

“Translational Research: The Nation’s Imperative”

The NEWRnet UNDERGRADUATE RESEARCHERS’ SYMPOSIUM

August 11, 2015

**Sidney A. McNairy, Jr. Ph.D., D.Sc., L.H.D.
Former Member: Senior Executive Service
Associate Director, NCRR and
Branch Chief, NIGMS,
National Institutes of Health, Bethesda, Md.
SIBOMCN@GMAIL.COM**

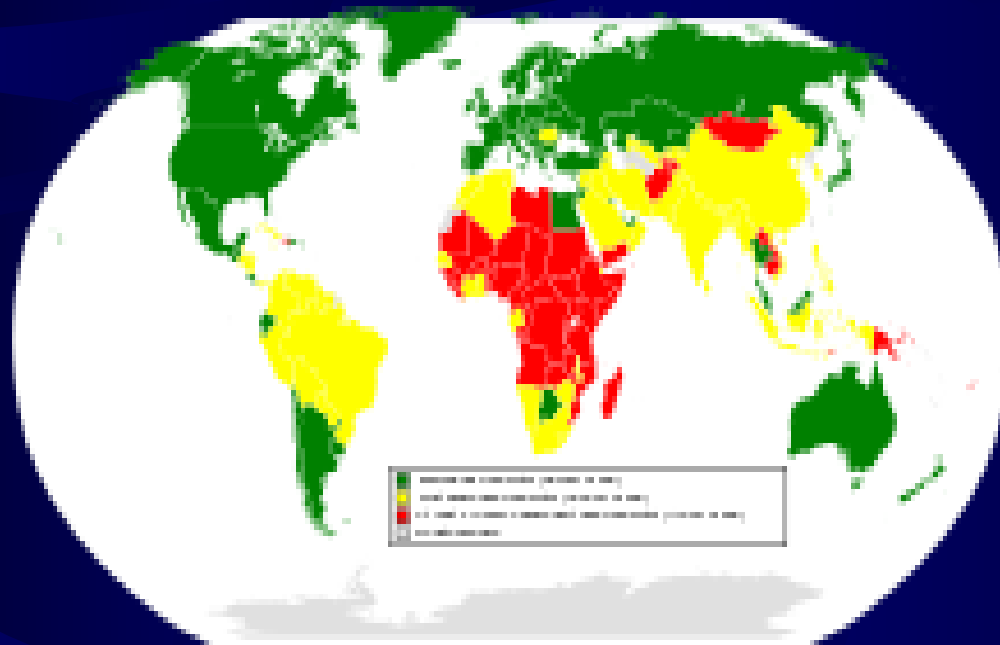
Why Be a Scientist

- Personal Satisfaction
 - Expert in Deduction Reasoning
 - Many-many career options
 - Community Respect
 - Able to Collaborate the world over
 - Be a mentor to young and old
 - Want to do some good in the world
 - Know more about your surrounds
 - Enjoy the challenge of experimenting
 - Make the world a better/secure place
-
- Why are you planning to be a scientist?

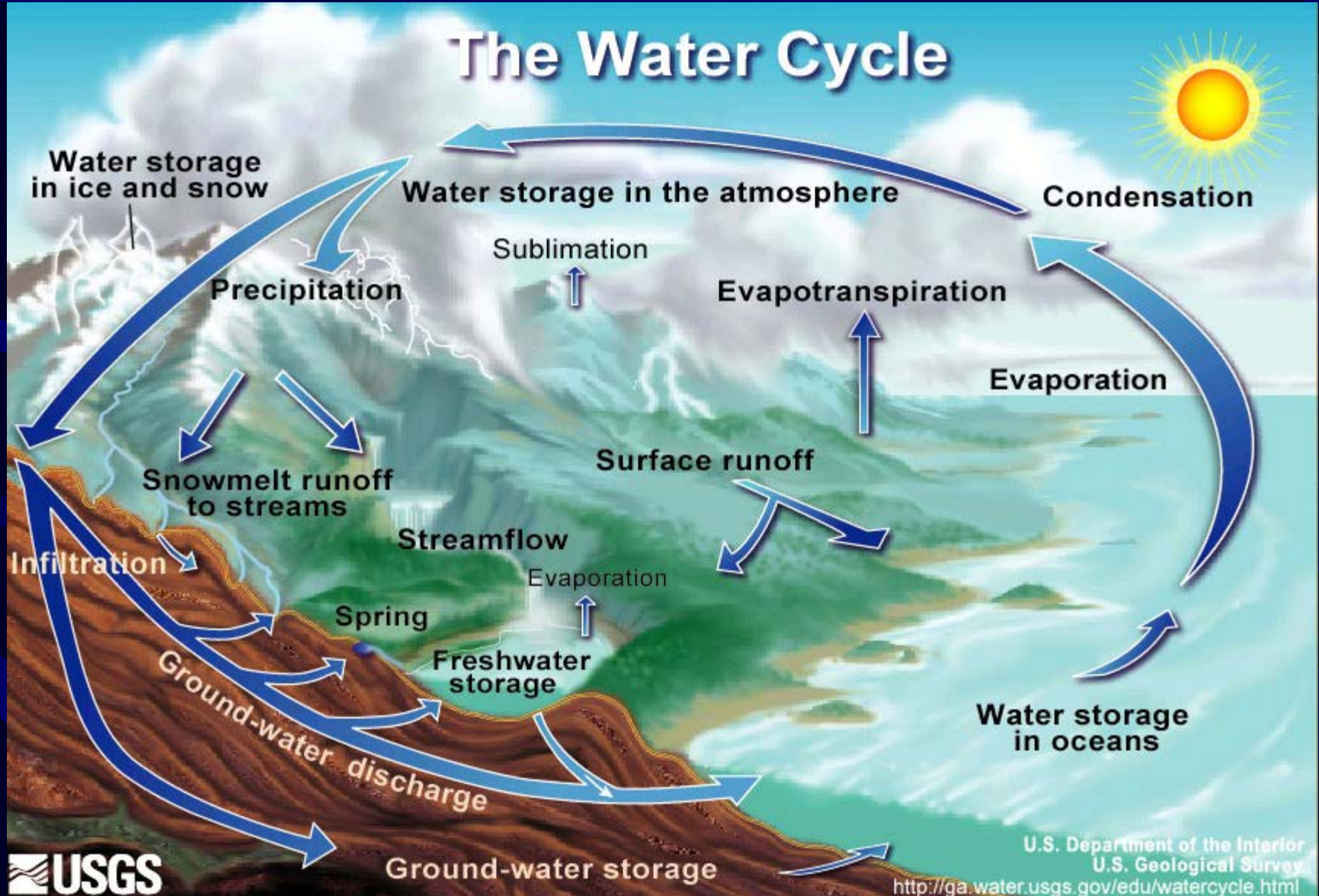
Water Purification Facility



Water availability: fraction of population using improved water sources by country

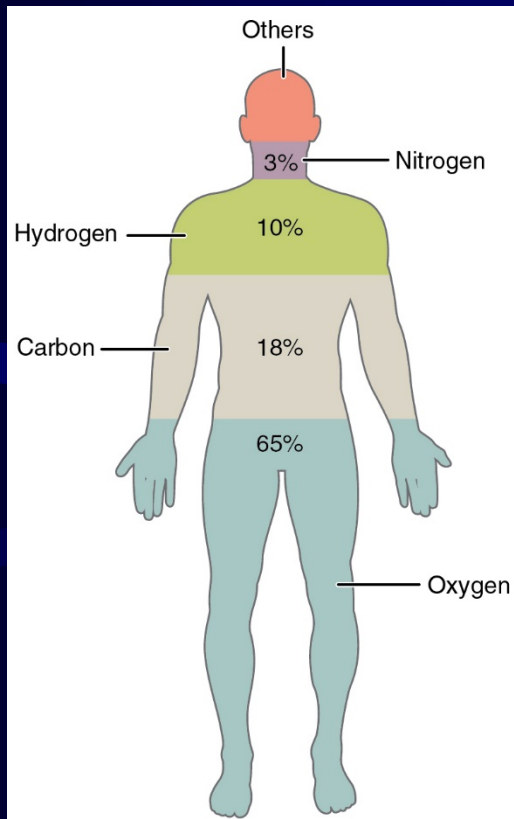


The Water Cycle



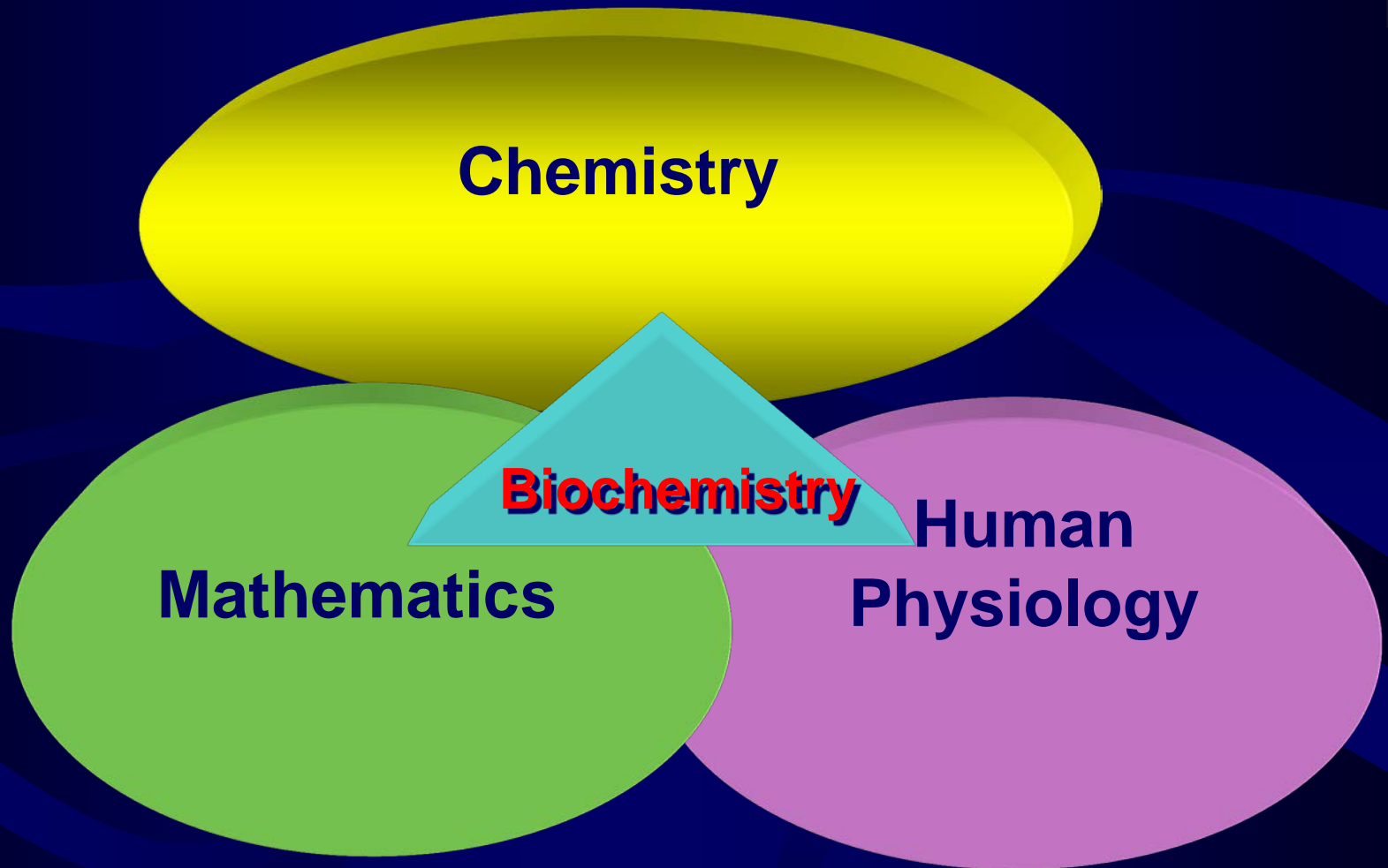
Water Composition of the Human Body

Parts Analyzed	Percent of Body	Water (%)
Skin	7.81	64.68
Skelton	14.84	31.81
Striated Muscle	31.56	79.52
Brain, Spinal Cord	2.52	73.33
Liver	3.41	71.46
Heart	0.69	73.69
Kidneys	0.51	79.47
Pancreas	0.16	73..08



Element	Symbol	Percentage in Body
Oxygen	O	65.0
Carbon	C	18.5
Hydrogen	H	9.5
Nitrogen	N	3.2
Calcium	Ca	1.5
Phosphorus	P	1.0
Potassium	K	0.4
Sulfur	S	0.3
Sodium	Na	0.2
Chlorine	Cl	0.2
Magnesium	Mg	0.1
Trace elements include boron (B), chromium (Cr), cobalt (Co), copper (Cu), fluorine (F), iodine (I), iron (Fe), manganese (Mn), molybdenum (Mo), selenium (Se), silicon (Si), tin (Sn), vanadium (V), and zinc (Zn).		less than 1.0

MY FORMAL TRAINING



What is Translational Research?



WHAT CREATED MY INTEREST IN TRANSLATIONATIONAL RESEARCH

1. SYNTHESIS OF QUINOLINE AND ISOQUINOLINES (ANTIBIOTICS)

2. ISOLATION OF TRITERPENOID GLYCOSIDES – ANTI CHOLESTEROL ADSORPTION AND ARROW HEAD POISONINGS

3. MARTIN LUTHER KING MARCH ON WASHINGTON 1963

4. GRAND ROUNDS LECTURE “BIOCHEMICAL BASIS OF SICKLE CELL DISEASE” - LSU/TULANE

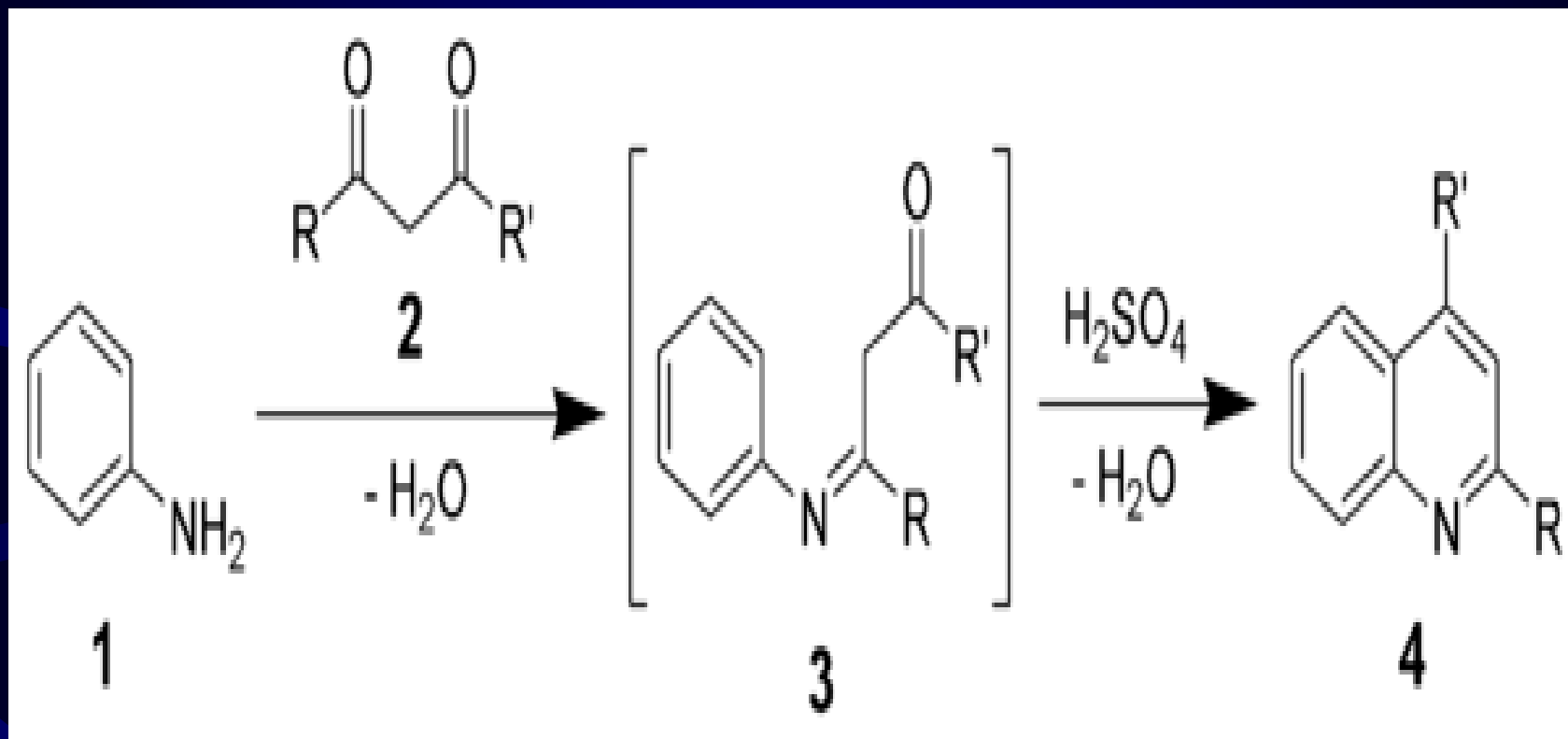
5. MEMBER OF AMERICAN HEART ASSOCIATION OF LOUISIANA – ASSESSMENT OF RISK FACTORS ASSOCIATED WITH PROGRESSION TO HEART DISEASE

6. DEVELOPMENT OF RADIOIMMUNOLOGICAL ASSAYS FOR PROINSULIN/INSULIN AND THYROXINE/TRIIODOTHYRONINE

7. SYNTHESIS OF RADIOLABELLED DETERGENTS AND EVALUATING THEIR BIODEGRADABILITY

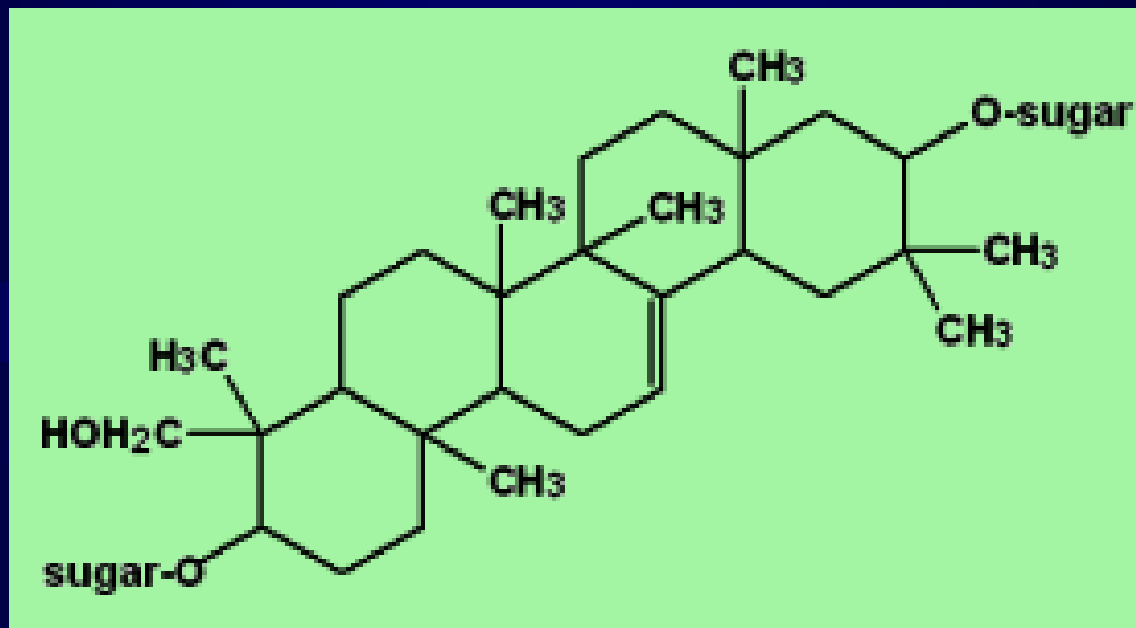
8. OVER THREE DECADE CAREER AT THE NATIONAL INSTITUTES OF HEALTH (MEMBER OF SENIOR EXECUTIVE SERVICES)

Quinoline Synthesis: condensation of unsubstituted anilines (1) with β -diketones (2) to form substituted quinolines (4) after an acid-catalyzed ring closure of an intermediate Schiff base (3). [1][2]

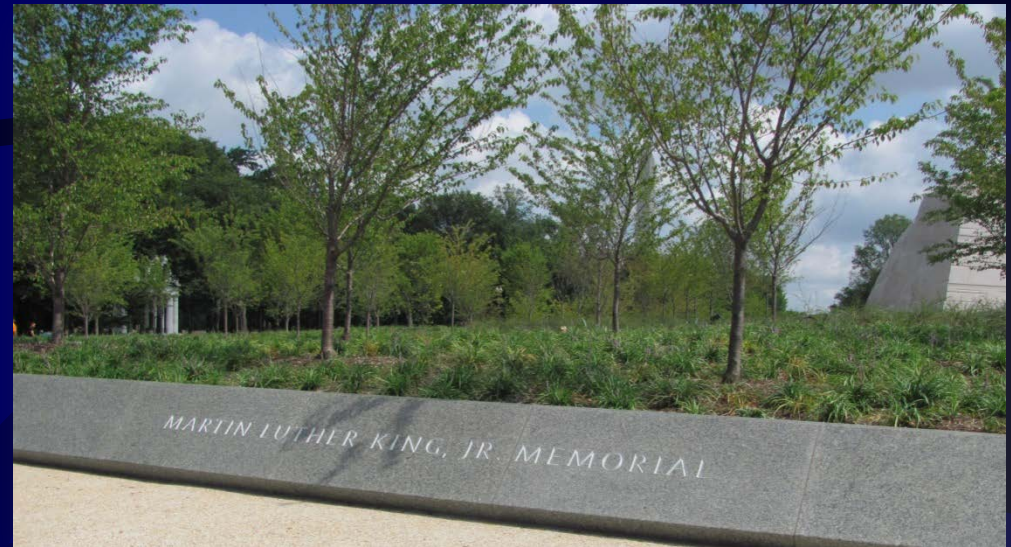


Liver tumors (adenomas and hepatomas) were observed in newborn CD-1 mice Exposed to quinoline via i.p. injection (LaVoie et al., 1987, 1988; Weyland et al. , 1993).

Saponins or Triterpinoid glycosides*



***During my graduate career at Purdue University my research focused on isolation, chemical and biological characterization of tri-Triterpinoid glycosides or saponins.**

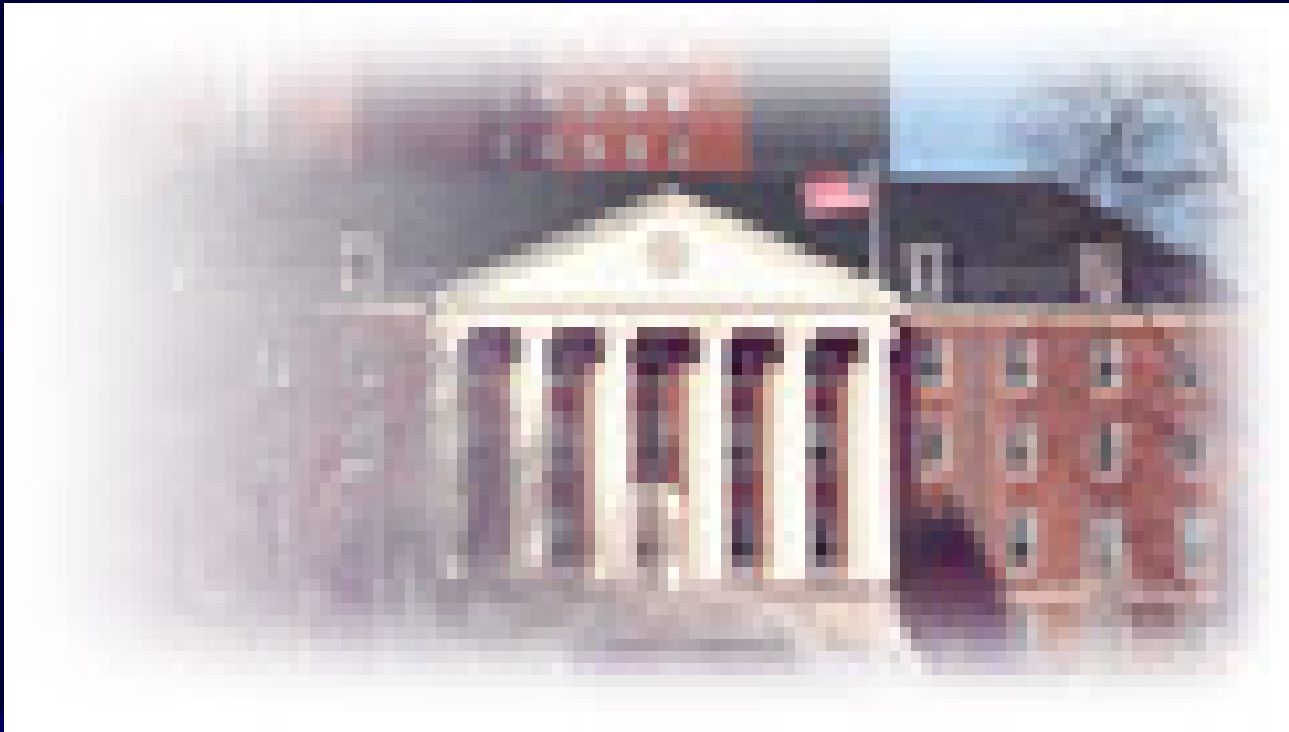


“The ultimate measure of a man is not where he stands in moments of comfort and convenience, but where he stands at times of challenge and controversy”

Dr. Martin Luther King, Jr.



**NIH Mission: Uncover new knowledge
that will lead to better health for everyone**
27 Institutes and Centers
More than \$30 Billion



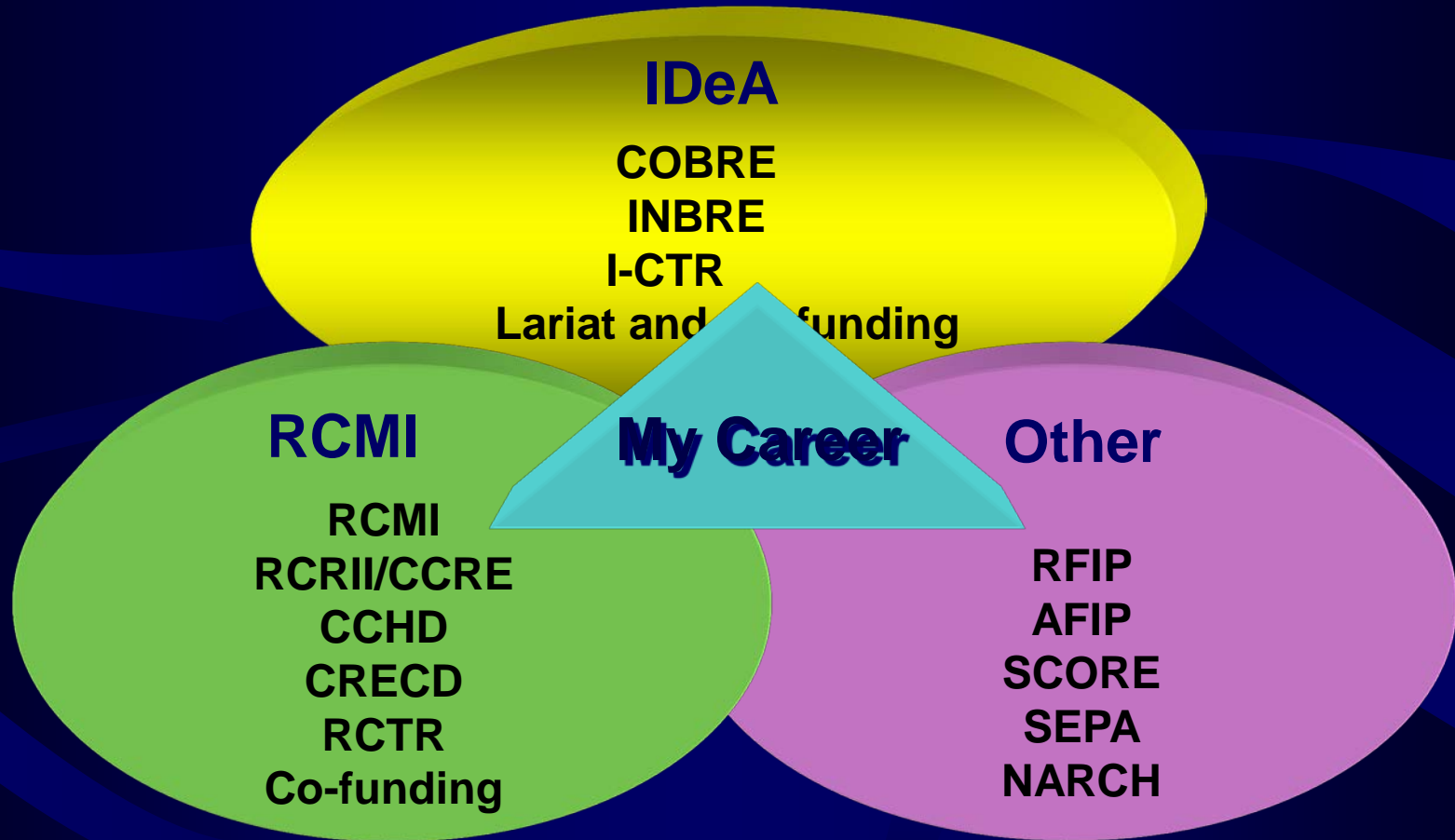
NIH MISSION

Uncover new **knowledge** that will lead to **better health for everyone**. NIH conducts research in its own laboratories; supports the research of non-Federal scientists in universities, medical schools, hospitals, and research institutions throughout the country and abroad; helps in the training of research investigators; and fosters communication of medical information.

It is one of **eight** health agencies of the Public Health Services which, in turn, is part of the U.S. Department of Health and Human Services. Comprised of **27** separate components, mainly Institutes and Centers, NIH has 75 buildings on more than 300 acres in Bethesda, MD. From a total of about **\$30 K** in 1887, the NIH budget has grown to more than **\$31 billion** in 2009. This was augmented with 10.3 billion via the ARRA supplement

PROGRAMATIC MANAGEMENT RESPONSIBILITIES AT THE NIH

Opportunities for Translational Research



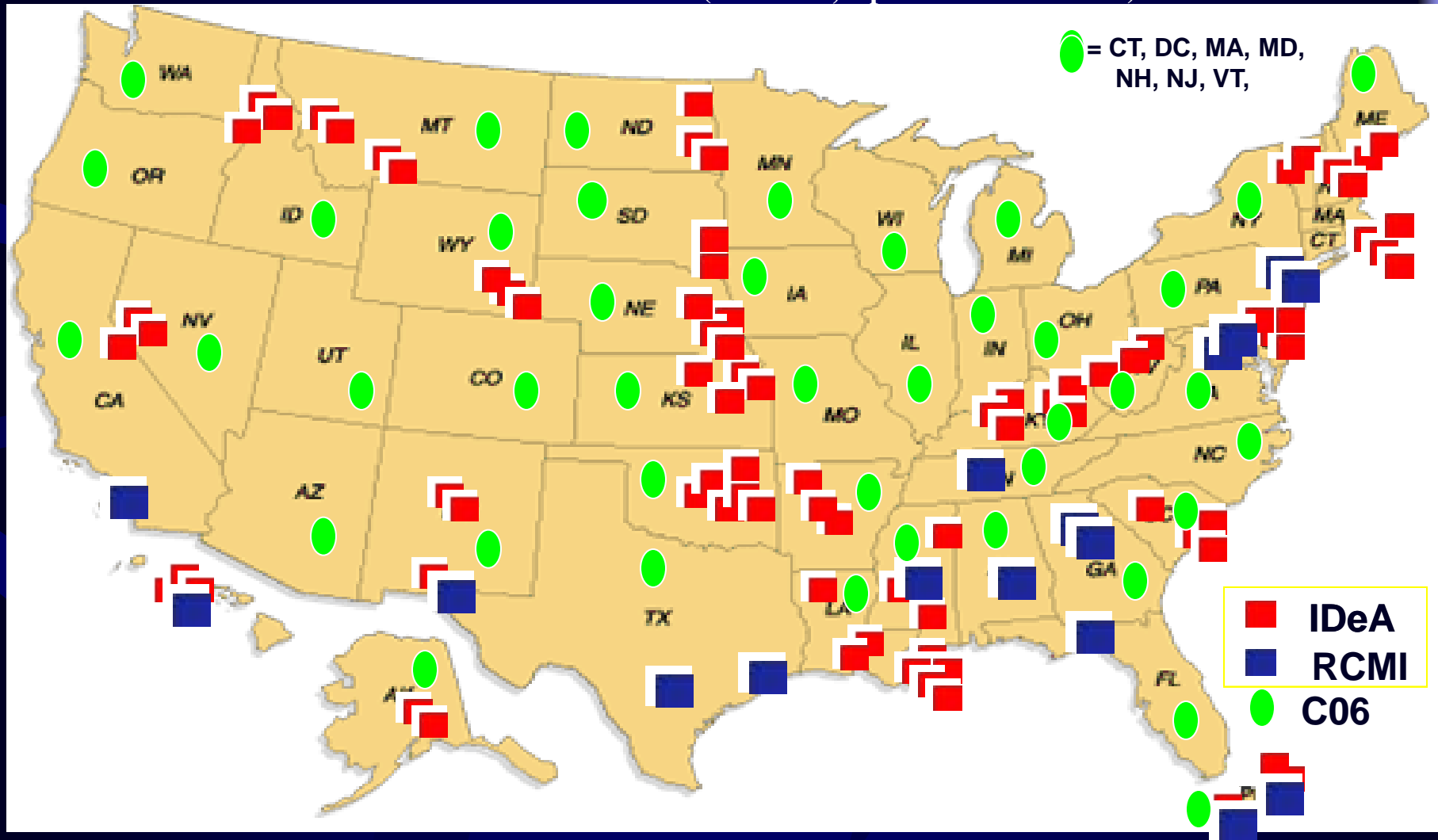
The Grantees

335 NCRR and 7 NIAID C06 awards

IdeA Program: INBRE- 23 statewide research networks; COBRE- 76 thematic research centers

RCMI- 18 sites including 5 clinical research centers;

IdeA + RCMI sites include 28 medical schools (8 GCRCs, 3 partner with CTSAs)



From Basic Discovery to Translation to Improve Patient Care

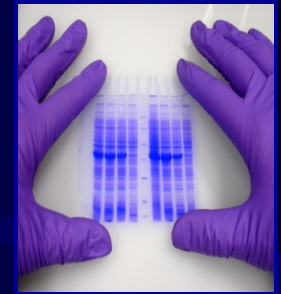
Effectiveness

Community
based Research



Basic Research

DNA → RNA → Protein



Community

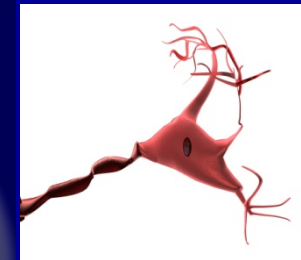
Efficacy



Clinical Trials

Clinical Research

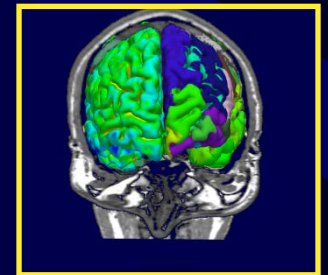
Improved patient
care



Pre-clinical



animal models





SOME SEMINAL EVENTS IN TRANSLATIONAL MEDICINE

Stem Cells 1998

- in 1998 James Thomson, a scientist at the University of Wisconsin in Madison, successfully removed cells from spare embryos at fertility clinics and grew them in the laboratory. He launched **stem cell research** into the limelight, establishing the **world's first human embryonic stem cell line** which still exists today.

Mapping of the human Genome in 2003 ushered in the “OMICS” era

Genomics
Proteomics
Glycomics
Metabolomics

Human Genome Project

- Completed in 2003, the Human Genome Project (HGP) was a 13-year project coordinated by the U.S. Department of Energy and the National Institutes of Health.
- During the early years of the HGP, the Wellcome Trust (U.K.) became a major partner; additional contributions came from Japan, France, Germany, China, and others.

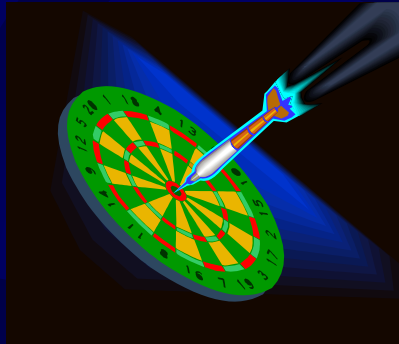
Nanomedicine

- *Protein-Protein Interactions.* Knowledge crucial for understanding the pathways and networks operating within and between cells
- *Intracellular Transport.* organize the cytoplasm, move organelles, orchestrate and implement the distribution of replicated chromosomes to daughter cells, and are the basic machinery of cellular migration.
- **2013 NOBEL PRIZE in Medicine** for understanding how hormones/enzymes enter and move around in cells!
- *Probing Biomolecular Events.* Often, measurements of molecular processes on a biologically relevant time scale are inadequate. For example, studies of second messenger signaling require harvesting tens of thousands of cells to measure significant changes of intracellular concentrations of relevant molecules.

21st Century Medicine



Predictive

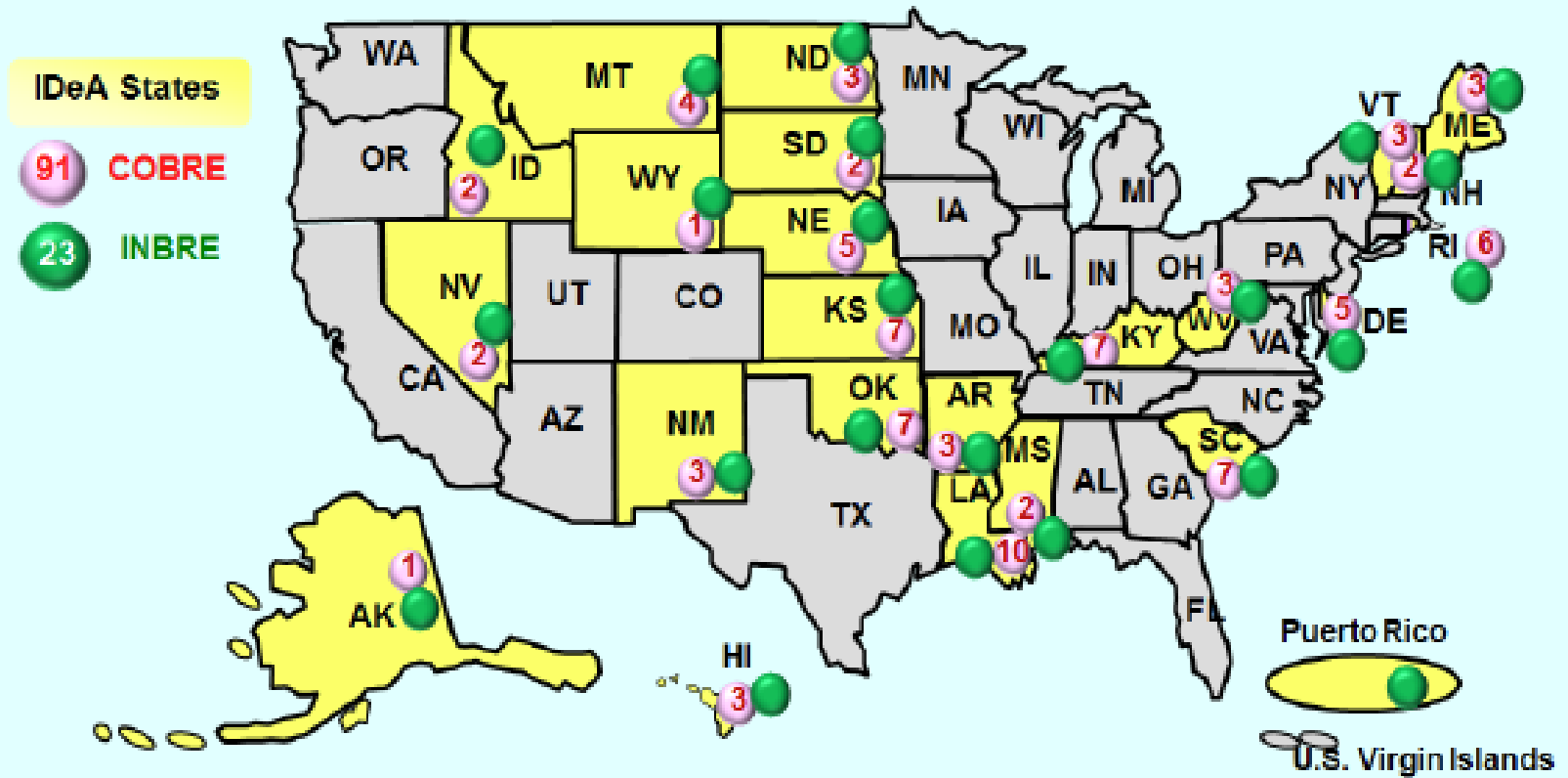


Personalized



Preemptive

Institutional Development Award (IDeA) Program



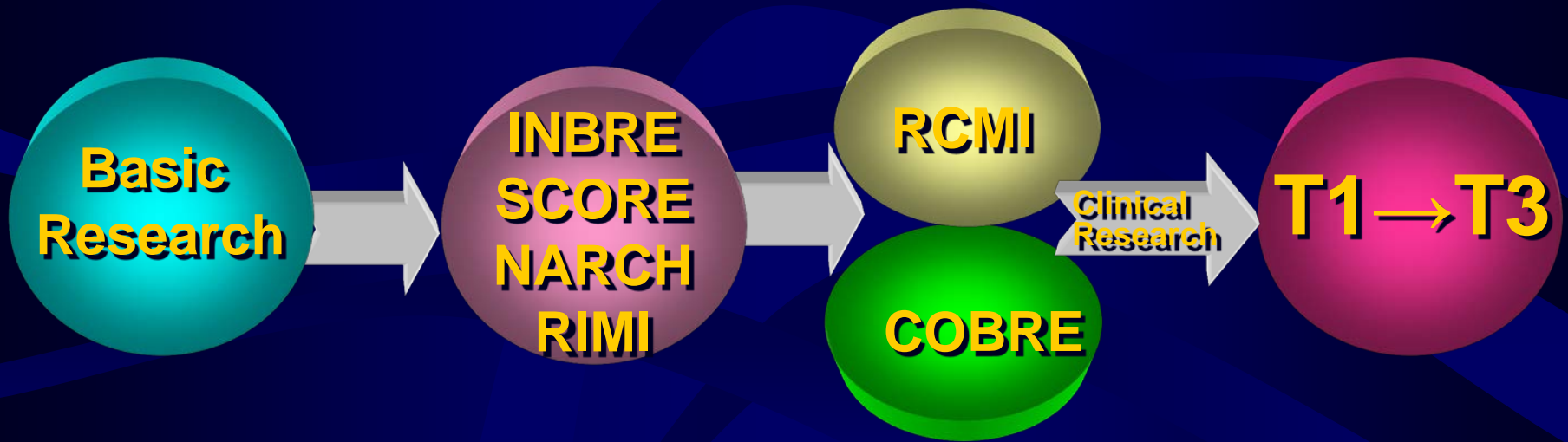
SOME WAYS TO ADDRESS HUMAN DISEASE

BASIC RESEARCH

CLINICAL RESEARCH

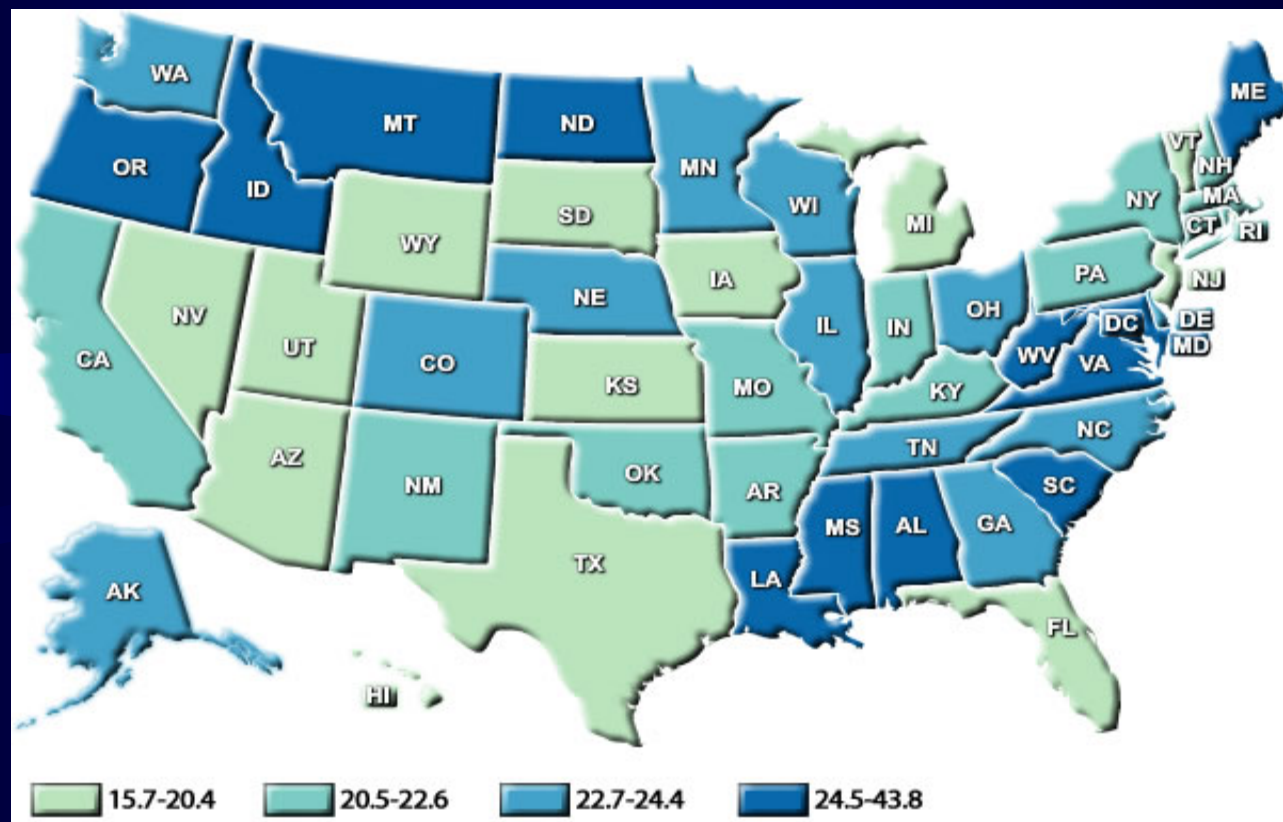
COMMUNITY ENGAGEMENT

The TRANSLATIONAL RESEARCH Paradigm: Programs that I Developed while at NIH



AMERICA'S HEALTH RANKINGS

Where you live, work, and play matters



<http://www.americashealthrankings.org/Downloads.aspx>

Ten Leading Causes of Death USA

10 LEADING CAUSES OF DEATH 2009

	USA		
1	Diseases of heart (heart disease)		
2	Malignant neoplasms (cancer)		
3	Chronic lower respiratory diseases		
4	Cerebrovascular diseases (stroke)		
5	Accidents (unintentional injuries)		
6	Alzheimer's disease		
7	Diabetes mellitus (diabetes)		
8	Influenza and pneumonia		
9	Nephritis, nephrotic syndrome and nephrosis (kidney disease)		
10	Intentional self-harm (suicide)		

Suroce: National Vital Reports Volume 60, Number 3, December 29, 2011. USDHHS, Center for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System.

Some Current Health Trends

- In the past year, the prevalence of smoking decreased significantly
- In the past year, the prevalence of obesity increased slightly
- In the past year, immunization coverage among adolescents increased

America's Health Rankings

STATE	OVERALL	DIABETES	SMOKING	OBESITY	CANCER*
LOUISIANA	48	48	46	50	219.2
MISS.	50	49	44	49	219.9
ARKANSAS	49	41	48	48	216.4
DELAWARE	35	11	29	31	195.0
RHODE I.	15	9.3	17	27	189.9
NEW HAMP.	5	22	11	22	180.0
HAWAII	1	7	3	3	156.2
VERMONT	2	4	9	5	192.3

* DEATHS PER 100,000

The Prevention Imperative: Protecting the Health and Well- Being of America's Families

- <http://www.americashealthrankings.org/Downloads.aspx>

The Big Three Threats

OBESITY

CHRONIC DISEASE

SMOKING

Obesity: The Biggest Threat to Our Health

1990-2011

- Obesity is one of the fastest growing health issues in our nation
- Obesity contributes to variety of diseases
 - Heart disease
 - Diabetes
 - General poor health
- 27.5% of Americans are obese compared to almost 11.6% in 1990
- This is the first year where no state has under 20% obesity
- If current trends continue, 43% of the population will be considered obese by 2018*

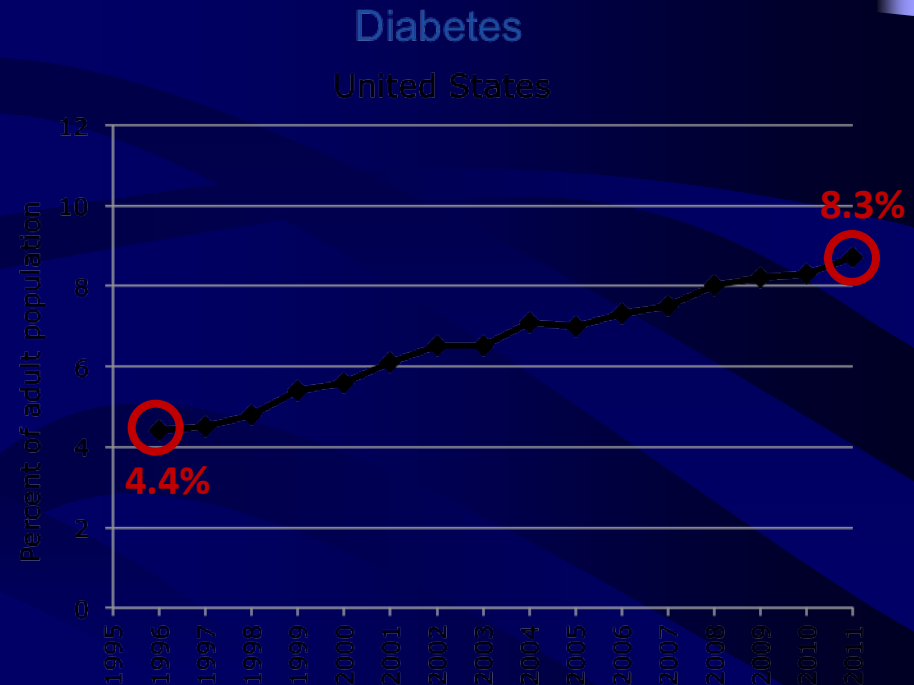


*Source: *The Future Costs of Obesity*; Dr.
Kenneth E. Thorpe

Chronic Disease: Growing Obstacle to Health

1995-2011

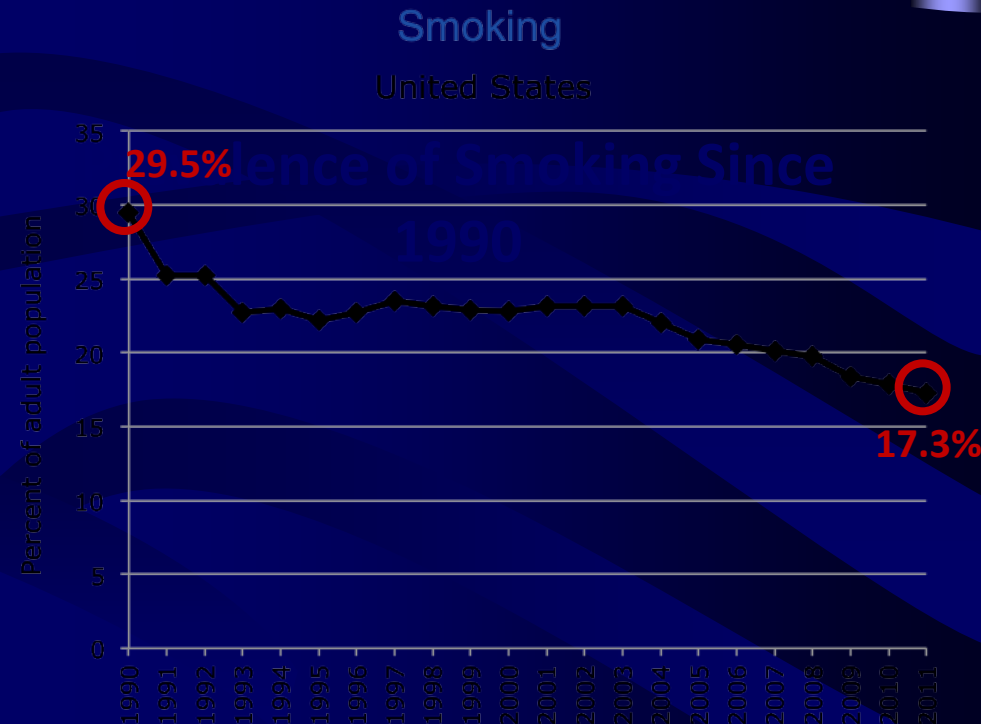
- Health not only means living longer but living healthier and without the presence of disease.
 - Diabetes is one major chronic disease that increasingly is getting in the way of our healthiness.
- Diabetes continues to increase, now at 8.7% of the adult population.
 - It was 4.4% of the adult population in the 1996 and 8.3% of the adult population in 2010.
- According to a report published in 2010, the U.S. was set to spend \$208 billion on diabetes and pre-diabetes in 2011.
 - If we don't turn this around, we will spend \$500 billion in 2020



Source: *The United States of Diabetes*,
UnitedHealth Group

Smoking in USA: A Tough Habit to Kick 1990-2011

- Smoking has been the biggest health battle of the past 40+ years
- Over the past year, the prevalence of smoking decreased from 17.9% to 17.3%
 - The lowest in 22 years
- Adverse impact on overall health
 - Respiratory diseases
 - Heart disease
 - Stroke
 - Cancer
- Despite improvements, more than 1 in 6 people smoke



The Full 50: This Year's Rankings

Rank	State
1	Vermont
2	New Hampshire
3	Connecticut
4	Hawaii
5	Massachusetts
6	Minnesota
7	Utah
8	Maine
9	Colorado
10	Rhode Island
11	New Jersey
12	North Dakota
13	Wisconsin
14	Oregon
15	Washington
16	Nebraska
17	Iowa

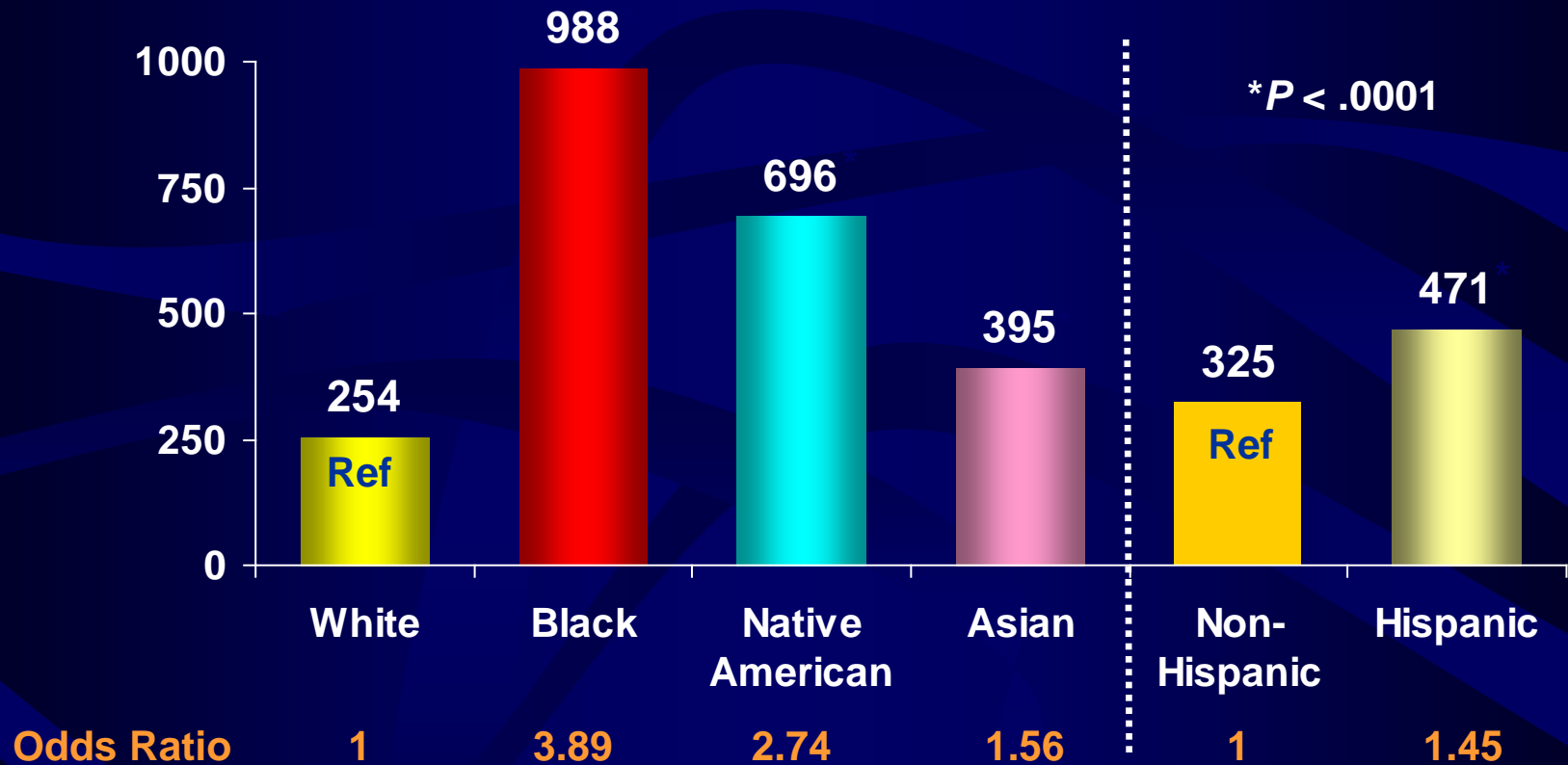
Rank	State
18	New York
19	Idaho
20	Virginia
21	Wyoming
22	Maryland
23	South Dakota
24	California
25	Montana
26	Kansas
26	Pennsylvania
28	Illinois
29	Arizona
30	Delaware
30	Michigan
32	North Carolina
33	Florida
34	New Mexico

Rank	State
35	Alaska
36	Ohio
37	Georgia
38	Indiana
39	Tennessee
40	Missouri
41	West Virginia
42	Nevada
43	Kentucky
44	Texas
45	South Carolina
46	Alabama
47	Arkansas
48	Oklahoma
49	Louisiana
50	Mississippi

End Stage Renal Disease

- In 1997, the incidence rates were 218 per million population in Caucasians, as compared to 586 in Native Americans and Alaska Natives, and 873 in African Americans.
- The leading cause of ESRD is type 2 diabetes.

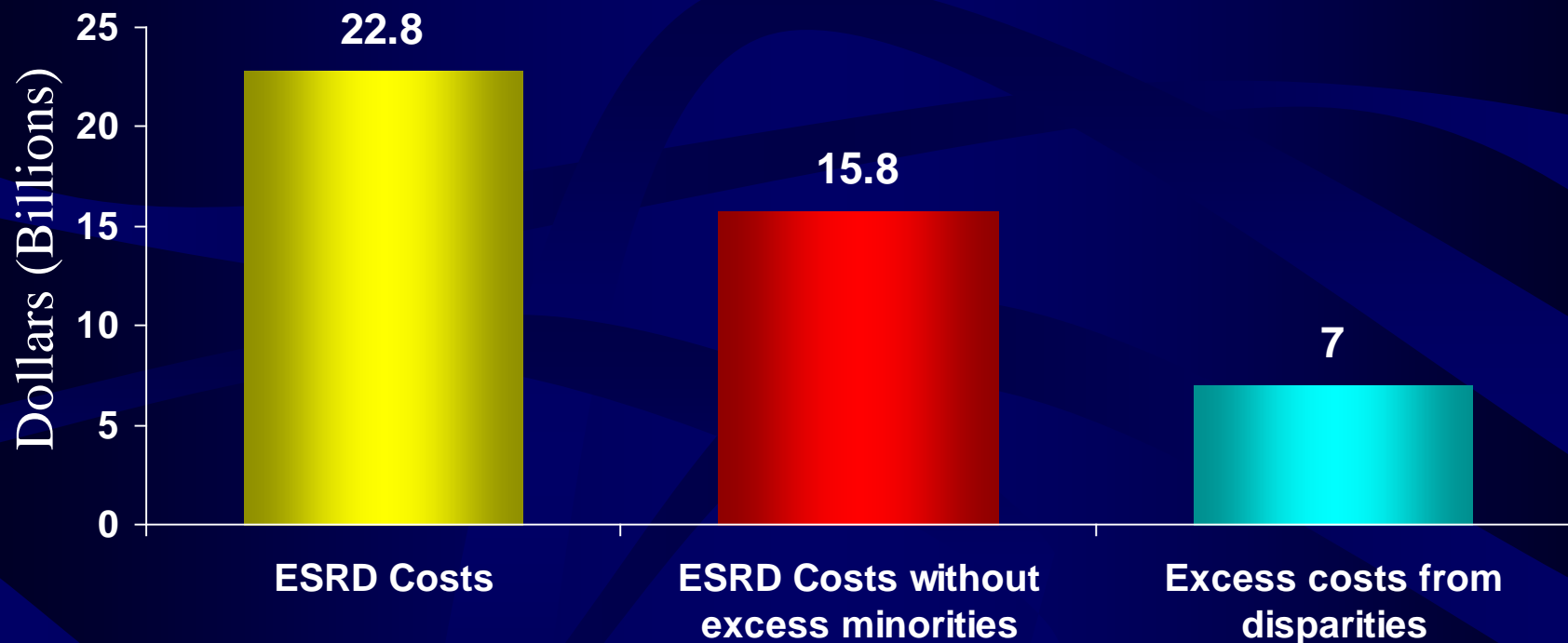
ESRD Incidence Rate per Million By Race/Ethnicity (2001)



USRDS. Annual Data Report. 2003; adjusted for age and gender.

Annual Fiscal Impact of Racial/Ethnic Disparities in ESRD

Gross Estimate of ESRD Cost in 2001 Due to “Excess” Minority ESRD Population



USRDS. Annual Data Report. 2003; adjusted for age and gender. Estimated excess costs if minority ESRD point prevalence rate= White ESRD point prevalence rate based on 2001 point prevalence counts and adjusted point prevalence rates (not adjusted for estimated changes in transplant and other ESRD specific costs)

Cancer continues to be the
leading cause of death in the U.S.
Only a slight decline in cancer
deaths in the last 20 years

CDC estimates that if tobacco use, poor diet and physical activity were eliminated, 40 % of cancers would be eliminated

2013 Estimated US Cancer Cases*

Men
854,790

Women
805,500

Prostate 28%

Lung & bronchus 14%

Colon & rectum 9%

Urinary bladder 7%

Non-Hodgkin lymphoma 6%

Melanoma of skin 5%

Kidney & renal pelvis 5%

Oral cavity 3%

Leukemia 3%

Pancreas 3%



29% **Breast**

14% **Lung & bronchus**

9% **Colon & rectum**

6% **Uterine corpus**

4% **Thyroid**

4% **Non-Hodgkin lymphoma**

4% **Thyroid**

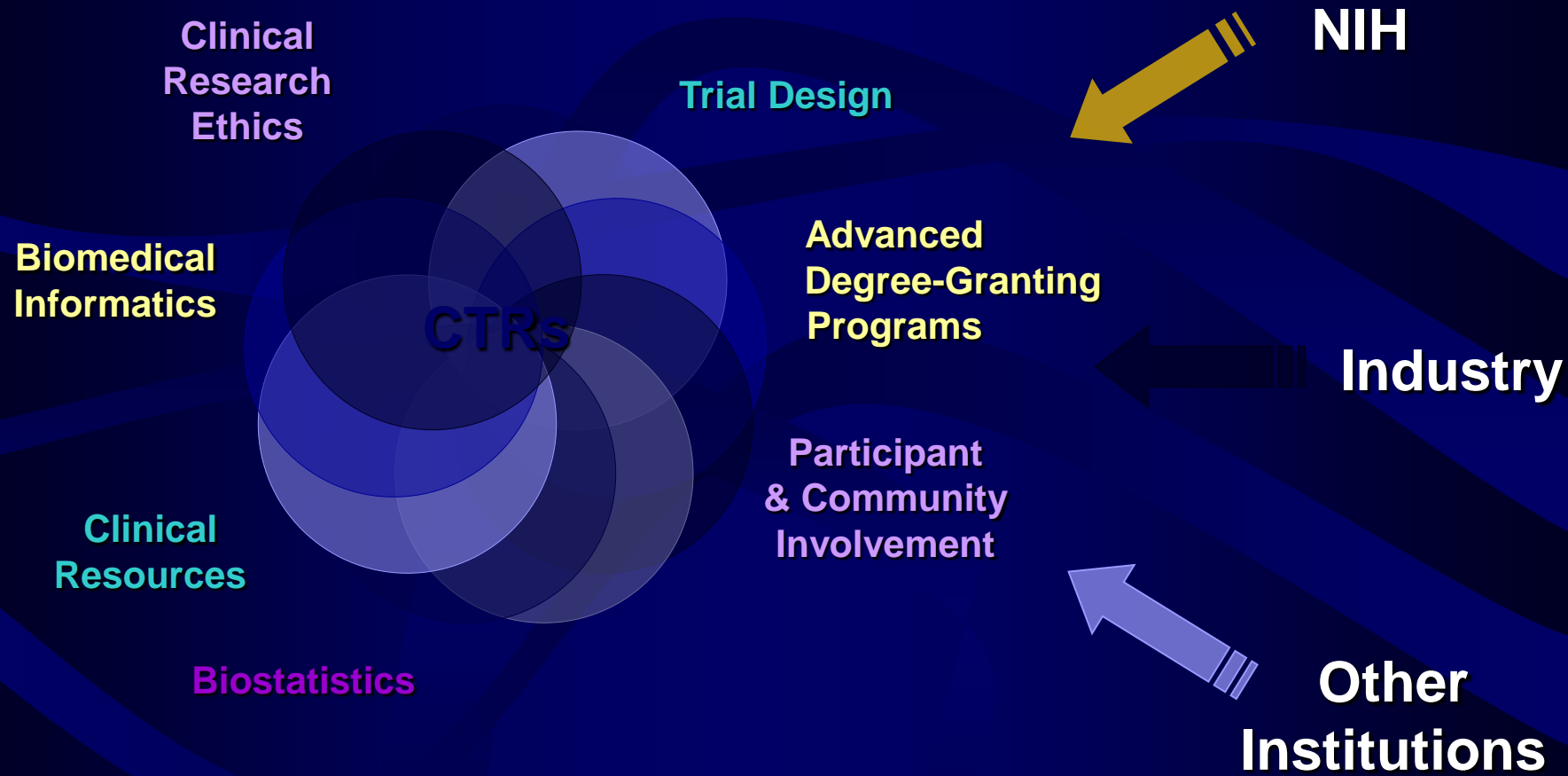
4% **Melanoma of skin**

3% **Ovary**

3% **Kidney & renal pelvis**

*Excludes basal and squamous cell skin cancers and in situ carcinomas except urinary bladder.

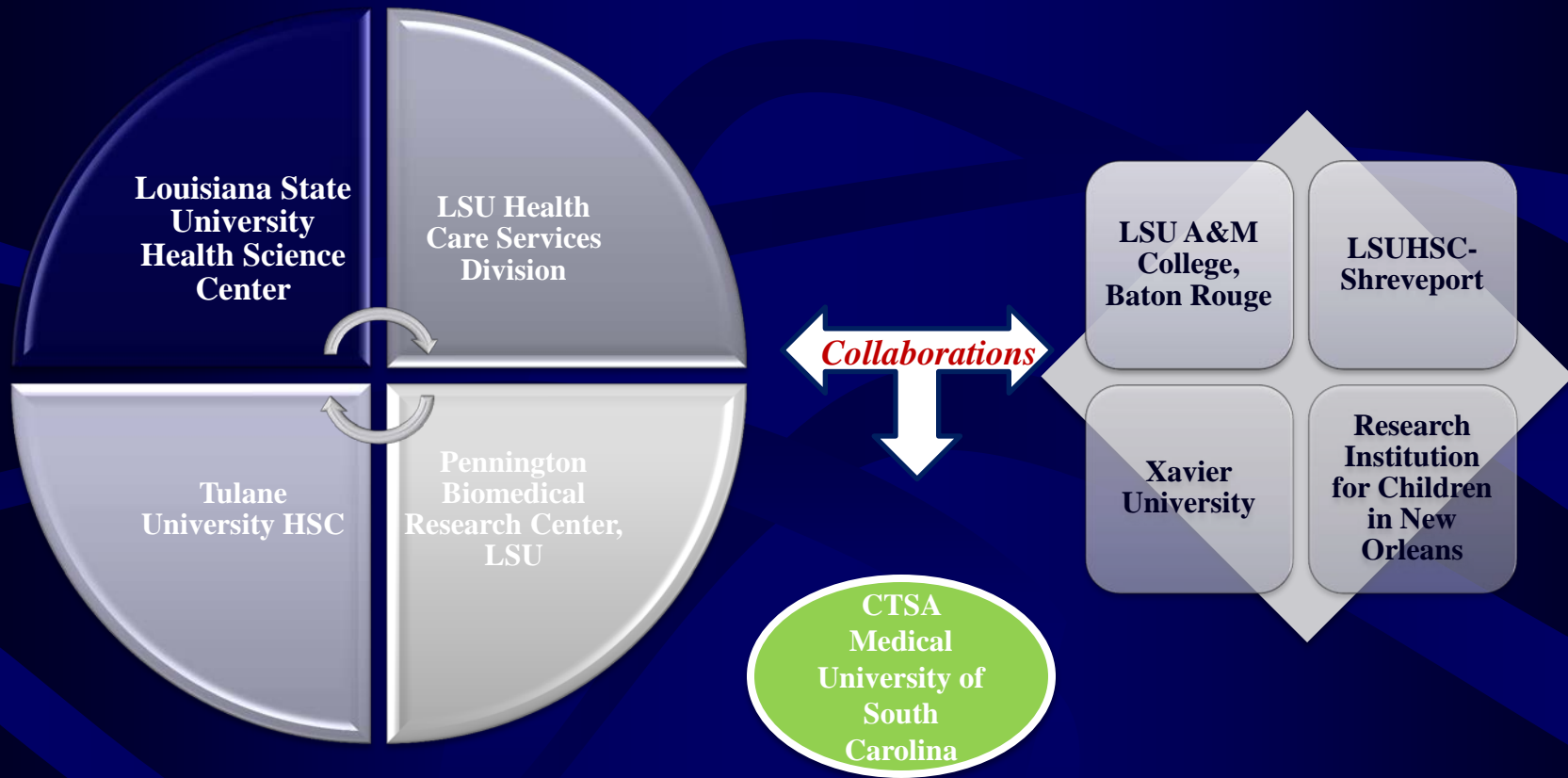
IDeA Awards: A Home for Clinical and Translational Science



Louisiana IDeA CTR



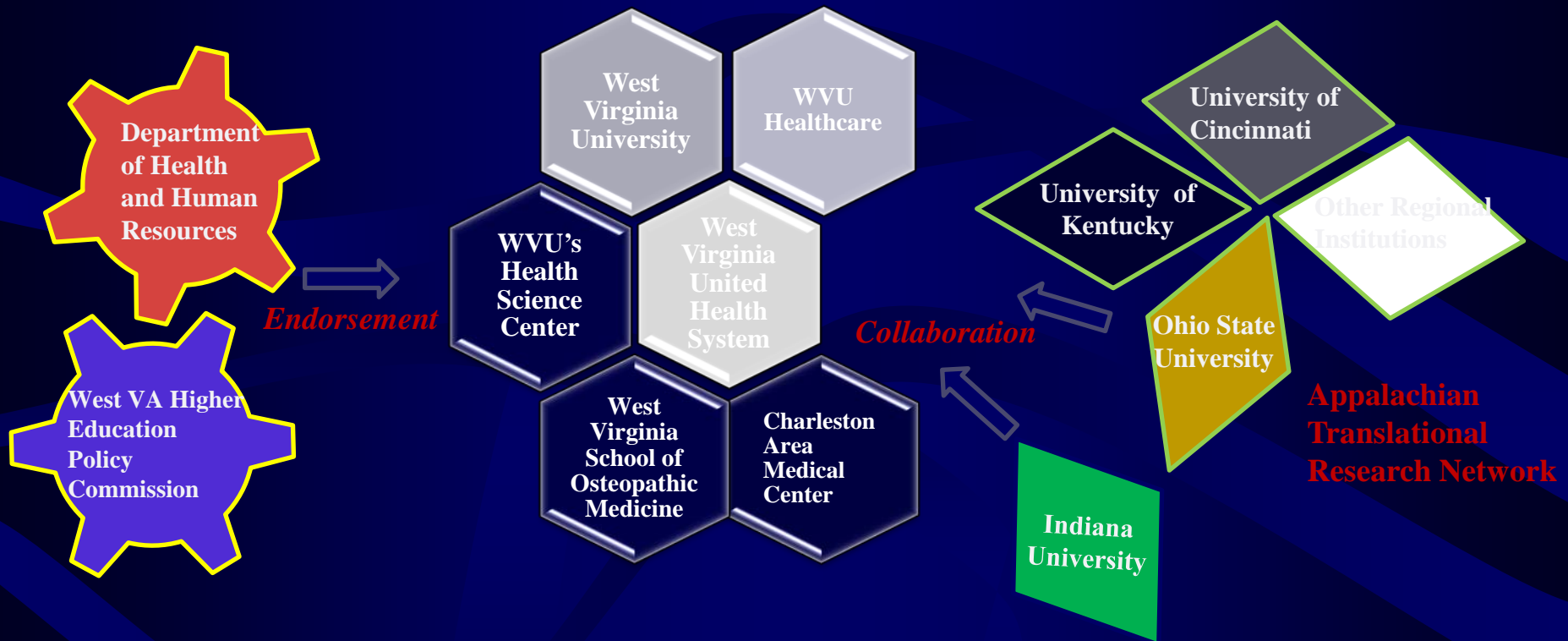
Louisiana Clinical and Translational Science Center (LA CaTS)



West Virginia IDeA CTR



University of West Virginia Clinical and Translational Science Institute



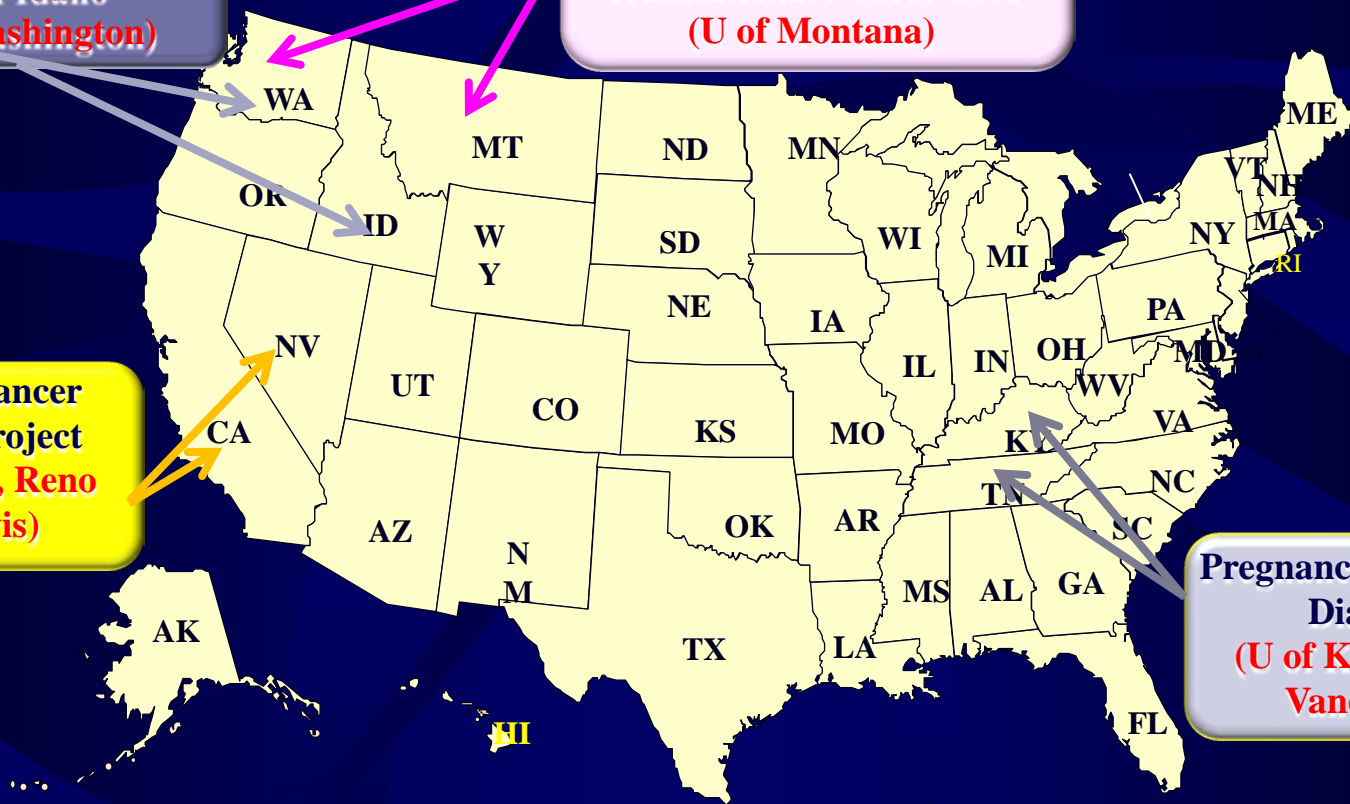
IDeA / CTSA Collaborations Supported by DRI/ARRA

Biosurveillance Project
(U of Idaho
U of Washington)

**Metabolomic
Immunotherapy for Q Fever**
(Montana State U)
Translational Neuro. Core
(U of Montana)

**Colorectal Cancer
Screening Project**
(U of Nevada , Reno
& UC Davis)

**Pregnancy outcome in
Diabetes**
(U of Kentucky &
Vanderbilt)



I challenge each of you as you go forth in pursuit of your life's dream - **to wonder how might future scientific discoveries such as the discovery of the Higgs boson or Higgs** particle on July 2012 or your knowledge of water quality impact the quality of life for people the world over.