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Biocomplexity in the Environment

- The vision
- The competition
- Examples

The vision

- Enhance understanding of the nature and dynamics of biocomplexity *in the environment*.

The means

- Integrative approach to modeling, prediction, and system understanding
- Study systems in the large rather than component by component

What is biocomplexity?

- Roughly speaking: complexity + biology *(+ environment)*
- Complex behavior arising from dynamic interactions among biological, physical, and social components of the Earth s diverse environmental systems

Complex systems share features

- Nonlinear dynamics
- Chaos, stochasticity/uncertainty
- Interactions between multiple scales (time, space, number)
- Emergent phenomena

Biocomplexity in the environment is interdisciplinary

- Must have biology
- Must have environmental aspects
- Must have quantitative elements (math, stat, modelling)

Biocomplexity competition builds on earlier activities

- KDI (Knowledge Networking and especially New Computational Challenges), Grand Challenges
- Specific activities within NSF divisions
- FY99 competition
  - about 100 preproposals, 34 proposals
  - 7 awards, about $25M

Biocomplexity competition is constrained

- Proposals must have
  - biological aspects
  - environmental aspects
  - quantitative elements
  - complexity
- Proposals must have math or statistics or modeling expert

Biocomplexity competition is constrained .. 2

- Proposals must present conceptual, mathematical, or computational model framing the research
- Proposals must describe how the work leads to a predictive understanding of the system studied

Biocomplexity competition is constrained .. 3

- Investigators may not participate in more than two proposals

Biocomplexity competition has a tight schedule in 2000

- Letters of intent by **JANUARY 31,** by email to biocom@nsf.gov
- Proposal deadline **MARCH 1, 2000**
- Proposals **MUST** be submitted via FastLane
- Awards **SEPTEMBER, 2000**

... a tight schedule

- Mail and panel review of proposals
- Panels in June
- Awards in September

Biocomplexity invites two kinds of proposals

- Research Projects
- Incubation Activities

Research Projects must be interdisciplinary

- Letter of intent STRONGLY ENCOURAGED by **JANUARY 31**
- Up to 5 years, up to $600K/year (up to $1M with strong justification)
- $45M; about 20 awards
- Must address uncertainty issues in design and analysis

Incubation Activities encourage new interactions

- Letter of intent not required
- Up to 2 years, up to $100K total
- $5M; about 50 awards
- For focused workshops, virtual meetings, beginning activities, planning grants

Biocomplexity is a long-term NSF opportunity

- We expect to run further competitions
- We expect to broaden the areas of emphasis beyond environment

Biocomplexity examples span science and engineering

- Bioremediation: flows in porous media from pore to field level scales
- Role of marine organisms in trace gas dynamics between ocean and atmosphere; consequences for heat balance, carbon cycling

Biocomplexity examples span science and engineering ... 2

- Extreme ecosystems in Antarctic dry valleys: interactions between paleoenvironmental conditions, short-term physical and chemical processes, and small spatial scale biological processes
- Diversity and adaptation of human species to environments

Biocomplexity examples span science and engineering ... 3

- Land cover: interactions between human activities and ecosystem functions on local to regional scales
- Invasive species: all space and time scales; effects on human interests (health, economics, cultural values)
- Environmental effects of manufacturing processes and materials

The bottom line

- There is lots of $$
- NSF will do this again, with more $$
- Interdisciplinarity is a must
- Keep it thematic