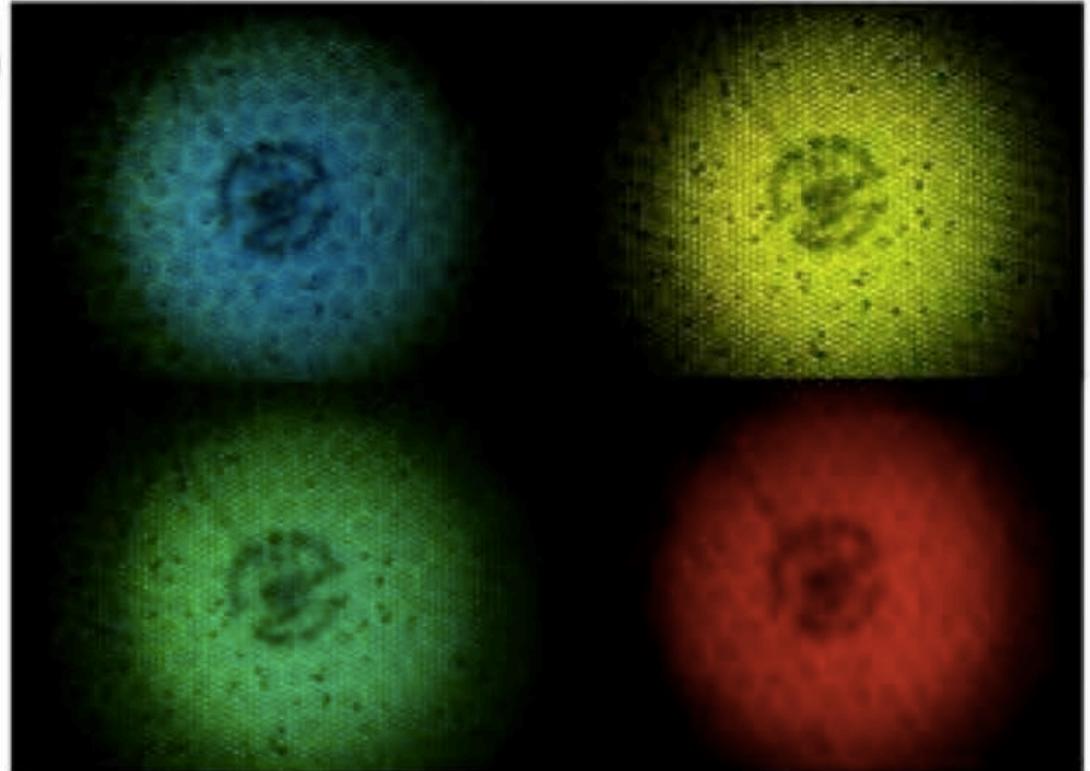
Steven P. Love
20110267ER

Steven P. Love

(a)



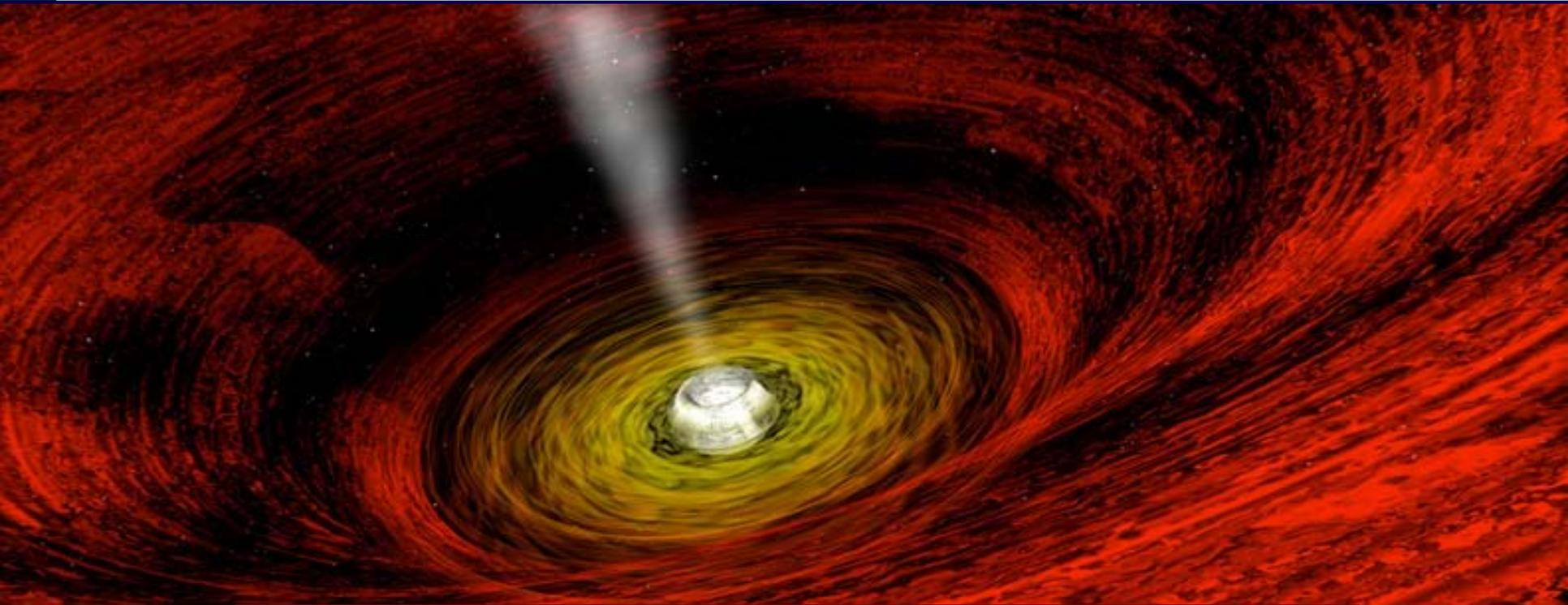
(b)



The Formation and Evolution of Black Holes in the Universe

Christopher L. Fryer
20100636PRD4

Postdoc: Johnson



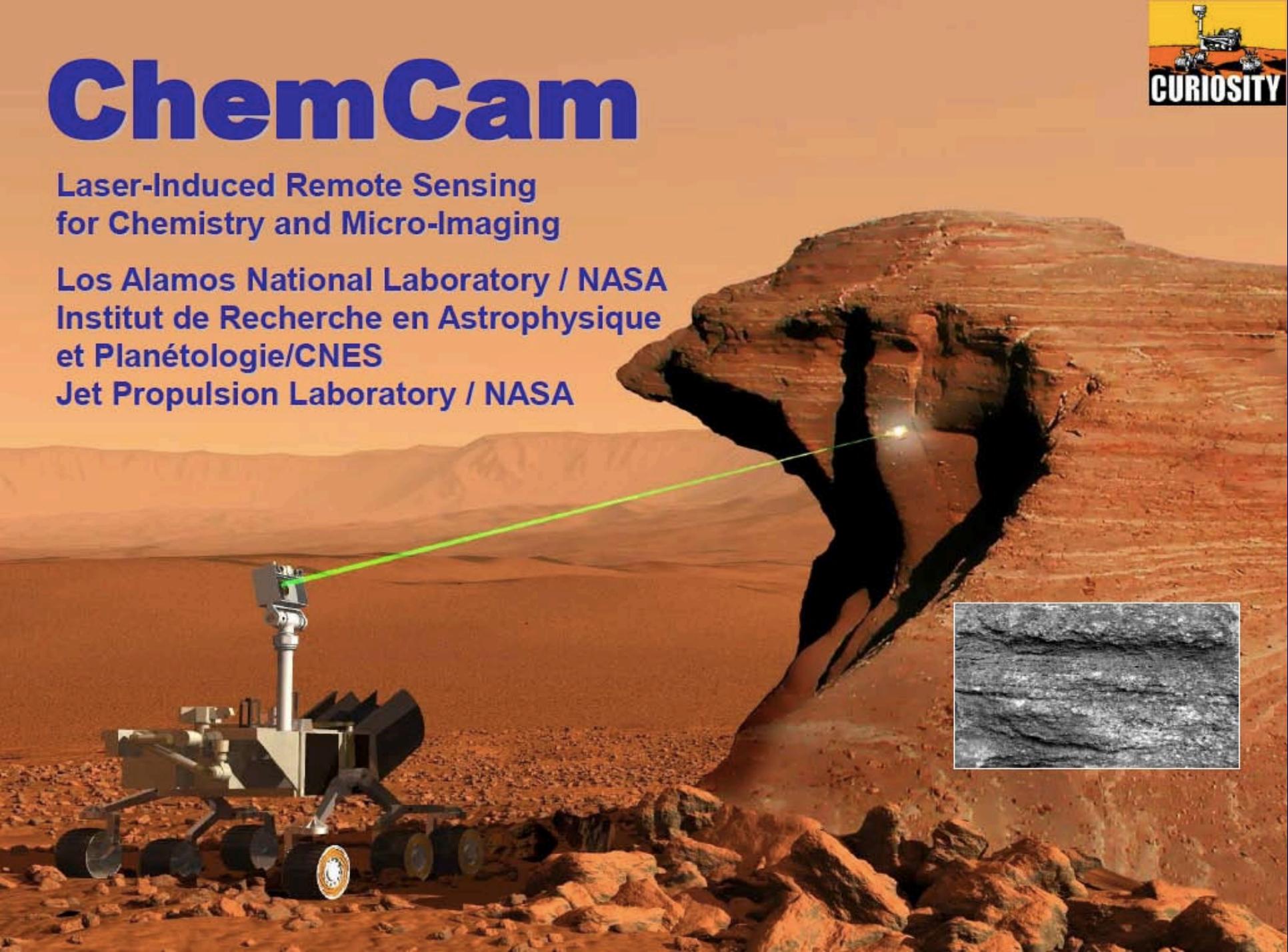
Benefit to National Security Missions

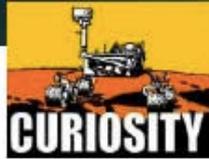
This project will develop and utilize advanced radiation transport codes that are relevant to the simulation of thermonuclear explosions. This will have direct relevance to stockpile stewardship efforts at LANL.

ChemCam

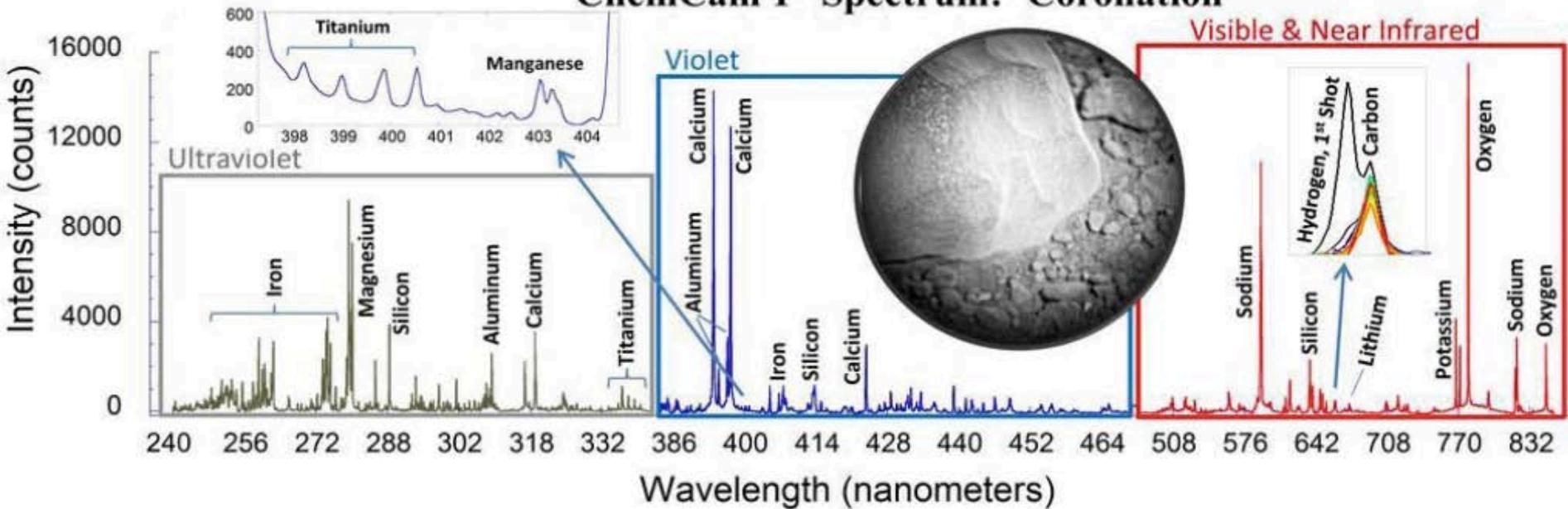
Laser-Induced Remote Sensing
for Chemistry and Micro-Imaging

Los Alamos National Laboratory / NASA
Institut de Recherche en Astrophysique
et Planétologie/CNES
Jet Propulsion Laboratory / NASA





ChemCam 1st Spectrum: 'Coronation'



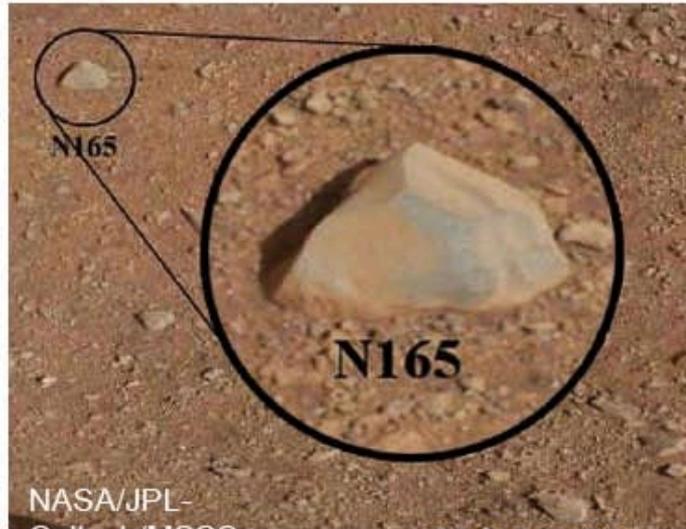
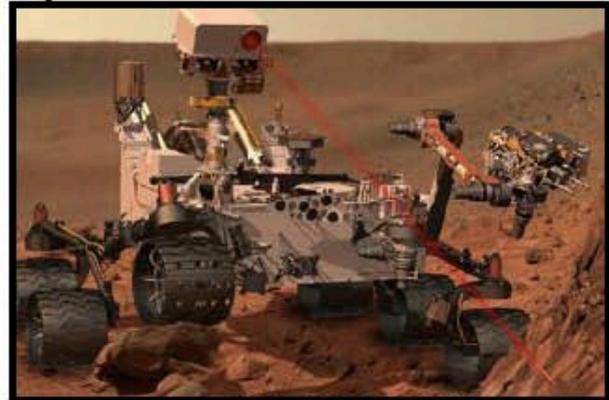
NASA/JPL-Caltech/LANL/CNES/IRAP/MSSS

ChemCam spectra of Coronation

Target: Coronation (N165)

Sol 13

Shots: 30





UC Lab Fees Research Program

2012 (cycle 2) Competition – Scope and Overview

Highlights from Cycle 1 (2009–2012)

UC Lab Fees Research Program

Net Fees Available: ~\$18M/yr (\$54M/3yr)

Proposal requests 2nd cycle:

- 490 proposals;
- \$520 M total ask; from \$120K – \$6M (for 3 years)

6 Content Panels

Panel allocation:

- | | |
|--|---------|
| ▶ Social Sci, Policy & Security Studies (25 apps): | \$1.4M |
| ▶ Biology, Biophysics & Bio-Engineering (94 apps): | \$8.7M |
| ▶ Earth, Environment & Energy (86 apps): | \$6.3M |
| ▶ Chemistry, Chem Eng & Materials (86 apps): | \$7.5M |
| ▶ Engineering, Computer & Computational Sci (100): | \$7.2M |
| ▶ Physics, Nuclear, Astronomy & Astrophys (99): | \$8.0M |
| ▶ Large Proposal/Portfolio Review Panel (>~\$500K/yr): | \$14.8M |

Competition Results

52 Proposals Awarded (10.6%)

\$53M in funding over 3 years (10.2%)

Awarded by Content Panel Area:

- ▶ Social Sci, Policy & Security Studies – 5 Proposals funded
 - ▶ Biology, Biophysics & Bio-Engineering – 9 Proposals funded
 - ▶ Earth, Environment & Energy – 8 Proposals funded
 - ▶ Chemistry, Chem Eng & Materials – 11 Proposals funded
 - ▶ Eng, Computer & Computational Sci – 10 Proposals funded
 - ▶ Physics, Nuclear, Astronomy & Astrophys – 9 Proposals funded
-
- ▶ **Los Alamos funded collaborator: 25.5 proposals (\$12.5M)**
 - ▶ **Livermore funded collaborator: 26.5 proposals (\$7.65M)**

Highlights from 2009– 2012 Award Cycle

Project: Berkeley Nuclear Research Center

\$3.77 M (3 years)

Partners with both LLNL and LANL

Graduate Student and PostDoc Training Opportunities

Emphasizes nuclear research and policy, non-proliferation and threat reduction

“With UC funding, The Center has created a pipeline of young people into the field of nuclear research; enabled joint positions for faculty to teach, conduct seminars, and mentor students both at the campus and in the lab; and develop national and international industry partnerships to pursue research projects and seminars.”

o PI: *Jasmina Vujic, Ph.D., Department of Nuclear Engineering, UC Berkeley.*
Project: Berkeley Nuclear Research Center

2010, PI awarded \$25M from NNSA to broaden pipeline!

External validation of LDRD research: “Excellent” to “Outstanding”

OUTSTANDING (5)

Work leads its technical field; outstanding ratio of results to investment; potential for revolutionary impact on Los Alamos Missions; results of project have spurred follow-on research.

GOOD (3)

Identifiable impact on mission or field; results mixed; success would have a distinct impact on Lab programs; identifiable early signs of external recognition

DEFICIENT (1)

Quality of research does not meet national and Laboratory standards; serious problems with project execution; anticipated minimal impact on Lab mission and science; minimal evidence of external recognition.

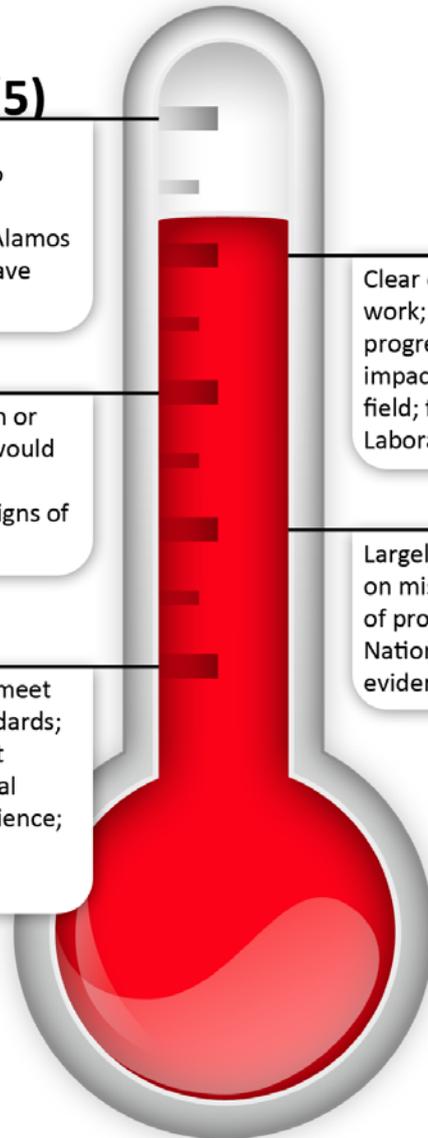
EXCELLENT (4)

Clear differentiation from previous work; team is making very good progress; potential for important impact on mission and technical field; follow-ons visible within Laboratory.

FAIR (2)

Largely incremental, marginal impact on mission or field; identifiable lack of progress; notional connections to National Security missions; minimal evidence of external recognition.

**Analysis of FY10
project appraisals
shows a mean rating
of 4.25**



LDRD dominates high-impact papers

Citations			
	CY07	CY08	CY09
LANL Citations	20550	13830	7075
LDRD Supported	7796	4756	2652
% due to LDRD	38%	34%	37%
Top 50 Most Highly Cited Publications			
LDRD Supported	50%	42%	44%

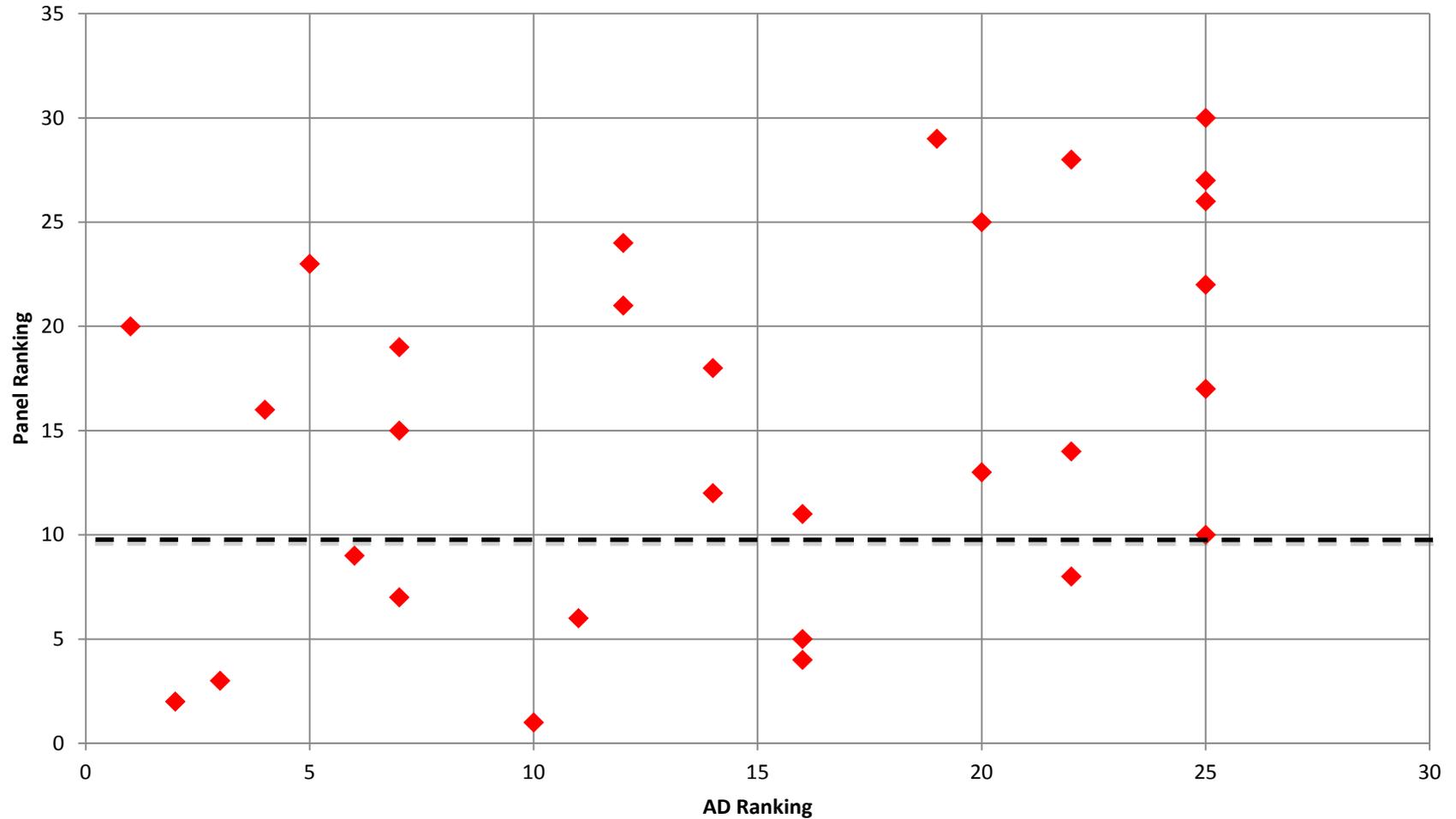
LDRD's Impact on Innovation

Patents				
	FY07	FY08	FY09	FY10
LANL Patents	49	28	52	56
LDRD Supported	22	8	12	12
% due to LDRD	45%	29%	23%	21%

Disclosures				
	FY07	FY08	FY09	FY10
LANL Disclosures	166	116	110	116
LDRD Supported	49	36	38	16
% due to LDRD	29%	31%	38%	21%

The Wisdom of the Market

Correlation with Endorsements



Research & the Future

$$x^2 - x - 1 = 0$$
$$x = \frac{1 + \sqrt{5}}{2} \approx 1.618$$
$$x = \frac{1 - \sqrt{5}}{2} \approx -0.618$$

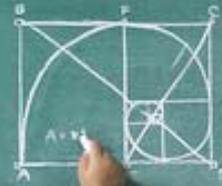
$$\phi = 1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \dots}}}}$$

$$\sqrt{1 + \sqrt{1 + \sqrt{1 + \sqrt{1 + \dots}}}}$$

$$x^2 - 1 = x$$
$$x^2 - x - 1 = 0$$

$$\frac{AD}{AB} = \frac{AE}{ED}$$

$$\frac{A+B}{A} = 1.618$$
$$\frac{A}{B} = 1.618$$



$$FE/ED = \phi$$

