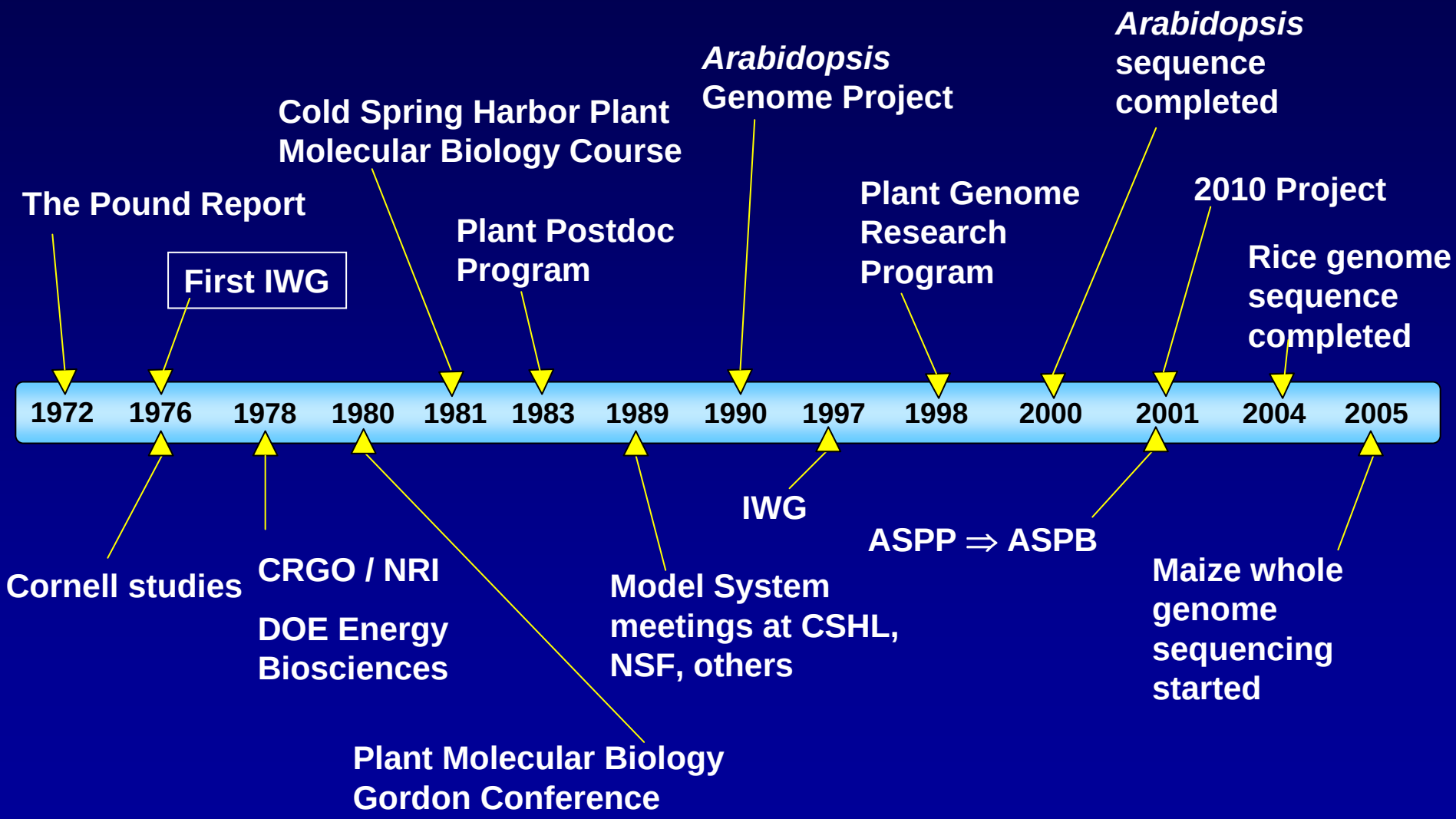
Predictions

Dr. Mary E. Clutter
American Society of Plant Biologists
August 5, 2006

Topics

- Significant Events
- 21st Century Biology
- Challenges
- Predictions

Significant Events



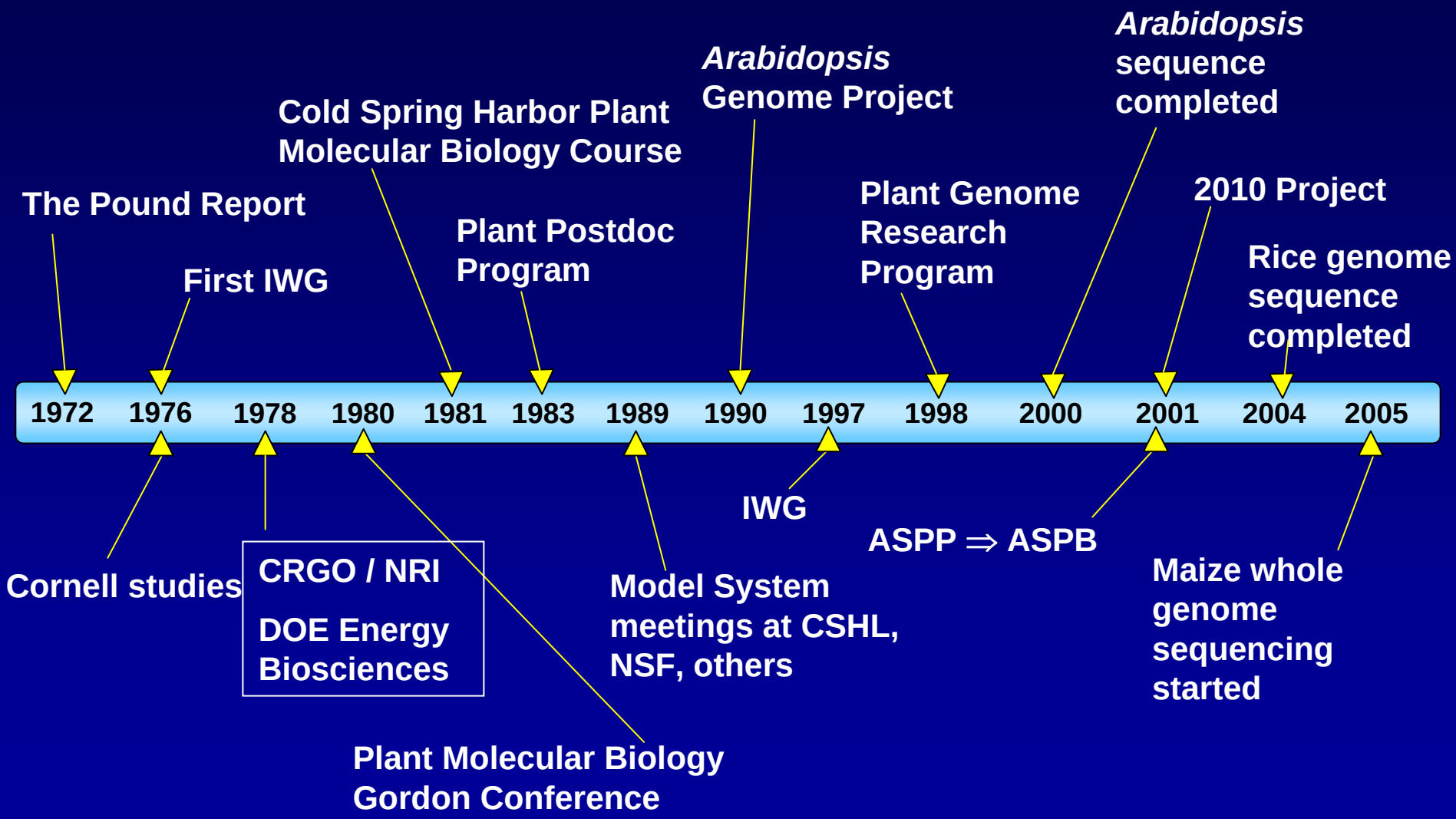
Meeting to Discuss Current and Long Range Plans for Support of Basic Research in the Plant Sciences

November 17, 1976 in Room 321 NSF 1800 G Street

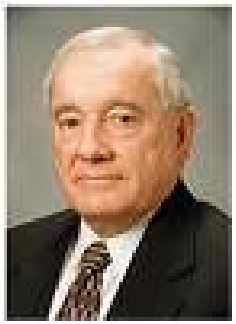
Participants:

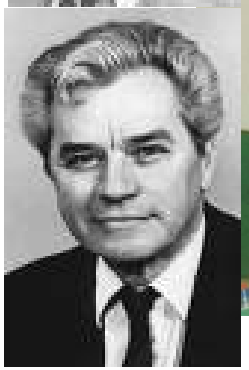
Dr. Mary Clutter, NSF
Dr. Janice Coffey, NSF
Dr. John Fulkerson, CSRS (USDA)
Dr. Hugo Graumann, ARS (USDA)
Dr. Stanley Krugmann, US Forest Service
Dr. Leon Prosky, FDA
Dr. Robert Rabson, ERDA/DOE
Dr. Elijah Romanoff, NSF
Dr. Richard Staples, OSTP
Dr. Elinor Terhune, STIA/NSF
Dr. Donald Wickham, NOAA
Mr. Floyd Williams, USAID
Dr. Oskar Zaborsky, RANN/NSF

Significant Events



USDA CRGO (NRI) established in 1978



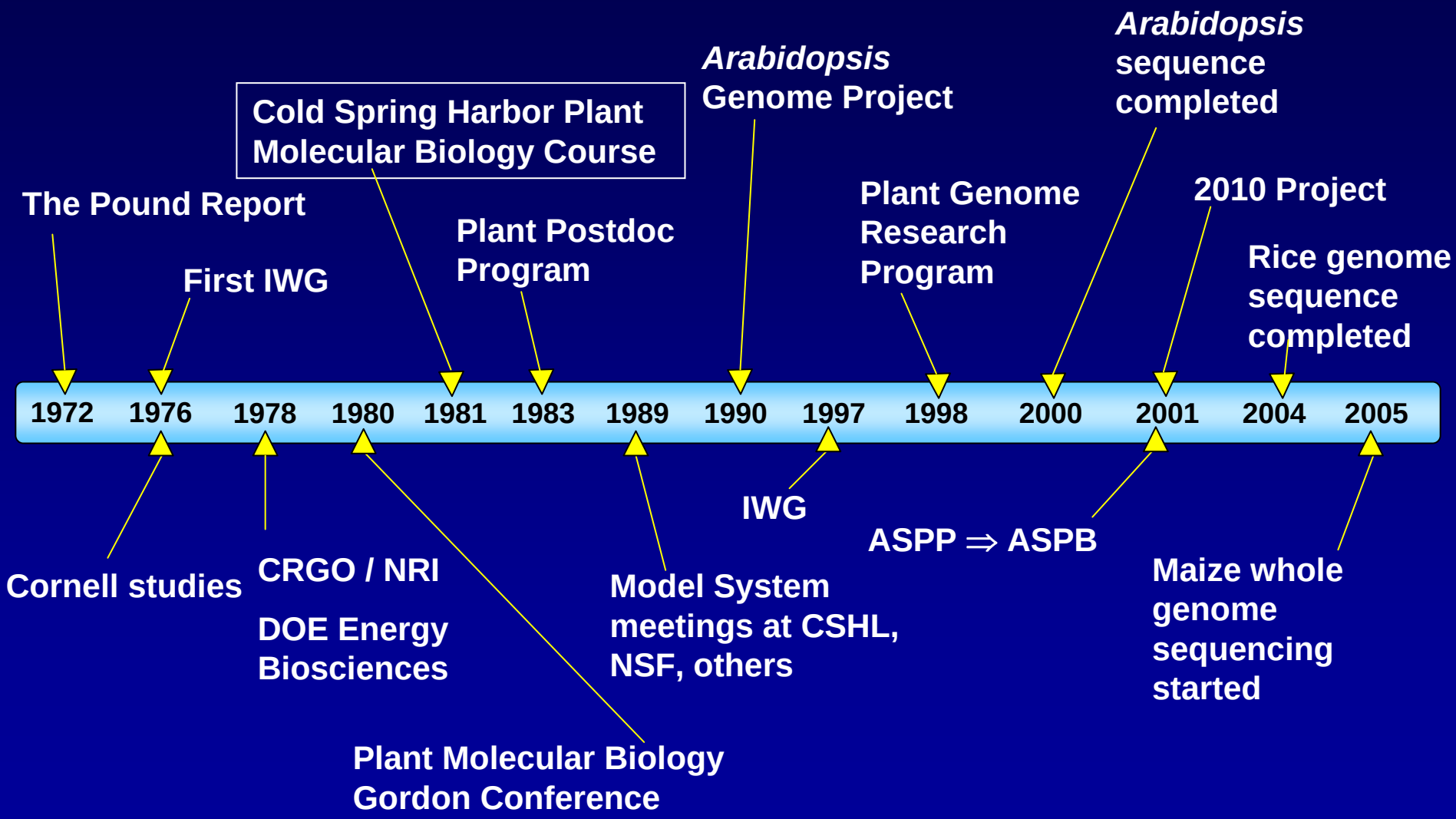






A CRGO panel, 1985

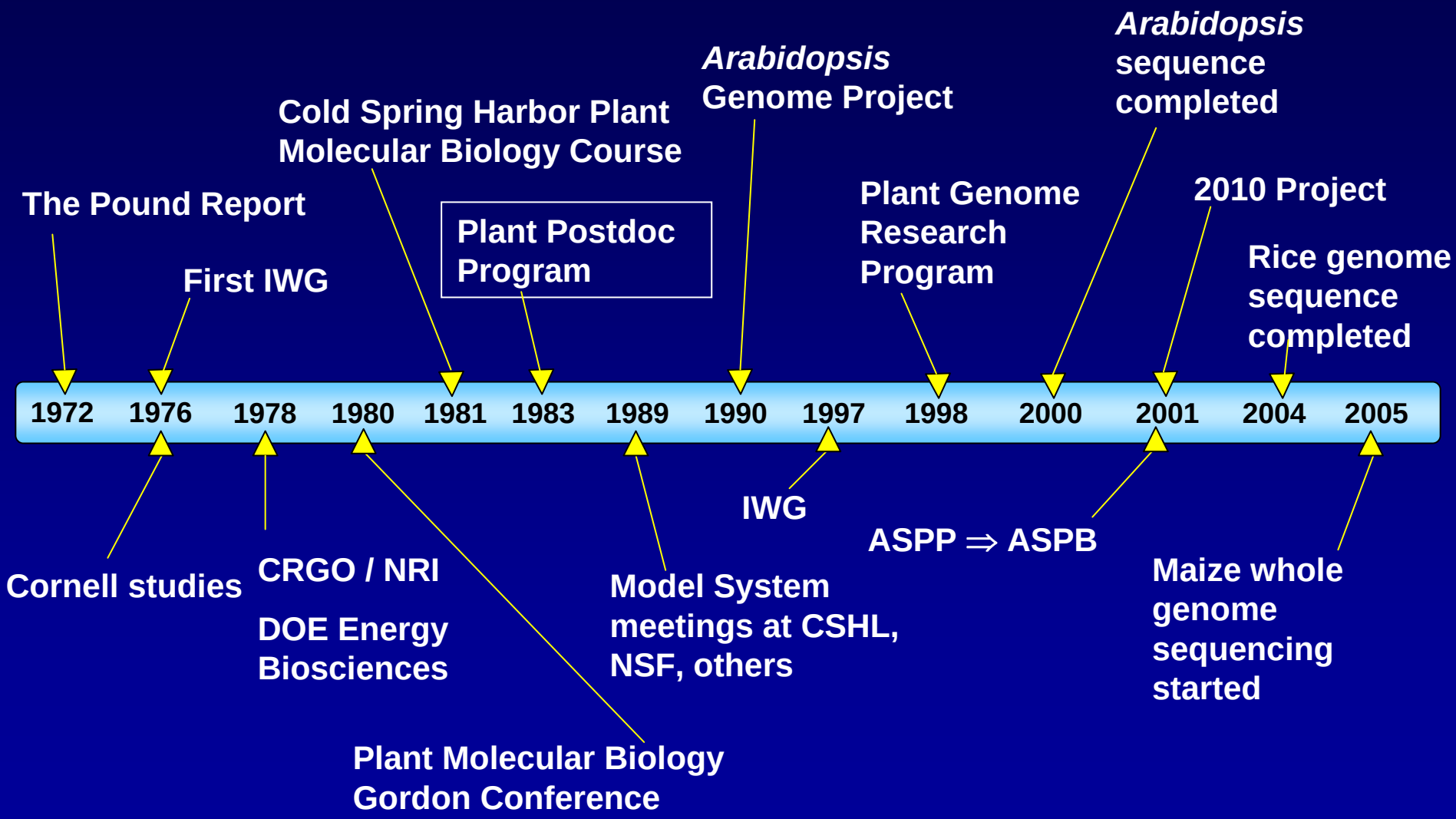
Significant Events



Cold Spring Harbor Summer Course on Plant Molecular Biology 1981 - Present

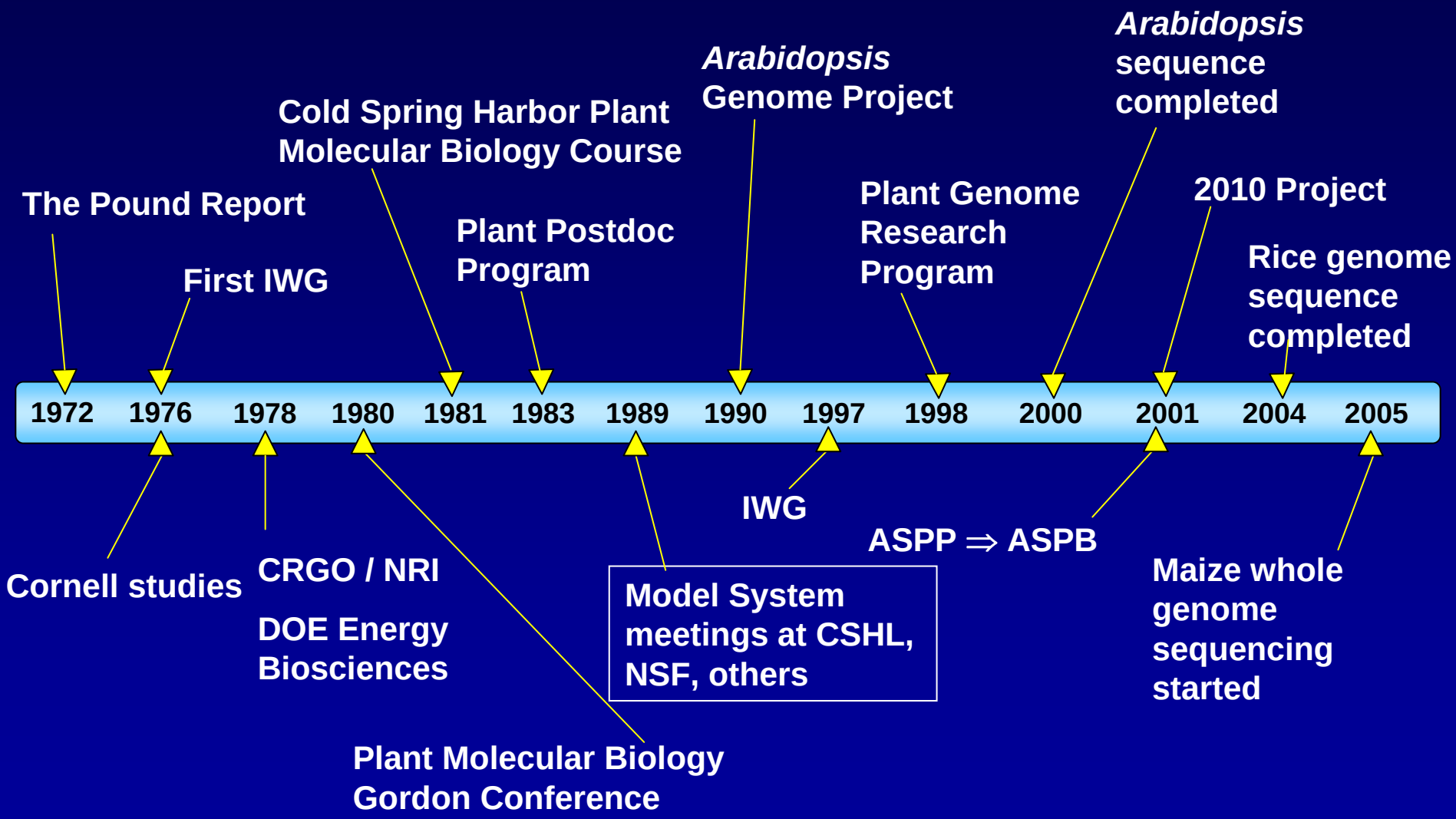
First Organizers: Fred Ausubel & John Bedbrook

Significant Events



Plant Postdoc Program

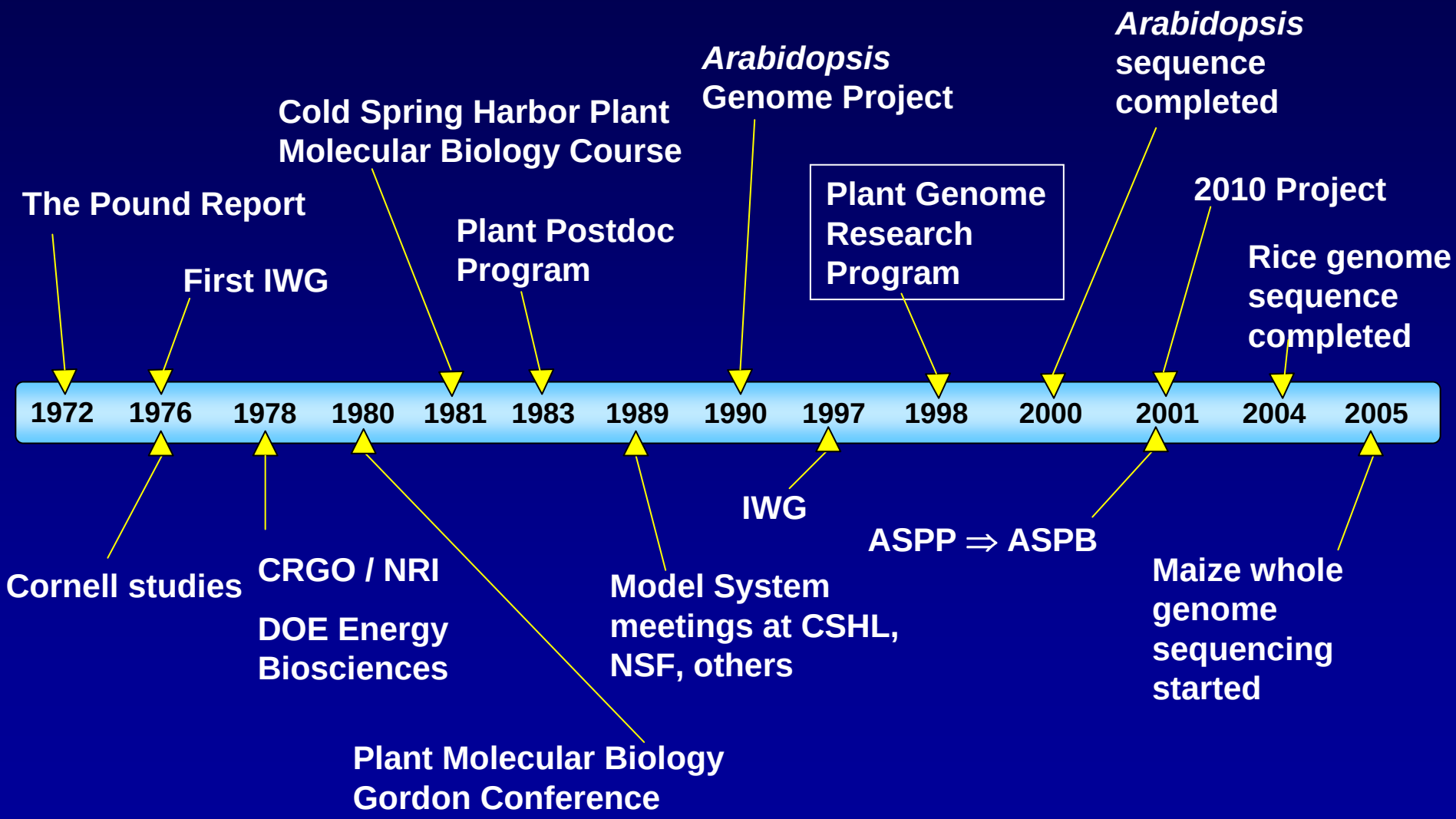
Significant Events



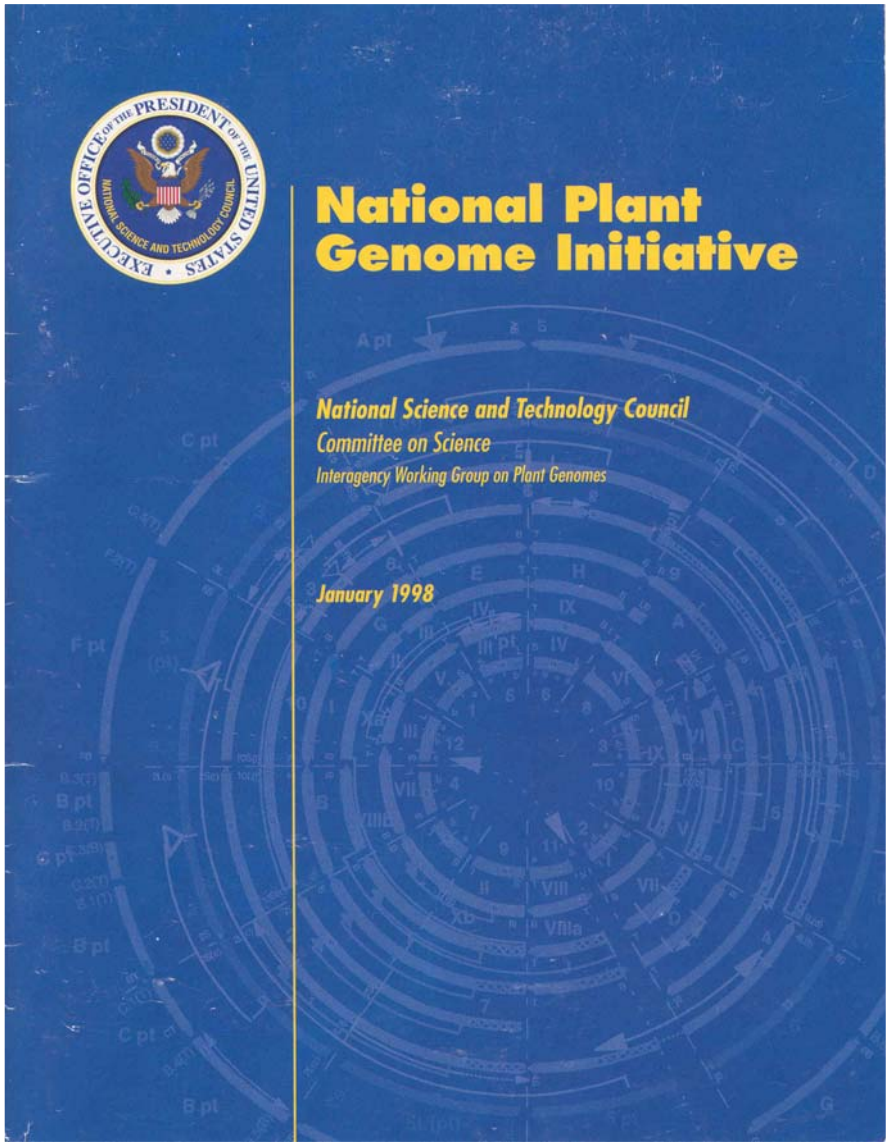
CSHL Model Organism Meeting: July 20, 1989

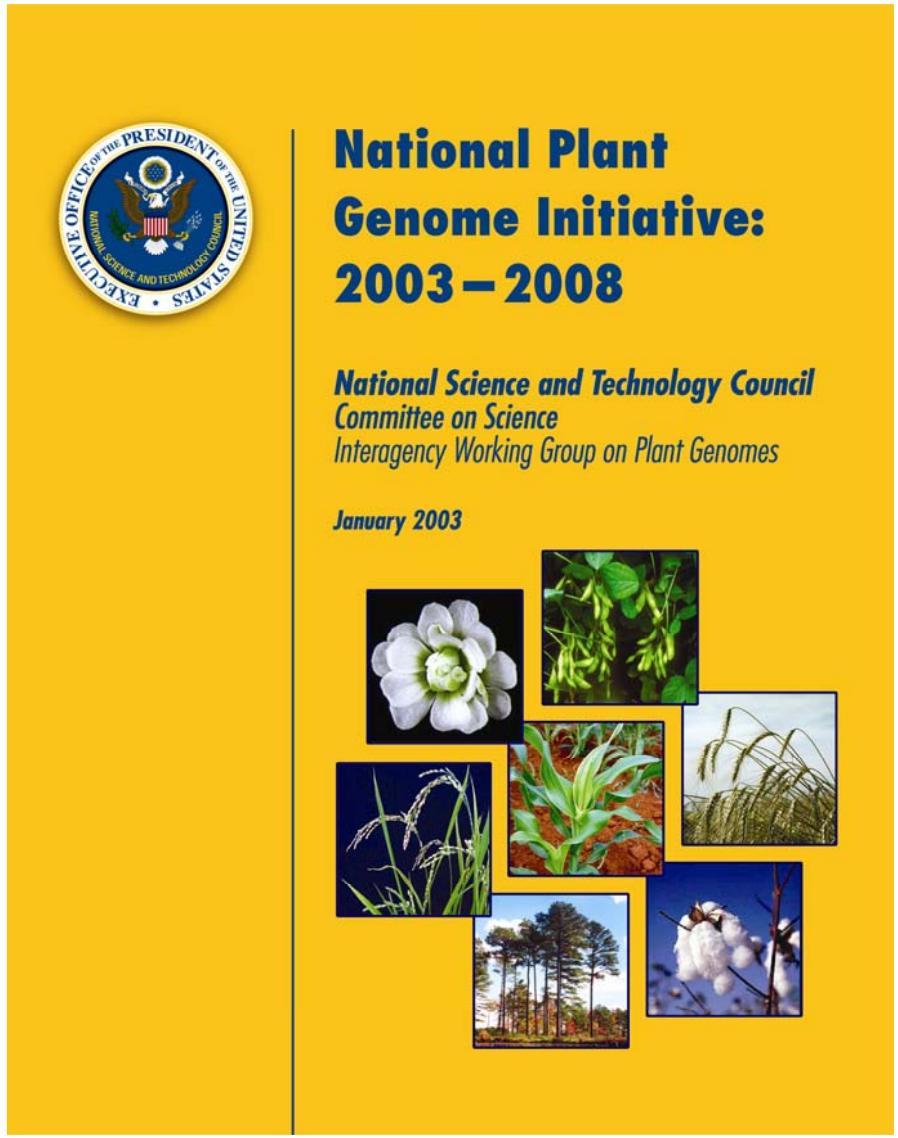
and others

Significant Events

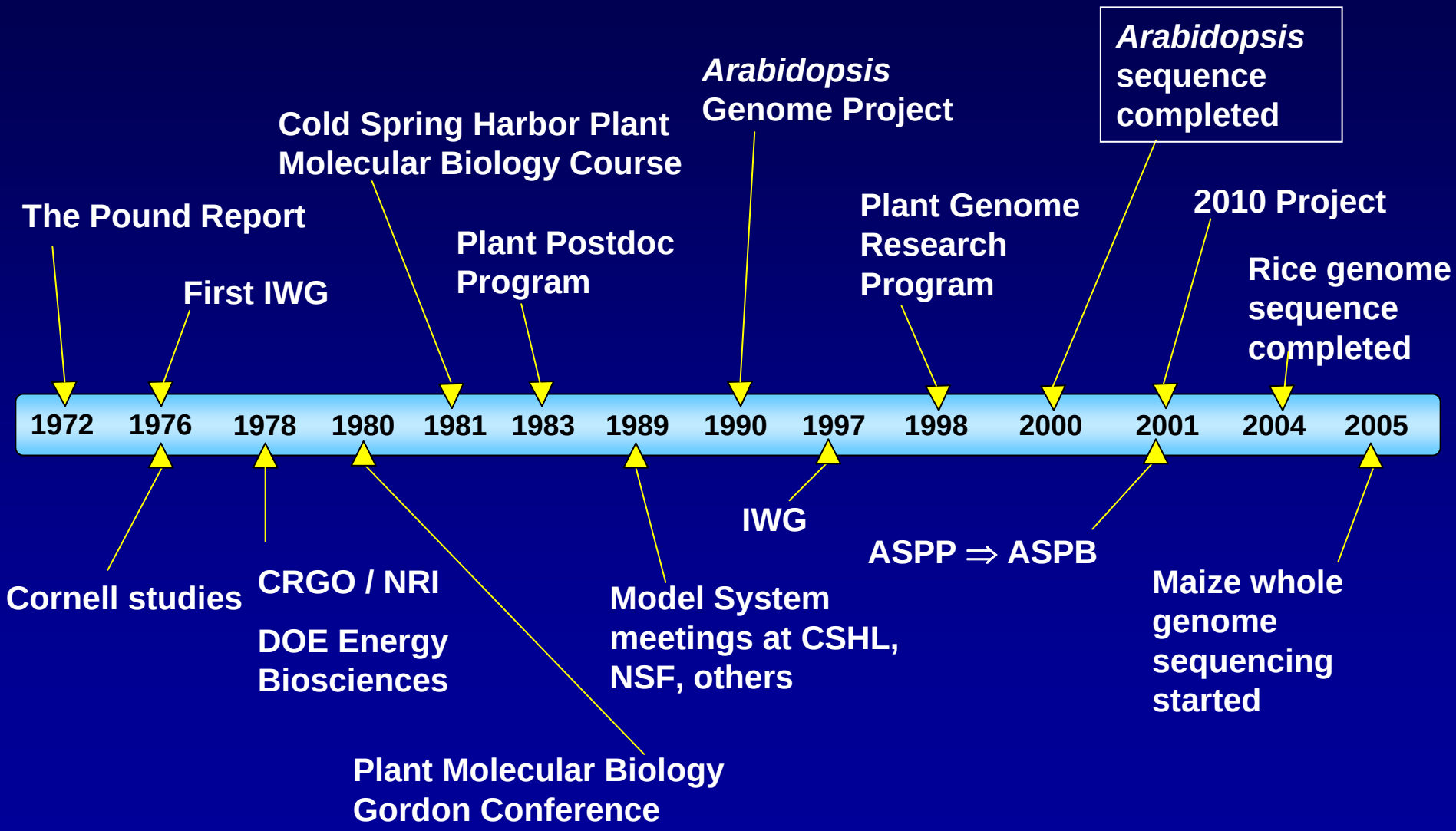


Plant Genome Research Program





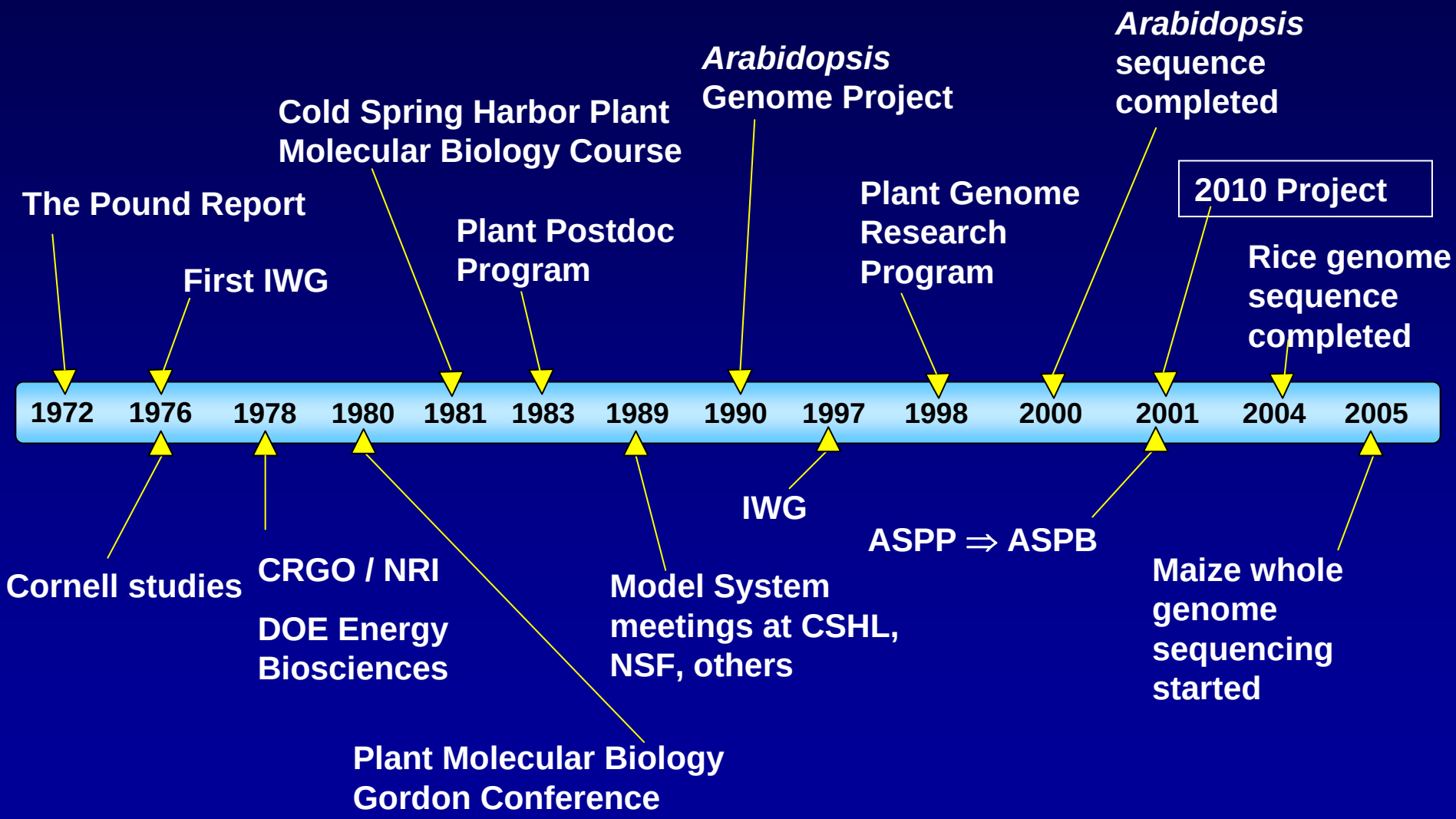
Significant Events



Arabidopsis genome sequence completed

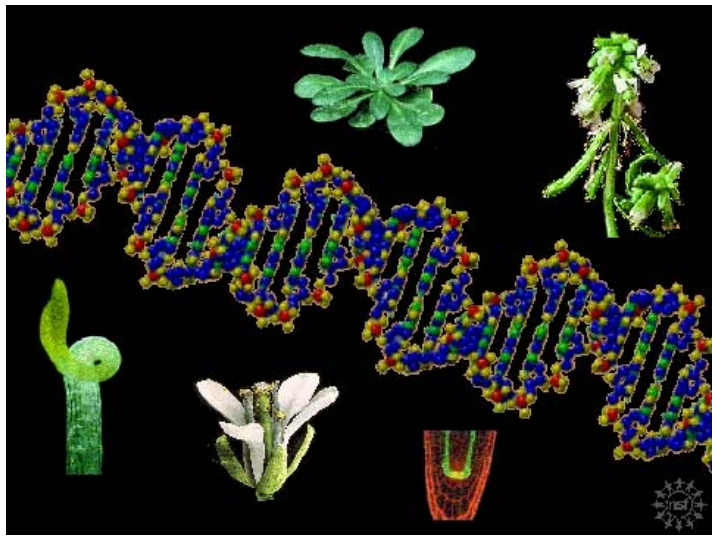
- First complete plant genome sequence
- Published December 14, 2000
- International effort including US, EU, France and Japan
- Funded in US by NSF, USDA, DOE

Significant Events



2010 Project

- **Goal: collaborative effort to determine the functions of the genes in *Arabidopsis***
- **Begun in 2001**
- **Planned to complete by 2010**
- **International collaboration**



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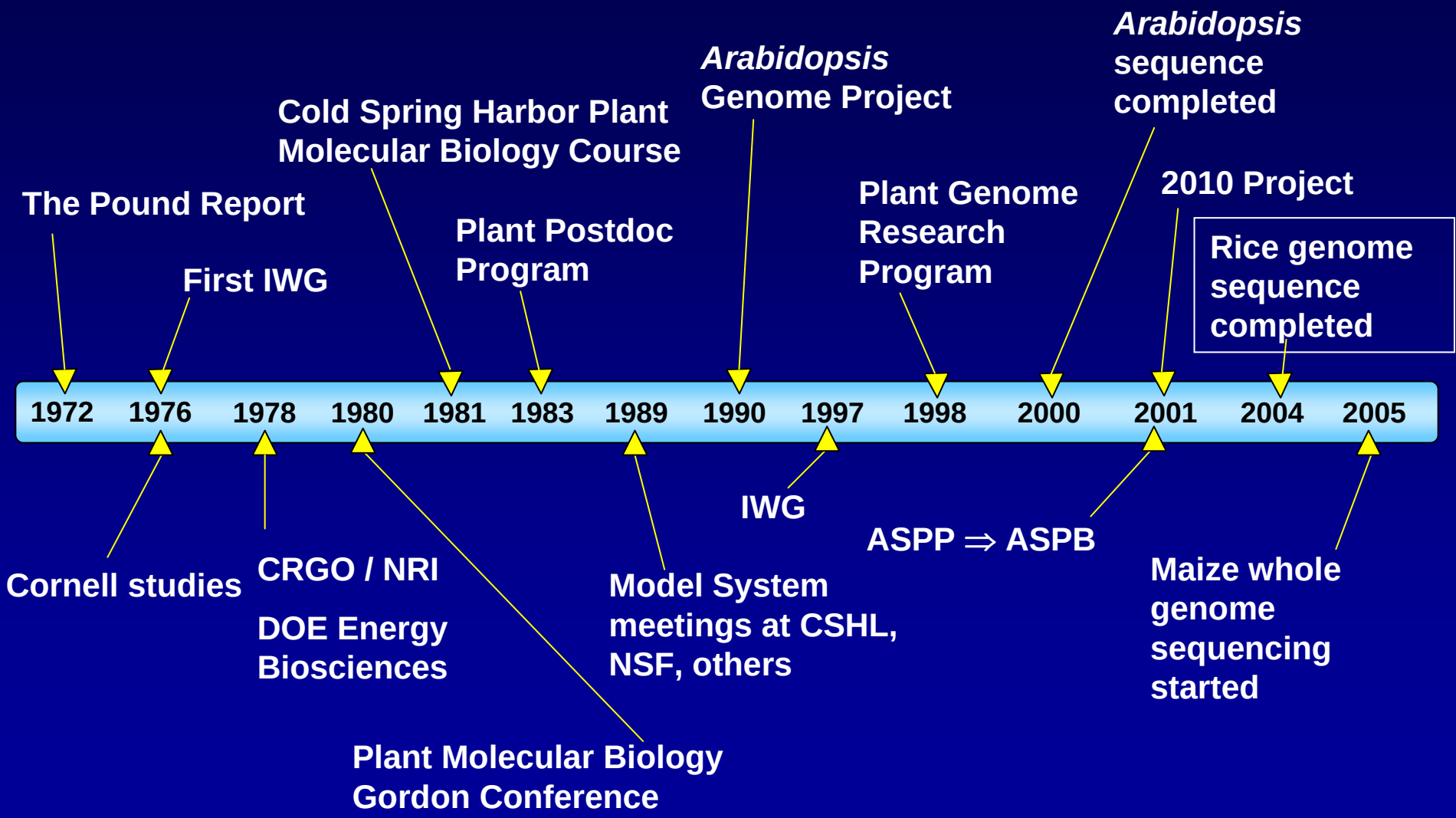
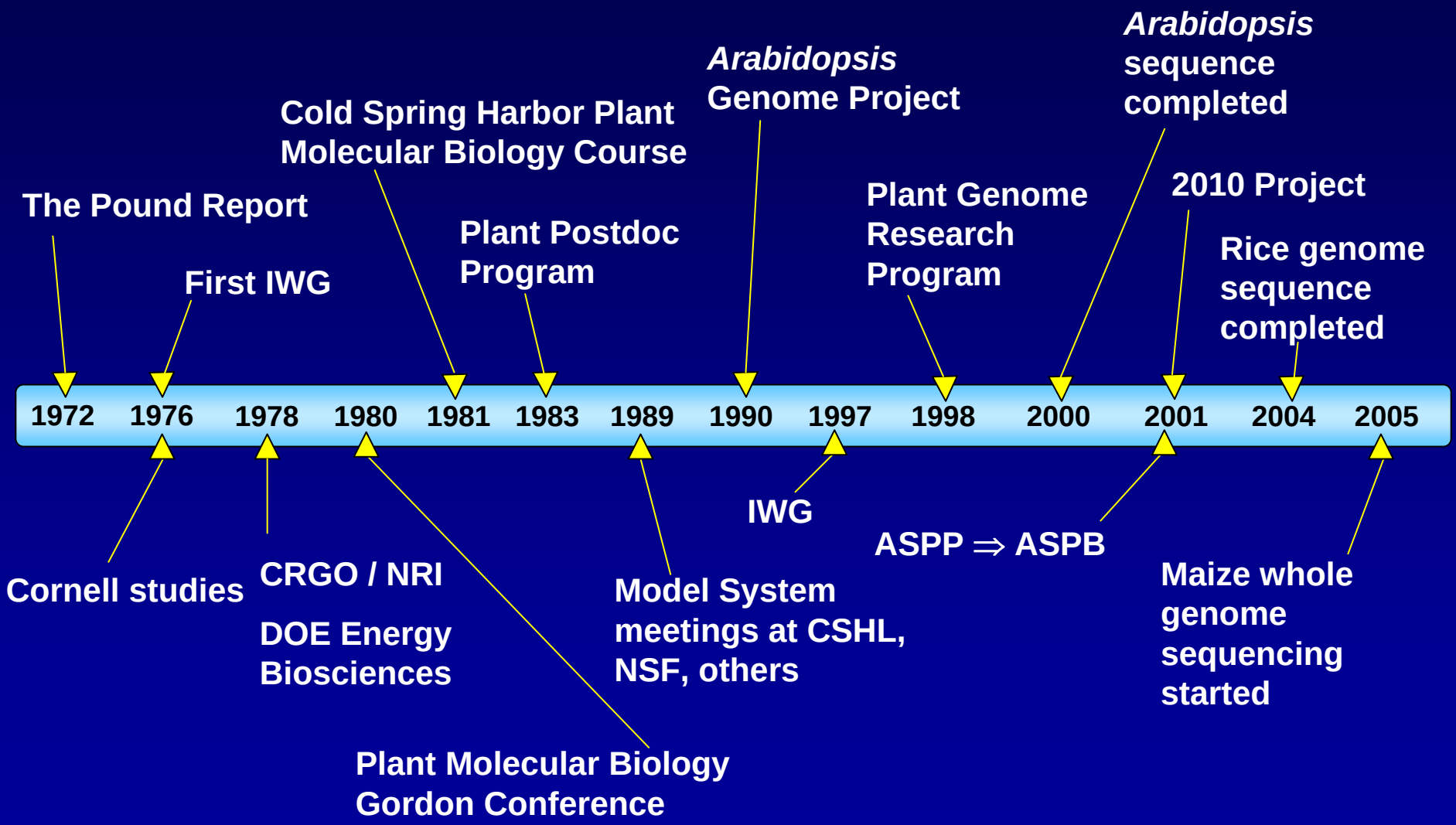


International Rice Genome Sequencing Project

- Model of international collaboration
- Members: Japan, Korea, China, Taiwan, Thailand, India, UK, France, USA, Brazil
- Led by Japanese rice genome program
- USDA (US lead), DOE, NSF
- Data in GenBank

Significant Events



Topics

- Significant Events
- **21st Century Biology**
- Challenges
- Predictions

“ …If this century is the age of physics, the 21st century will be the age of biology.”

- D. Allan Bromley

“ the 21st century is going to see a cohesion of the sciences and disappearance of their borders.”

- David Baltimore

21st Century Biology
Omics and Beyond

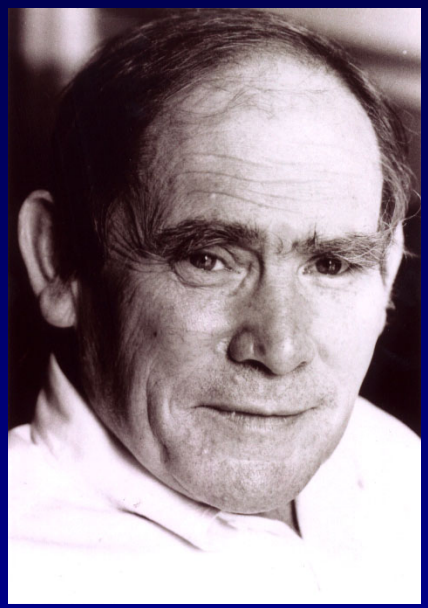
- Multidisciplinary
- Multidimensional
- Cyberinfrastructure-enabled
- Education-oriented
- International

“ Computers have changed biology forever, even if most biologists don’t yet realize it.”

- Michael Levitt

“ Two months of hard work in the laboratory can easily save an afternoon on the computer. ”

- Alan Bleasby



“ Reading sequences off a machine tells us nothing about biology. ”

- Sydney Brenner

Plant & Animal Genome Conference

January 2004

" The phrase 'understanding biocomplexity' speaks of a deeper concept we must reach beyond, to discover the complex chemical, biological, and social interactions that comprise our planet's systems. "

- Rita R. Colwell

The Next Biological Revolution

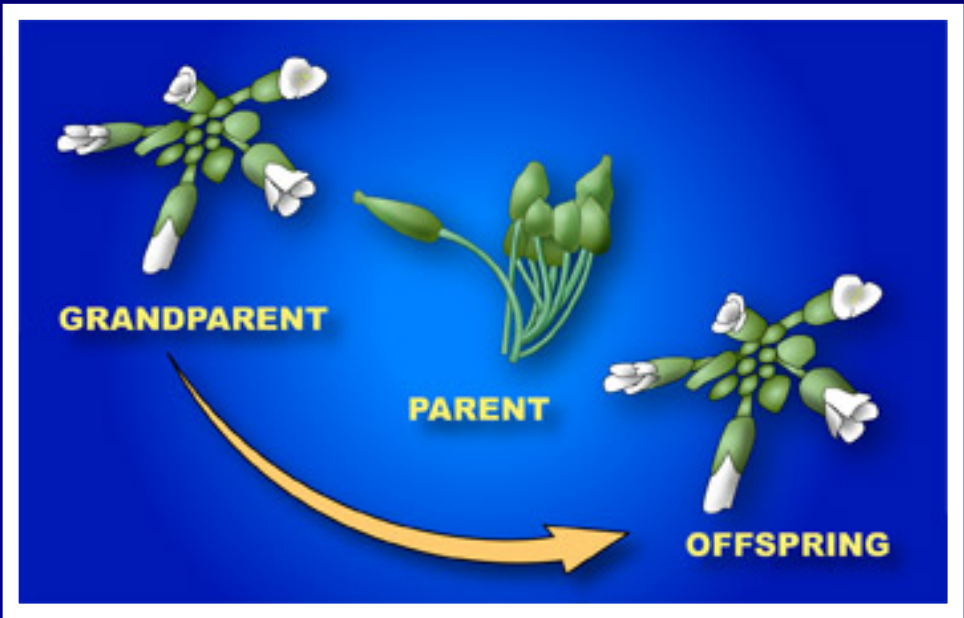
Discovery of RNA Interference

The phenomenon now known as RNA interference (RNAi) was first uncovered by Richard Jorgensen as a sequence-specific gene silencing response provoked by the introduction of exogenous multicopy transgenes into petunia.

Discovery of a Non-Mendelian Mode of Inheritance

" For decades, we have imagined the nuclear genome as the center of the biological universe but as our technology develops and our understanding of biology expands, we have come to realize that this universe is much more diverse and much more interactive than we had assumed. "

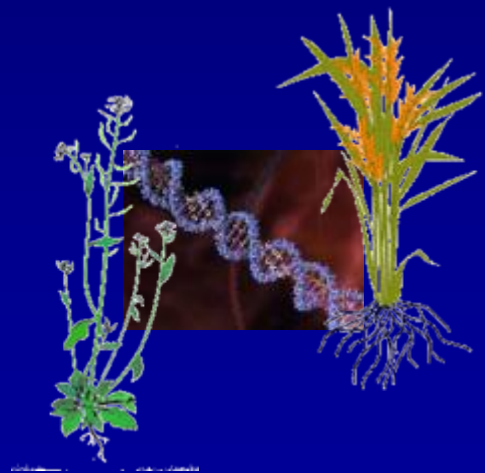
- Susan Lolle



Lolle, S.J. et al. Nature, 2005.

“This mechanism is likely to underlie much of "epigenetics", which plays a huge role in cancer, childhood diseases (imprinting) and much more, as well as underlying somaclonal variation, polyploidy and perhaps hybrid vigor in plants.”

- Robert A. Martienssen



Topics

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Challenges

- Overcome 20th Century Barriers
- Enhance Diversity
- Increase Investment
- Reshape Education
- Redefine Communication

Overcome 20th Century Barriers

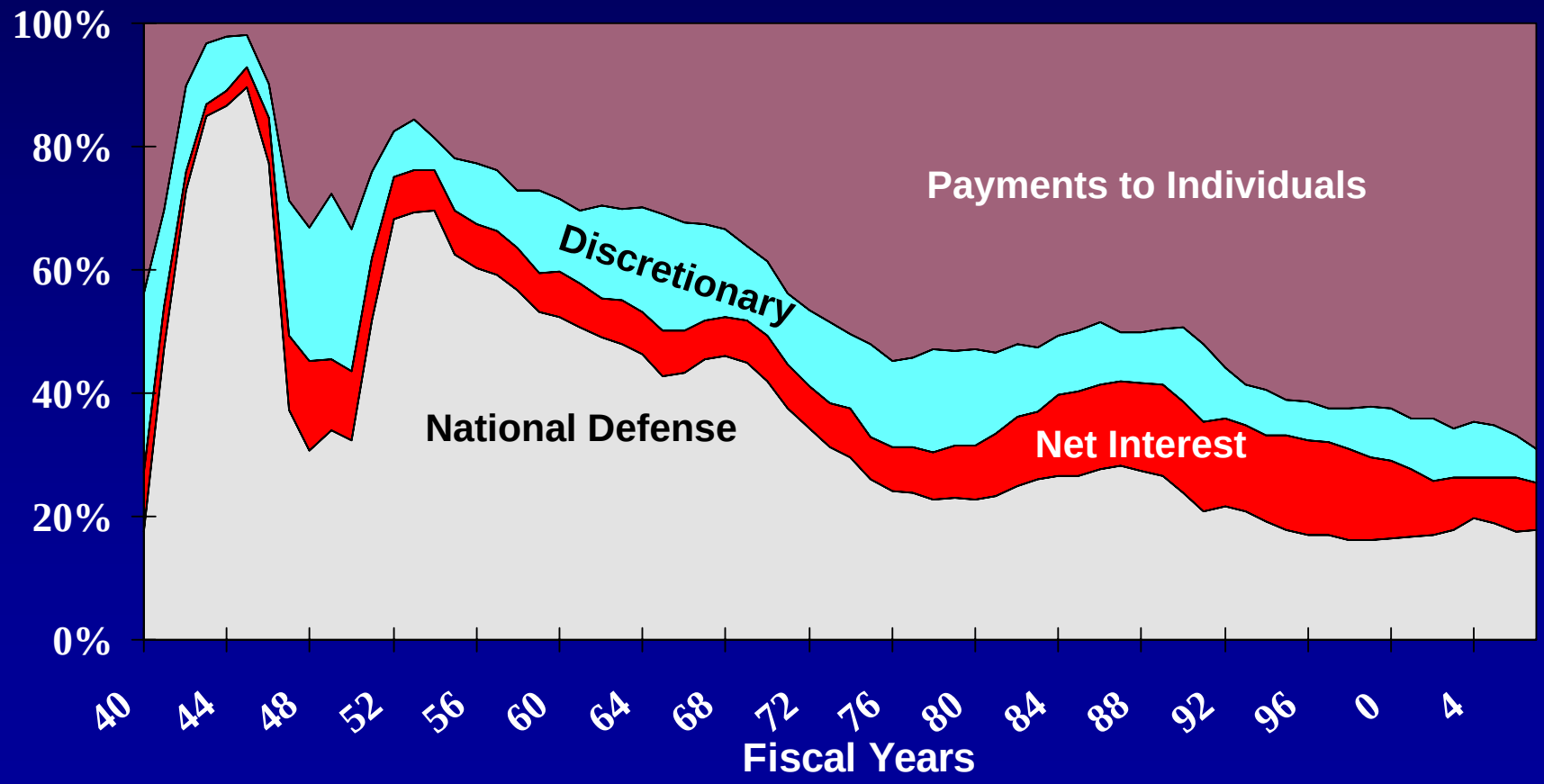
- Boxology
  - Disciplinary barriers
  - Academic barriers
  - Federal agency barriers
  - Geographic boundaries

Enhance Diversity

- Broaden Participation
  - Tap diversity of human resources in the US
  - Include diverse institutions

Increase Investment

Percentage Composition of Federal Government Outlays (FY 2004 = $2.32 T)



Source: Outlays by Superfunction and Function, Office of Management and Budget

Reshape Education

- Reshape education of scientists and engineers
  - Revamp the undergraduate curriculum
  - Emphasize cross disciplinary / cross institution teams
  - Focus on K-12 Math & Science
  - Promote international experience

Redefine Communication

" In the next 25 years we are going to have to teach biologists another language. I don't know what it is called yet. Nobody knows. "

- Sydney Brenner

"A new generation of young scientific talent from all disciplines across the world will be needed to become this language's first native speakers."

- Torsten Wiesel

Partnerships

Meeting these challenges will require the development of effective partnerships among Federal agencies, the private sector, state governments and international organizations.

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Alice laughed. 'There's no use trying,' she said: 'one CAN'T believe impossible things.'

'Why, sometimes I've believed as many as six impossible things before breakfast,' said the Queen.

Through the Looking Glass
Lewis Carroll

Predictions

#10 The brain drain will become the global knowledge flow.

Predictions

9 The disciplines will merge or coalesce.

Predictions

8 The federal investment in non-medical biology will grow to equal the medical.

Predictions

7 Public-private partnerships will increase.

Predictions

6 The total investment in R&D will quadruple.

Predictions

5 Students will be trained to be fearless scientists.

Predictions

4 Diversity issues will no longer be issues.

Predictions

3 The epigenome will be decoded leading to a deeper understanding of biocomplexity.

Predictions

2 A new scientific language will be invented and spoken by scientists not yet born across the globe.

Predictions

1 …

Kit Bond will live forever!!

American Society of Plant Biologists

Predictions

10. The brain drain will become the global knowledge flow.
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7. Public-private partnerships will increase.
6. The total investment in R&D will quadruple.
5. Students will be trained to be fearless scientists.
4. Diversity issues will no longer be issues.
3. The epigenome will be decoded leading to a deeper understanding of biocomplexity.
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