Chaire d'innovation technologique
Lilianne Bettencourt

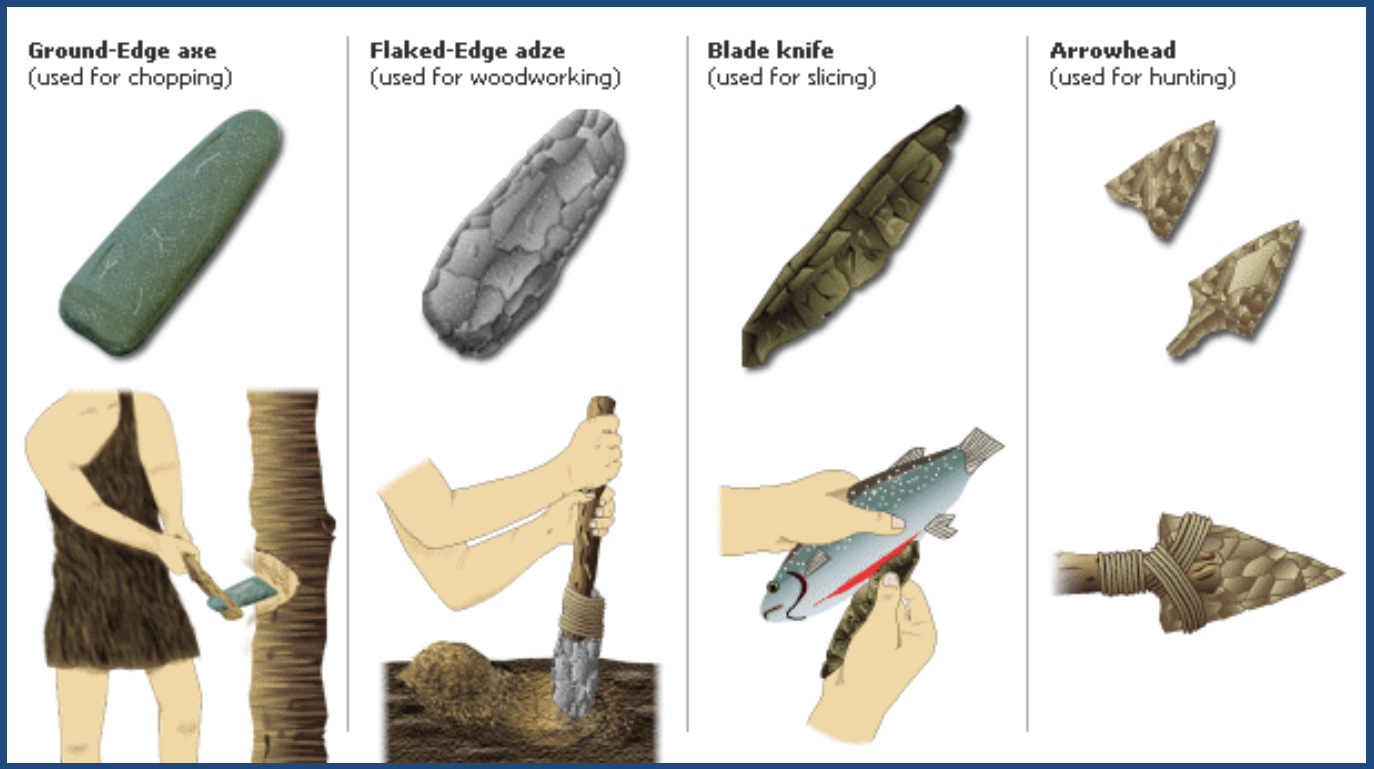
Peut-on gerer « scientifiquement » la science et l'innovation

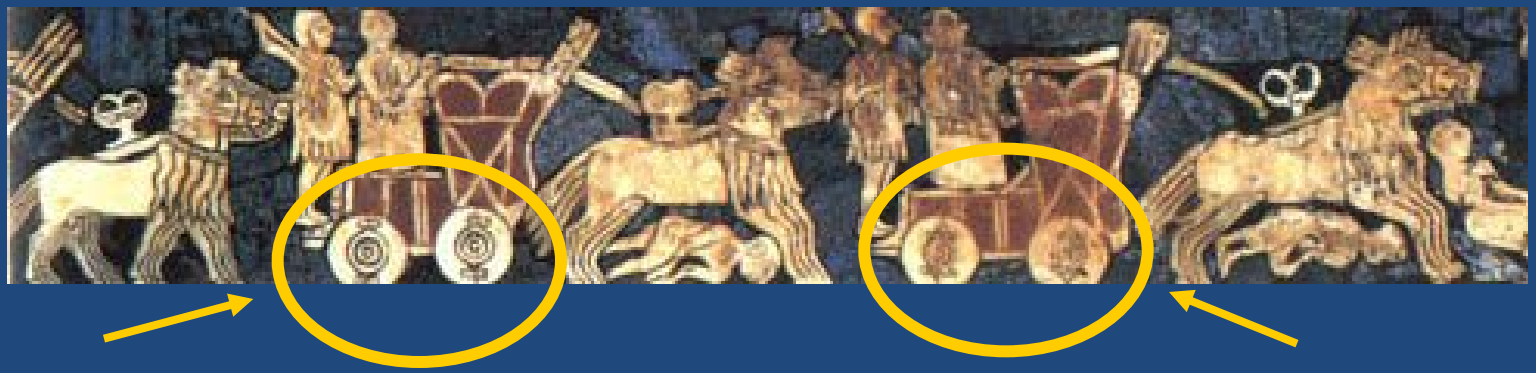
Elias Zerhouni

7 fevrier 2011

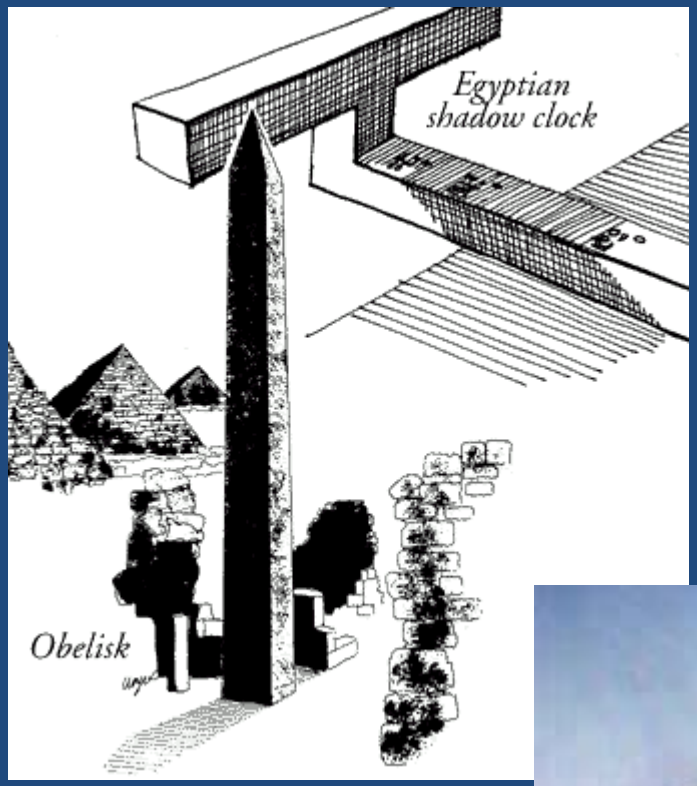
COLLÈGE DE FRANCE
1530

Natural History of Science & Technology

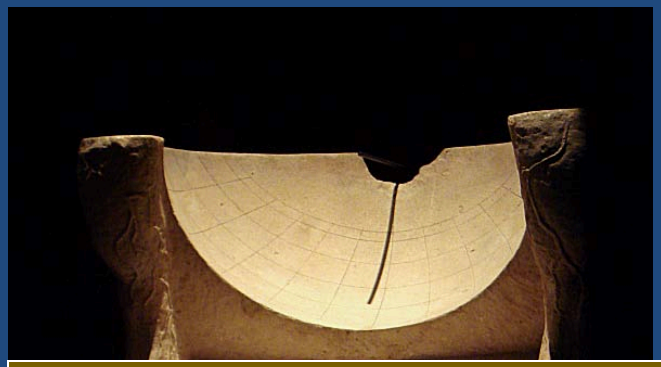




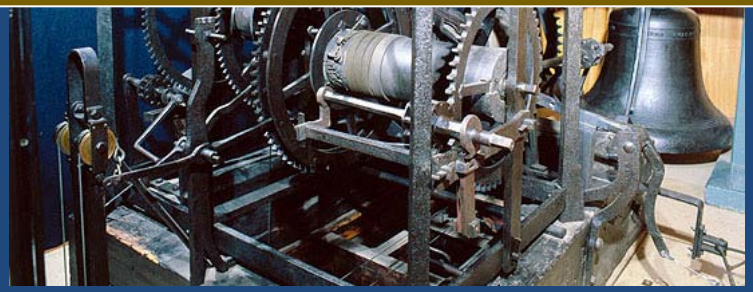
Quantifying the Passage of Time



Quantifying Time – Over Time

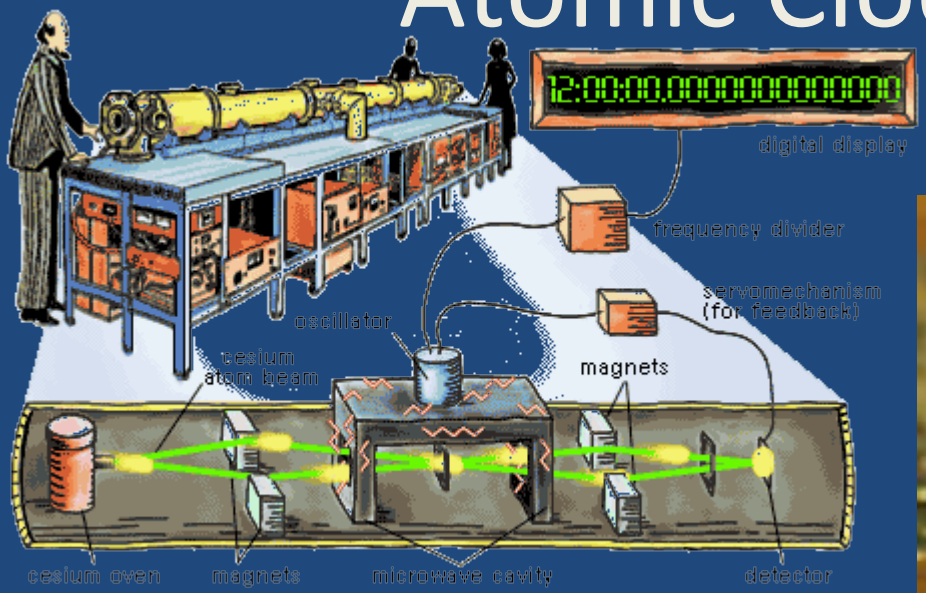


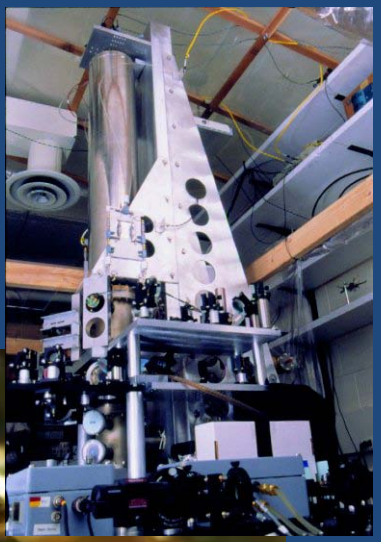
The History of Science Runs Parallel to Our Ability to Quantify and Measure

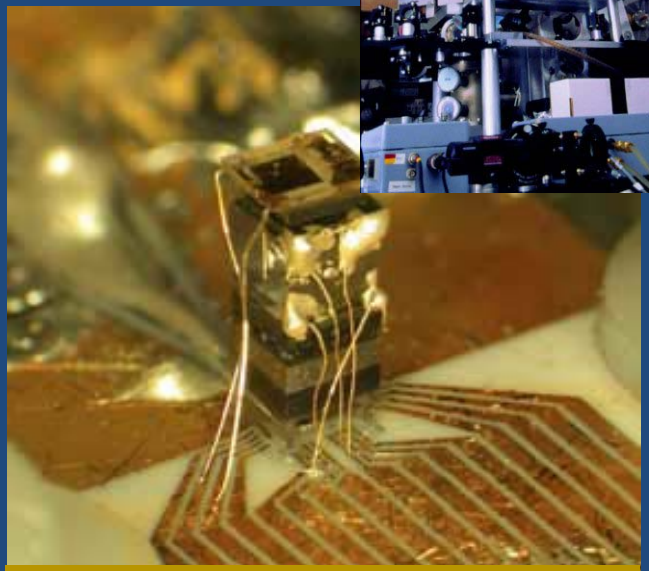


Turret Clock(14th c.)

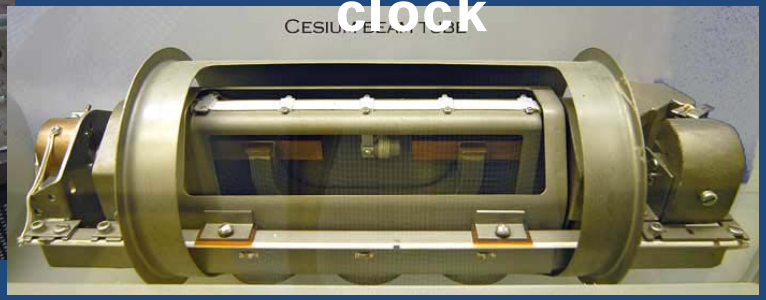
Atomic Clocks







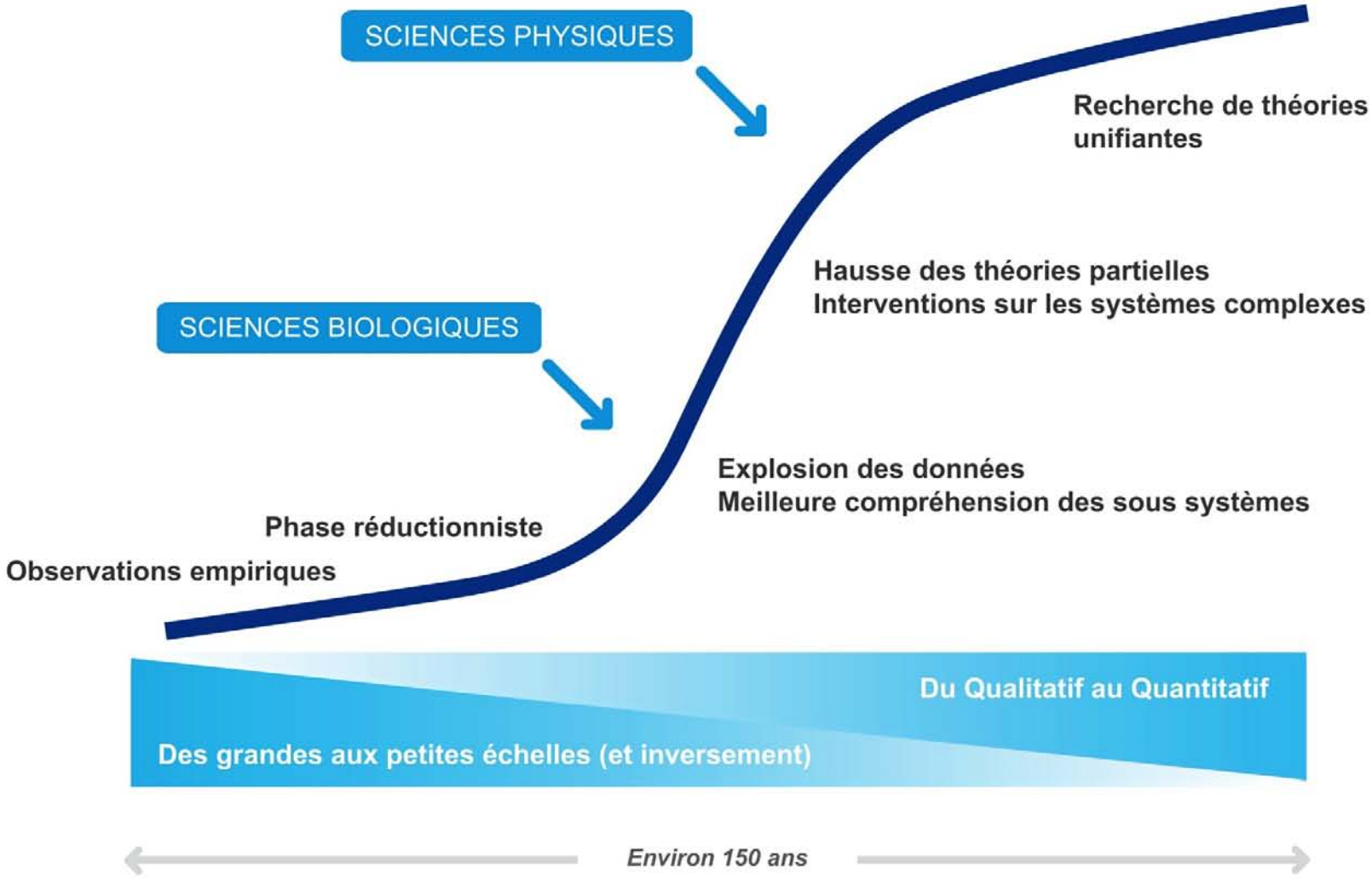
chip-scale atomic clock



Navstar Constellation:

UNE SYNTHESE POSSIBLE

LA COURBE EN S DES SCIENCES



Common Factors in Managing and Supporting Science and Technology

- An economic surplus dedicated to S&T
- A committed political leadership
- Mechanisms of education and selection of the most talented individuals
- Institutions dedicated to the advancement of S&T
- Not a single approach but common principles varying from centralized to decentralized systems

Institutional Models

- Government funded and operated
  - Government Laboratories (Military research)
- Government funded but delegated to semi autonomous self governing organizations
  - Academies of Sciences (China, Russia)
  - CNRS
  - Max Planck Society
- Government funded but not operated
  - NSF, ANR, DFG, UK research councils
- Mixed models
  - NIH is a hybrid
- Philanthropically endowed Institutions: Pasteur, Rockefeller , Carnegie, Advocacy funding….

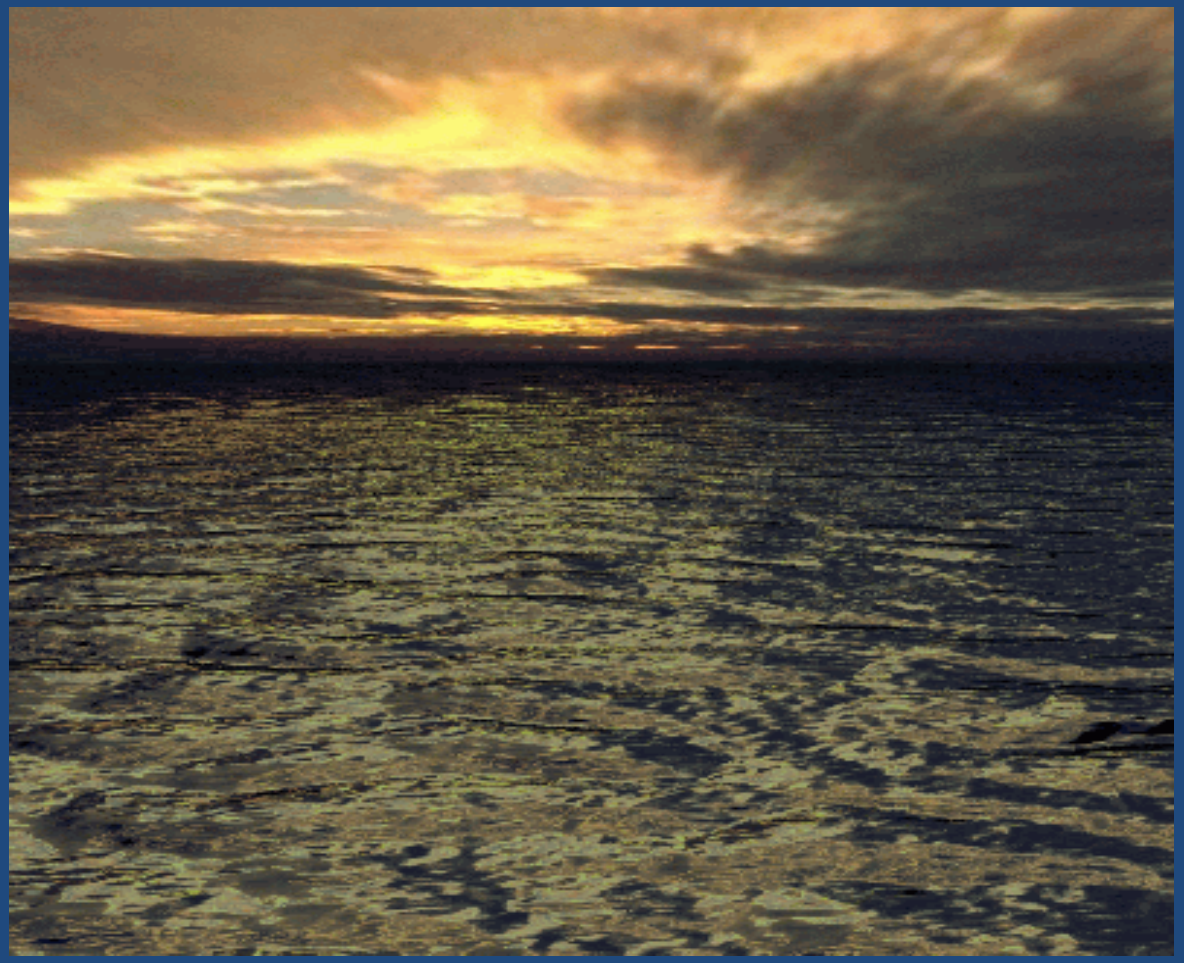
Two Fundamental approaches

- The Top Down method:
  - Experts and advocates advise funder
  - A strategy with priorities is formed
  - A program is created, fully funded and scientists are recruited as employees to accomplish a predetermined goal
- The Bottom Up method:
  - Proposals are initiated by the researchers
  - Funding mechanism and independent competitive review system
  - Grants for a limited period but renewable after review of progress

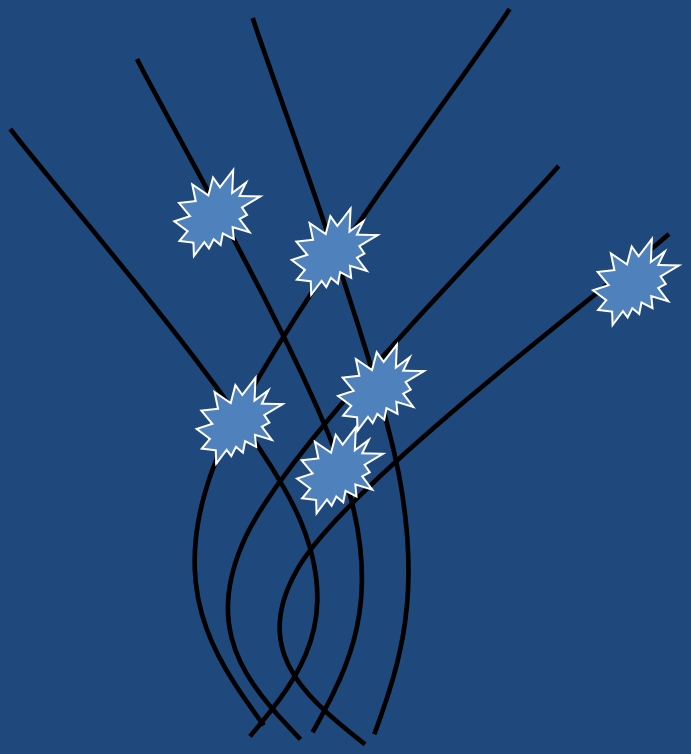
SO WHICH IS BEST??

- No simple answer
- Public funders expect results and prefer top down type of programs for political reasons but these tend to become obsolete and bureaucratic after a few years
- Science advances rapidly and a more flexible decentralized bottom up system is inherently more adaptive but not for large complex projects
- Most countries adopt a hybrid approach with different levels of top down and bottom up ratios (NIH 30/70- EU 90/10)

Exploring the Unknown:



At the frontiers of knowledge we are all ignorant



The “Titanic” Strategy!

Exploration Requires a Diversity of Strategies

Discoverers
Pioneers

Team explorers

Early settlers

La Science de la Science
“managing science”

« Les scientifiques sont fondamentalement des artistes qui utilisent la méthode scientifique mais sans que cette méthode ne s’applique à eux »

Il faut fournir in environnement propice mais comme on ne peut commander un chef d’œuvre a l’artiste on ne peut commander l’innovation au scientifique

Vannevar Bush
Resistance to New Knowledge

"... much of new knowledge is certain to arouse opposition because of its tendency to challenge current beliefs or practice."

20

- Aw
  Ho
  pre
  He
- "Th
  lor
  car
  inh

GASTROENTEROLOGICAL SOCIETY OF AUSTRALIA

145 Macquarie Street,
SYDNEY. 2000

Telephone 27 3288

17th March, 1983

Dear Dr. Marshall,

I regret that your research paper was not accepted for presentation on the programme of the Annual Scientific Meeting of the Gastroenterological Society of Australia to be held in Perth in May, 1983.

The number of abstracts we receive continues to increase and for this Meeting 67 were submitted and we were able to accept 56.

There were a large number of high quality abstracts which made it extremely difficult to choose those which should be accepted for presentation, and as you know, this is now done by a National Abstract Selection Committee which reviews the abstracts without knowledge of the Authors concerned.

The National Programme Committee would like to thank you for submitting your work, and would hope that this might be re-submitted in the future, perhaps following critical review from your colleagues.

My kindest regards,

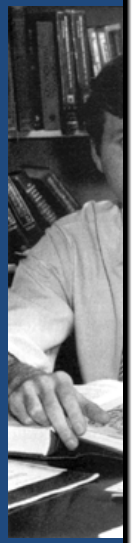
Yours sincerely,

for Terry D. Bolin,
Honorary Secretary.

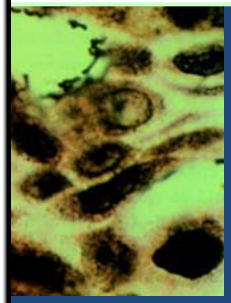
oyal Perth
lenged

disease"

e is no
ase that
retion



Photos: M

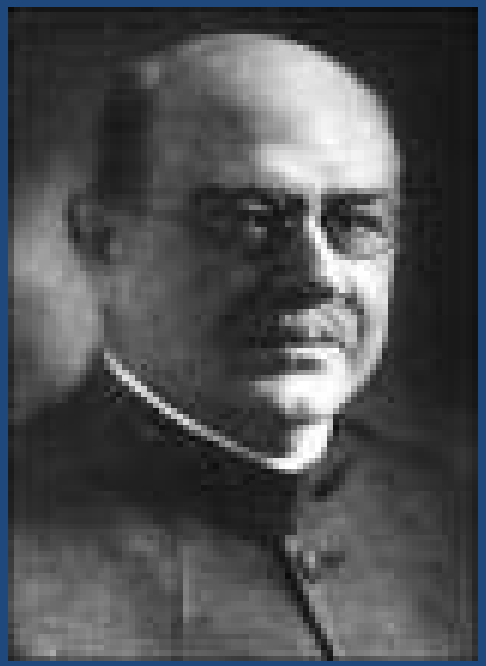


ll's gastric
r ingesting

NIH History

- 1887: Laboratory of Hygiene established; first Director, Dr. Joseph Kinyoun
- 1891: Hygiene Laboratory moved to Washington, D.C
- 1930: Ransdell Act changed name of Hygienic Laboratory to National Institute (singular) of Health (NIH)
- 1937: National Cancer Institute established with sponsorship by every U. S. Senator

History of International Science at NIH



Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world.

Joseph Kinyoun, MD
First Director of NIH

Louis Pasteur (1822 – 1895)

Elias A. Zerhouni,
M.D. Director, NIH

NIH: A Vision of Hope

" Scientific progress is one essential key to our security as a nation, to our better health, to more jobs, to higher standard of living, and to our cultural progress."

***Science, The Endless Frontier*….**
(1945)

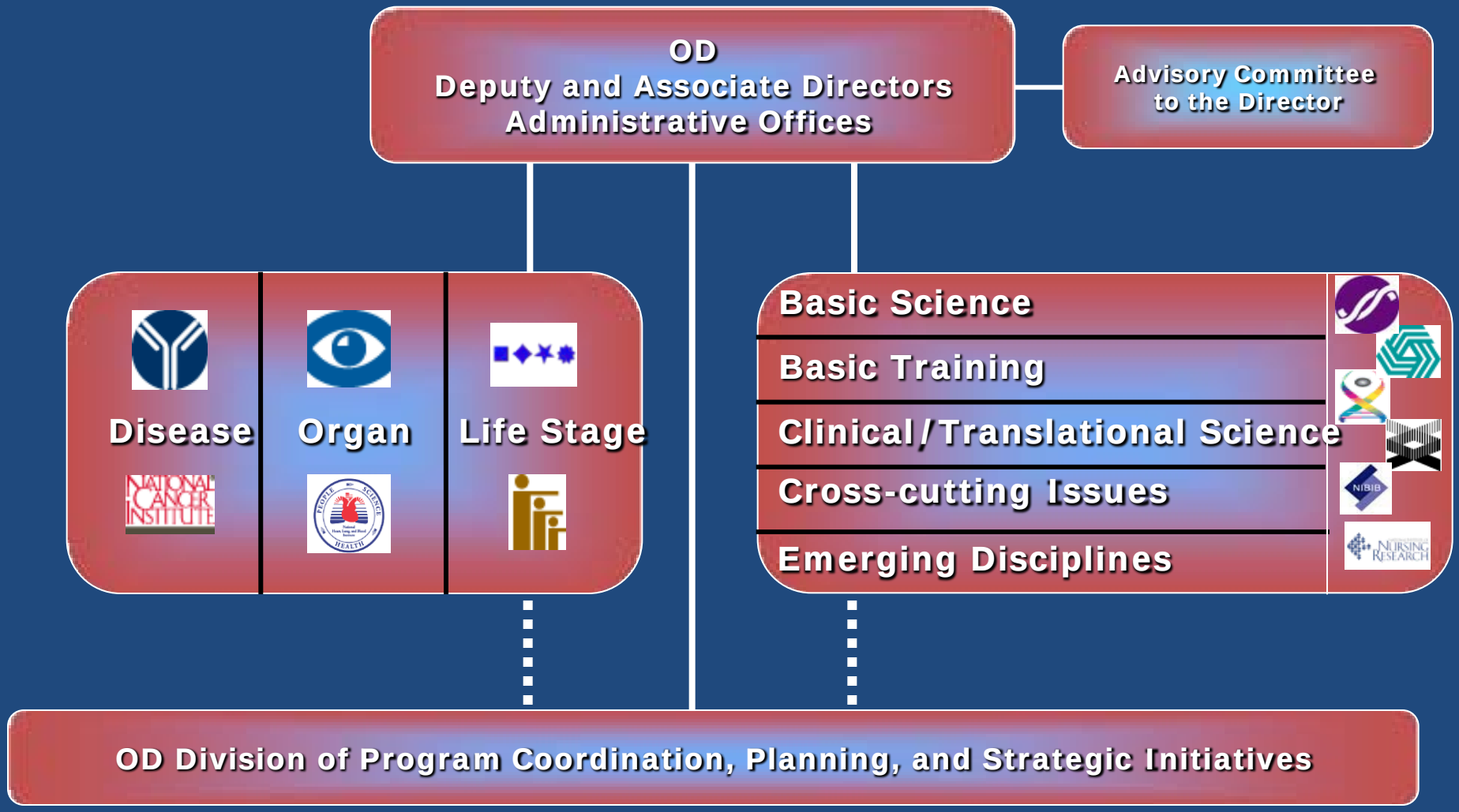
Vannevar Bush (1890 –1974)

NIH Mission

Uncover new knowledge that leads to better health for everyone by:

- Conducting research in its own laboratories
- Supporting research of non-Federal scientists in universities, medical schools, hospitals, and research institutions throughout United States and overseas
- Help translate research into medical innovations
- Helping train research investigators
- Fostering communication of medical information

24 institutes and 3 centers



CENTER FOR SCIENTIFIC REVIEW

Elias A. Zerhouni, M.D.
Director, NIH

NIH Resource Allocations

- Budget of 31 billion dollars (over 90% of all biomedical research) in 24 institutes and 3 centers coordinated by NIH director who is responsible to Congress and Government
- About 10% for « intramural » laboratories for 10,000 scientists in 1200 labs
- 5% administration
- 85% extramural funding with over 80% at 120 research universities
- Strict eparation of intramural and extramural activities

The Cornerstones of NIH

- World Class Peer-review Process (Congressionally mandated)
  - Independent- Conducted by outside reviewers
  - Competitive- ~22% get funded

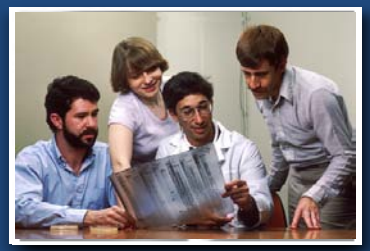
- Scientific and Public Advisory Structure
  - Each institute has a statutory council 2/3 scientists and 1/3 public representatives
  - Director NIH is advised by 2 separate committees: Council of public representatives, and the Advisory Council to the Director

Researcher

NIH Grant Proposal

Initiates grant proposal:
- New project
- Continuing project

Scientific Review Panel



Scientists evaluate scientific merit of grant proposal

Program Office

Main contact for applicant
Helps interpret review results

Institute National Advisory Councils

Assess programs
Approve applications
Public members

Institute Director

Makes final decision
Allocates funds
Provides annual justification to Congress

Congress

Funds

Important Characterisitics

- All grants are awarded to the principal investigator in name.
- In addition to the grant, institutions receive indirect costs (from 40 to 70% of the grant value for buildings, utilities and administration)
- The grants are fully transferable if the principal investigator goes to another institution
- Consequence: institutions compete for funded scientists by providing them a supporting environment

NIH and its Partners

Congress

FDA

Public

NATIONAL INSTITUTES OF HEALTH

Industry

Products

Universities

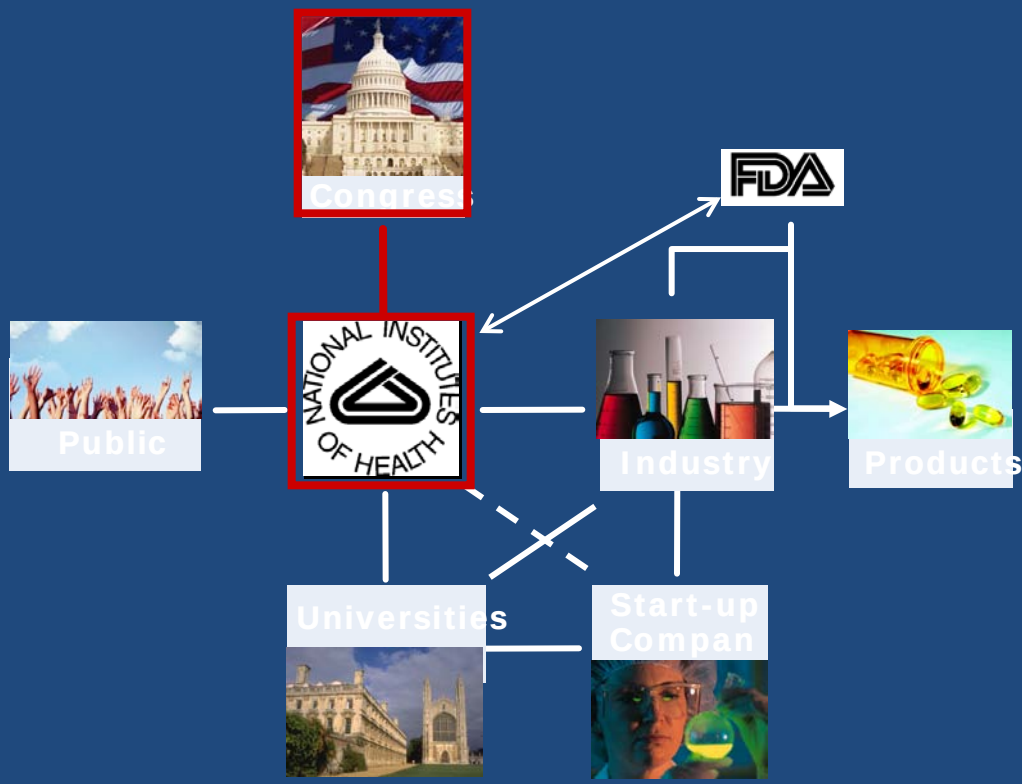
Start-up Companies

Partnering with the Private Sector

If we harness the scientific strengths and financial resources from the private & public sectors, the synergy created will help us improve public health faster than any single partner can do alone!

NIH and Congress:

Establishing the Legal Framework for Technology Transfer And Government-Academia-Industry Partnerships



Bayh-Dole Act of 1980

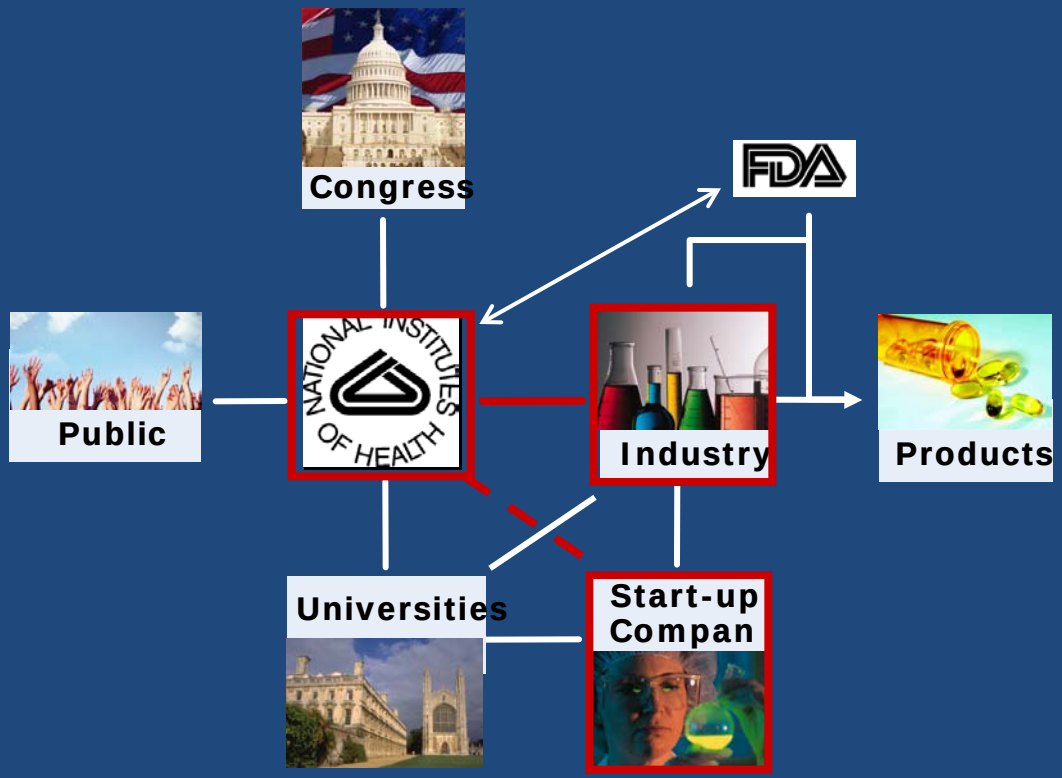
Allows nonprofit organizations to retain title to federally-funded inventions

Federal Technology Transfer Act of 1986

Allows Federal Agencies to conduct joint research with non-federal partners, protecting intellectual property

NIH and Industry:

CRADAs and PPPs



233 Active NIH Cooperative Research and Development Agreements (CRADAs)

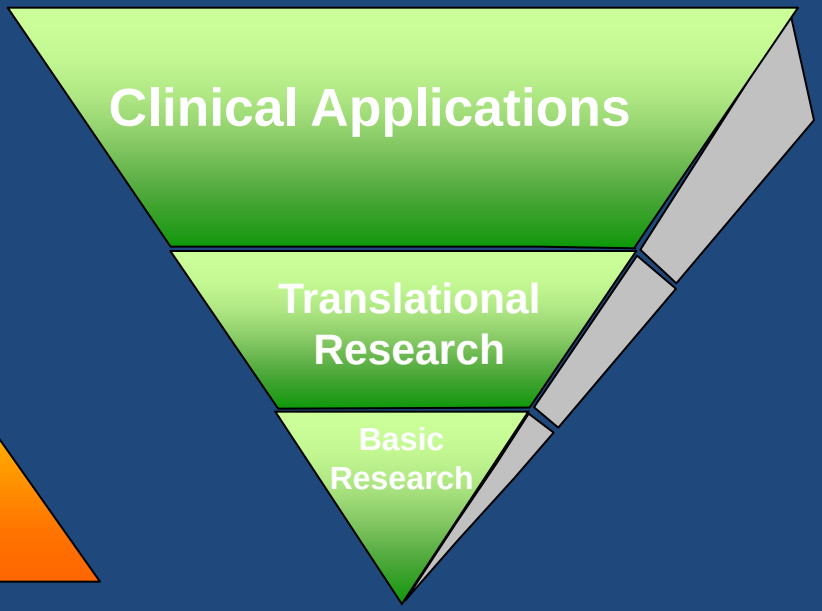
- TAXUS® Express2™- *Angiotech*
- PreserVision-*Bausch & Lomb*

Public Private Partnerships

- Osteoarthritis Initiative (OAI)
- Genome Association Information Network (GAIN)

Balanced National Biomedical Research Portfolio

NIH



Private Sector

FY 2005 NIH Extramural Grants by Research Institution

3,114 New Technologies Brought to Market

By 185 US Research Institutions (1998-2004)

Funding to Develop Technologies Provided by Both US Government and Private Industry

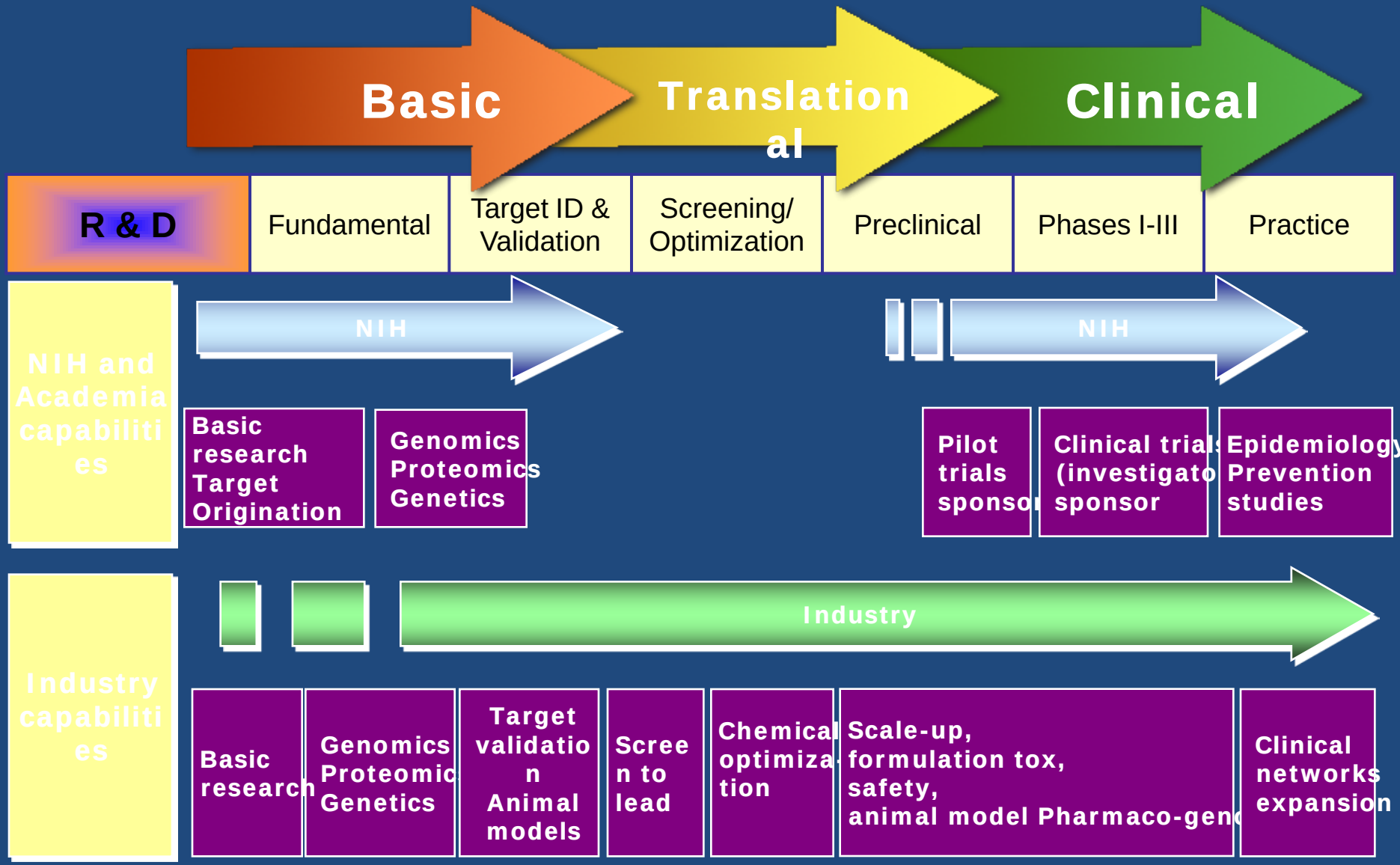
4,543 New Companies Formed

Around Technologies from US Research Institutions (1980-2004)

2,671 Companies Still in Operation as of 12/2004

Data: Assoc of University Technology Managers (AUTM) Survey 2004

NIH, Academia, and Industry: Complementary Roles

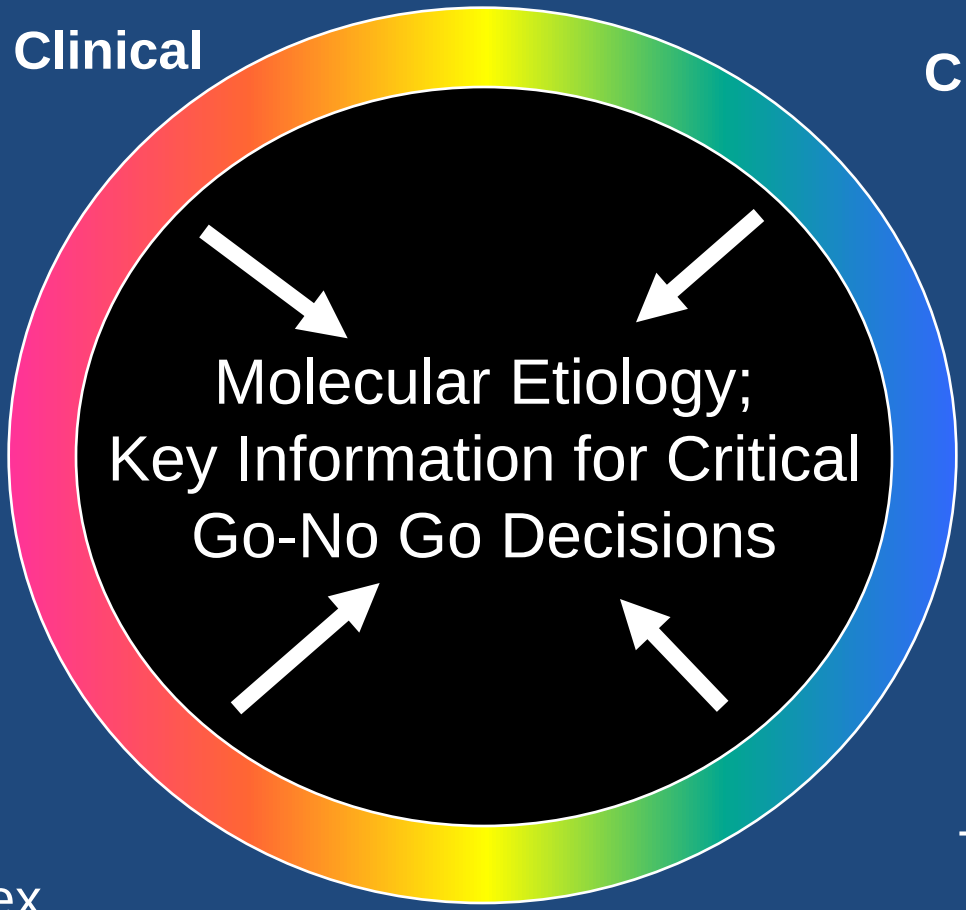


New Model

Use All Available Data to Address Problems

Population-based Clinical Research:
Disease definitions
Natural History

Patient-oriented Clinical Research:
Etiology
Genetics
Biomarkers
Drug Targets

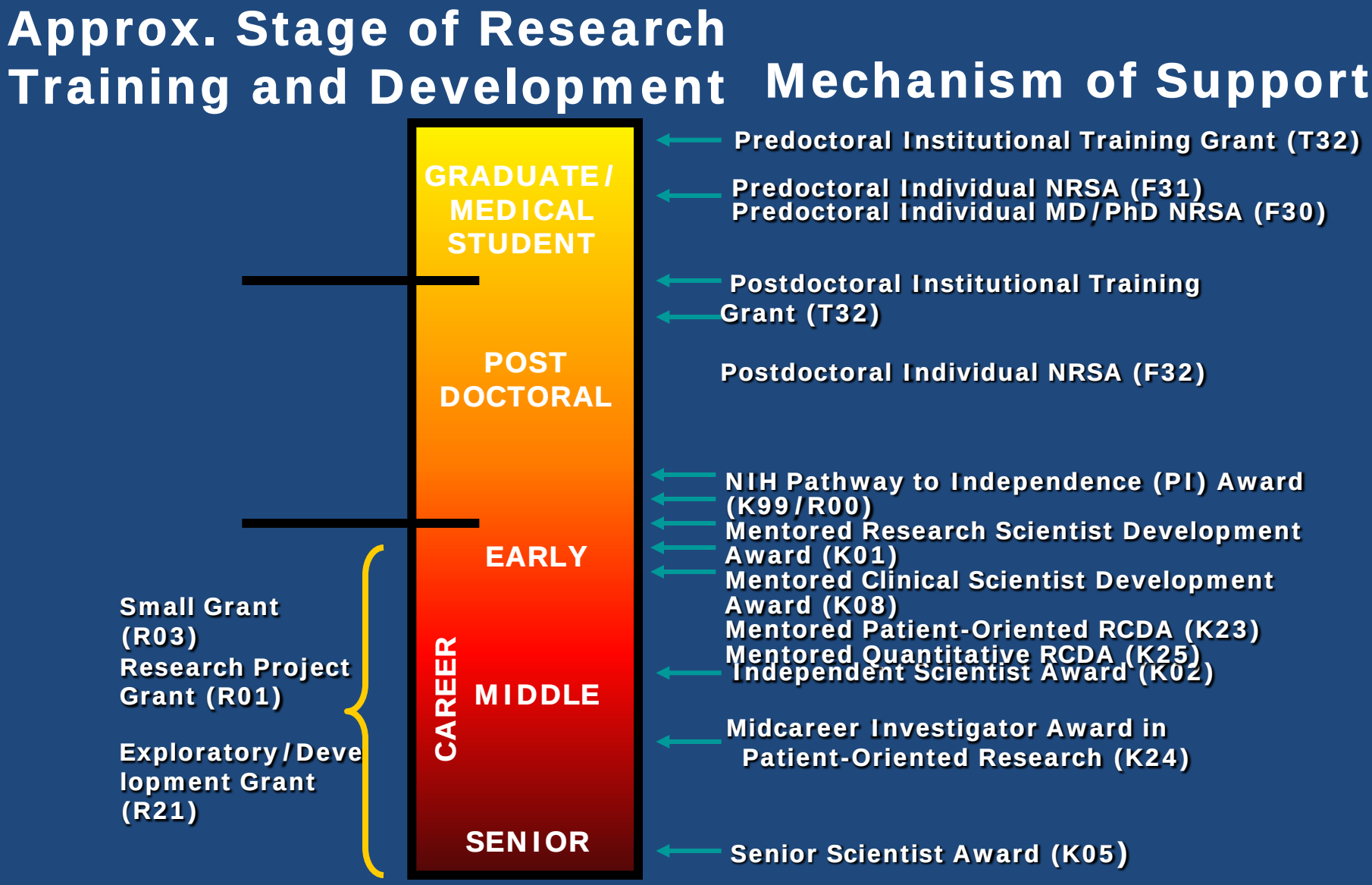


Clinical Trials:
Toxicity
Efficacy
Effectiveness
Therapeutic Index

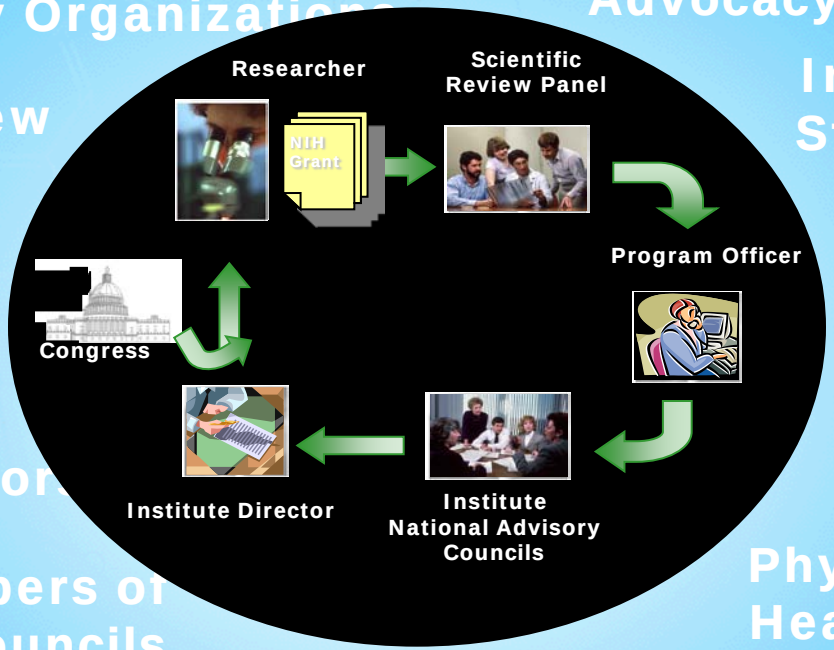
Laboratory Research:
Drug Screening
Target Pathways
Optimization

Requires interactive interdisciplinary workforce

NIH Training and Career Timetable



Setting Research Priorities: Every Voice Counts



General Public

Scientists

Patients & Their Advocacy Groups

Voluntary Organizations

Institute Staff

Scientific Review Committees

Congress

President & Administration

Scientist Council Members

Boards of Scientific Counselors

Ad Hoc Advisors

Public Members of Advisory Councils

Physicians & Other Health Professionals

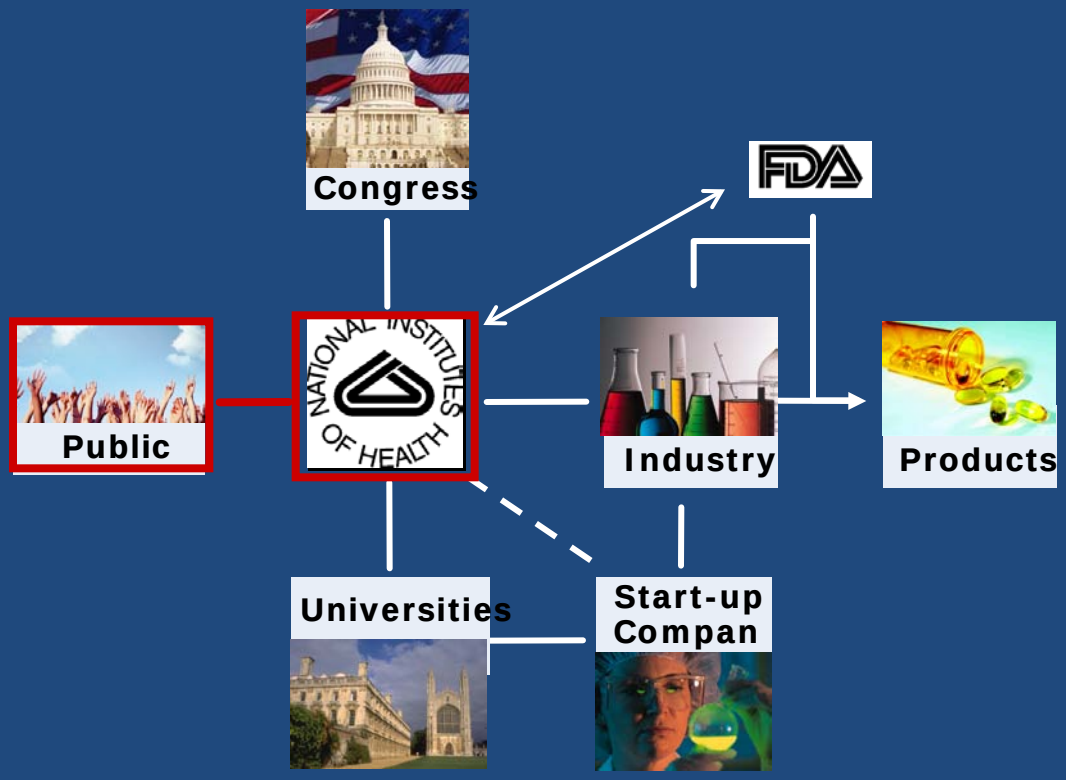
Professional Societies

Industry Scientists

Industry Managers

NIH and the Public:

Role in Scientific Review



World Class Peer-review Process

- Independent Reviewers
- Competitive- ~22% get funded

Each Institute has a statutory Council with 1/3 public representatives

Engaging the Public

- NIH Web sites
- Public Information Campaigns
- NIH Radio
- Public Inquiry Response
- Newsletters
- Exhibits at Health Fairs and Community Events
- Advisory Committee to the Director
- Council of Public Representatives (COPR)

NIH Web Sites

- NIH Health Information Page

- PubMed

- Medline Plus

- ClinicalTrials.gov

Public Outreach Campaigns

Lessons in the politics of innovation

- **Tension entre politiques centralisees et decentralisees-**
  - **Court terme contre long terme.**
  - **Recherche fundamentale doit etre protegee**
- **L'importance pour tous les scientifiques de quitter leur « tours d'ivoire » et communiquer et developper des relations positives avec les instances politiques et sociales de chaque pays**
- **Toujours reserver un pourcentage des ressources pour la recherche a haut risque et les nouveaux chercheurs!**