Due to Advances of Past 30 Years

*Americans are Living Longer and Healthier*

- For the second consecutive year, annual cancer deaths in the United States have fallen

Cancer investment per American

$\sim$9/yr

1974-2004
Due to Advances of Past 30 Years

Americans are Living Longer and Healthier

For the second consecutive year, annual cancer deaths in the United States have fallen

Over 60% drop in mortality for heart disease and stroke – in 2004, drop in deaths of women from Heart Disease from 1/3 to 1/4 reported

Heart disease investment per American

~$4/yr

1974-2004
Due to Advances of Past 30 Years

**Americans are Living Longer and Healthier**

- For the second consecutive year, annual cancer deaths in the United States have fallen.

- Over 60% drop in mortality for heart disease and stroke – in 2004, drop in deaths of women from Heart Disease from 1/3 to 1/4 reported.

- Chronic disability among older Americans has dropped by 30% in the past 2 decades, and the rate of decline is accelerating.

- Life expectancy rises to 78 years, up 6 years since 1974.

**Chronic Elderly Disability**

Source: KG Manton et al., *PNAS*: 103 (48) 18374

**Total NIH Investment per American**

~$44/yr

1974-2004
Major Factors Will Force a Transformation of Medicine and Health

- Socio-economics
- Demographics
- Landscape of disease
- Global health
- Scientific challenges and opportunities
Evolving Public Health Challenges

- Shift from Acute to Chronic Conditions
- Aging Population
- Health Disparities
- Emerging and Re-emerging Infectious Diseases
- Emerging Non-communicable Diseases - Obesity
- Biodefense
Challenge of Rising U.S. Health Expenditures

Biomedical Research Must Deliver

National Health Expenditures as a Percent of GDP

Actual
Projected

Percent of U.S. GDP

8%
10%
12%
14%
16%
18%
20%


$4.1 trillion

How will NIH help meet these challenges?
The Current Paradigm:

*Manage Disease*

Disease Burden

- Preclinical
- Tolerable
- Intolerable

Cost Savings

Symptom management

Curative treatment

Time

Cost
The Future Paradigm: *Preempt Disease*

- **Preclinical**
- **Molecular preemption**
- **Symptom management**
- **Cost savings**
- **Intolerable**
- **Curative treatment**

Disease Burden vs. Cost over Time
The Value of Molecular Preemption

Early Rheumatoid Arthritis

Intermediate Rheumatoid Arthritis

Late Rheumatoid Arthritis

Courtesy of J. Cush, 2002
The Value of Molecular Preemption

Early Rheumatoid Arthritis  Intermediate Rheumatoid Arthritis  Late Rheumatoid Arthritis

Today, a new class of anti-rheumatic drugs dramatically slows disease progression

Courtesy of J. Cush, 2002
### The Value of Molecular Preemption

<table>
<thead>
<tr>
<th>Early Rheumatoid Arthritis</th>
<th>Intermediate Rheumatoid Arthritis</th>
<th>Late Rheumatoid Arthritis</th>
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</thead>
</table>

- **In 2006,** genetic study reveals three genes involved in Rheumatoid Arthritis progression.

- **Tomorrow,** we will intervene and *preempt* inflammation and joint damage.

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*Courtesy of J. Cush, 2002*
The Future Paradigm: The 4 P’s
Transform Medicine from Curative to Preemptive

Predictive  ↔  Personalized  ↔  Preemptive

Participatory
Era of Precision Medicine
Where Are We Today?

Biosensor Chip

2 cm

Lab on a Chip

Remote Glucose Monitor

Heart Monitors
New Discoveries Make it Possible to “Personalize” Anticoagulation Therapy

- Warfarin: An anticoagulant drug used to reduce the risk of clots causing strokes or heart attacks in millions of patients
  - Take too little: clots, stroke
  - Take too much: bleeding/death
- Genomic experiments revealed: two different genetic variations that predict best dose
**Preemptive: Vaccine Advances**

**HPV Vaccine**
- Human Papillomavirus (HPV) infects over 80% of 15–50 year old women and can cause cervical cancer
- First FDA-approved vaccine against cancer

**HIV vaccine**
- Large-scale Phase IIb trials opened this year
- New vaccine target identified
Scientific Challenge:  
*Tackling Biological Complexity*

Cell’s Response to Damage  
Electronic Diagram

*Image courtesy of UCSD*
Discoveries from Basic Research: RNA Interference (RNAi)

Andrew Z. Fire

Craig C. Mello

2002 Breakthrough of the year

2006 Nobel Prize
Healthy individual constantly monitoring spectrum of biomarkers

Healthy patient consults with doctor to assess risk should a biomarker change

Tailor medications and lifestyle changes to preempt disease

Reduce disease burden and costs
Participatory: Community Involvement

Jackson Heart Study
- Community participation and education
- Identify minority risk factors for cardiovascular disease

*In October 2006, NIH opened a new health information center for the public at the Jackson Medical Mall*
What is NIH’s Core Strategic Vision?

- Transform medicine and health from a *Curative* to a *Preemptive* paradigm
- Support basic research to identify the earliest molecular stages of disease in complex biological systems
- Accelerate translation of findings from the bench to the bedside to the community
- Provide the evidence and knowledge base to allow for a rational transformation of our healthcare system
NIH
Transforming medicine and health through discovery