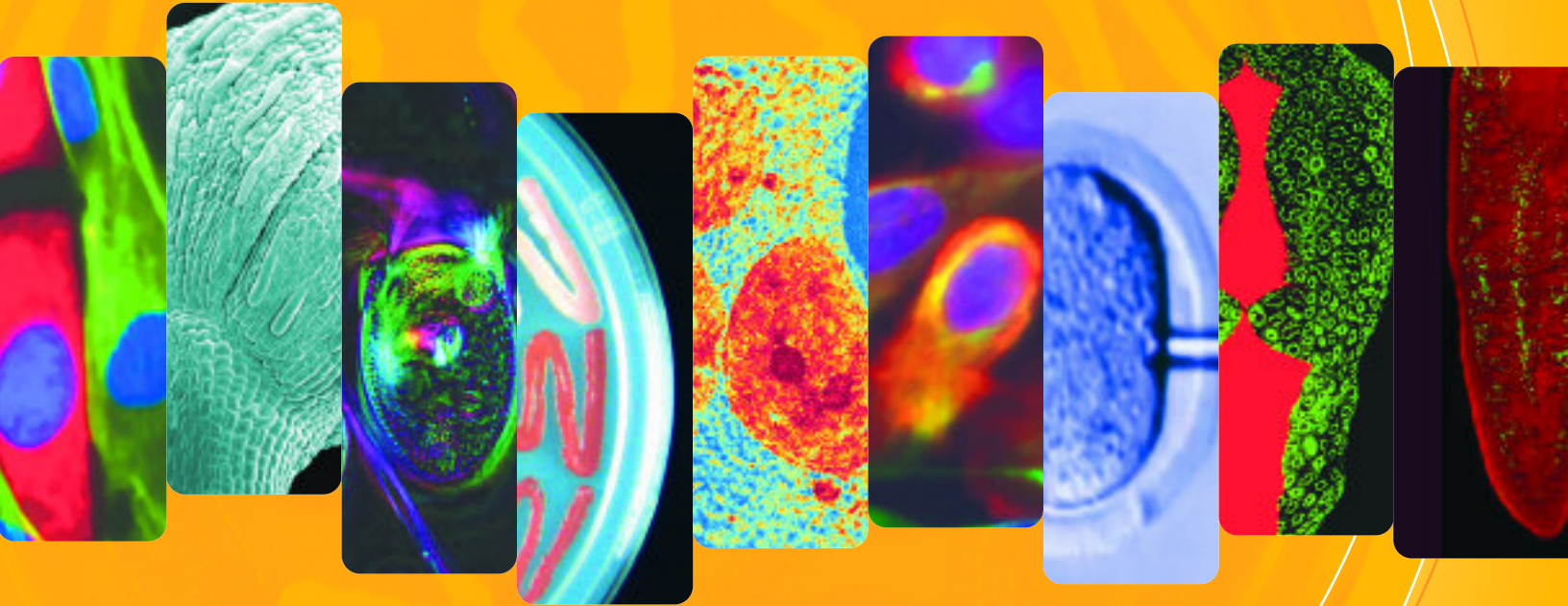




WHITEHEAD INSTITUTE



At biology's frontiers...

## WHITEHEAD'S FOUNDING VISION

Whitehead Institute for Biomedical Research is a non-profit, independent research and educational institution with pioneering programs in stem cells, cancer research, immunology, neurological disorders, developmental biology, genetics and genomics. It was founded in 1982 through the generosity of Edwin C. “Jack” Whitehead, a businessman and philanthropist whose dream was to create a new type of research enterprise—one that could exist independently, yet fully benefit from partnering with a world-class academic institution. This dream was realized in 1982 when Whitehead Institute was established with a faculty and teaching affiliation with Massachusetts Institute of Technology. Since then, through new waves of innovation, Whitehead researchers continue to refine and redefine our understanding of how life works.

## THE INSTITUTE TODAY

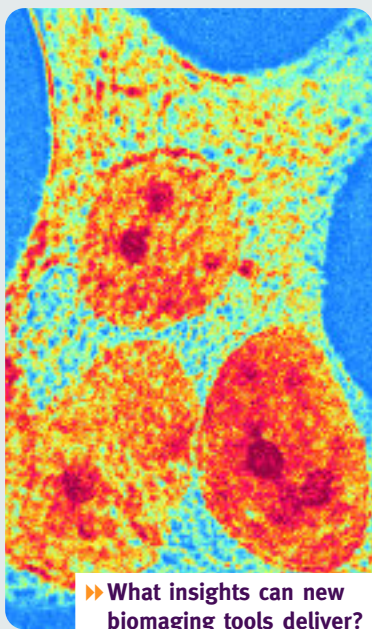
True to its founding vision, the Institute gives outstanding young investigators broad freedom to pursue new ideas. Less like a traditional lab and more like an artists' colony, Whitehead encourages its researchers to step out into bold new areas of inquiry and to ask the questions that no one else is asking. This requires supplementing federal research grants with major funding from the Institute's endowment and from individuals, foundations and corporations.

Research at Whitehead is conducted by a total of 20 principal investigators (15 Members and 5 Fellows) and more than 200 visiting scientists, postdoctoral fellows, graduate students and undergraduate students from around the world.

## AN EXTRAORDINARY IMPACT

Whitehead is small, but its impact is immense. Its research is so widely cited in the scientific literature that it has been ranked among the world's top three life-sciences research institutes.

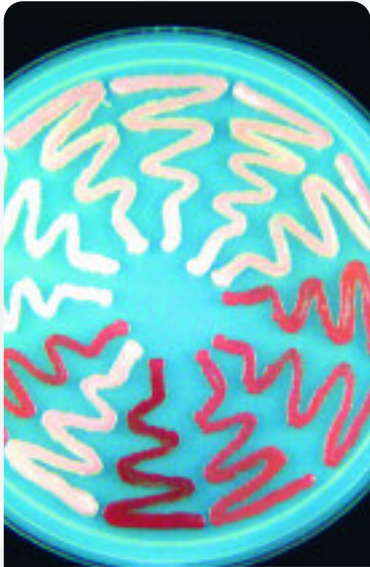
Among other accomplishments, Whitehead researchers are deciphering the genetic roots of cancer, unraveling the essence of how stem cells operate and discovering the circuitry of devastating neurological conditions such as Alzheimer's and Parkinson's. The Institute is living proof that when a small group of the top researchers is brought together in a highly collaborative and supportive environment and encouraged to pursue the questions that intrigue them, great things happen.



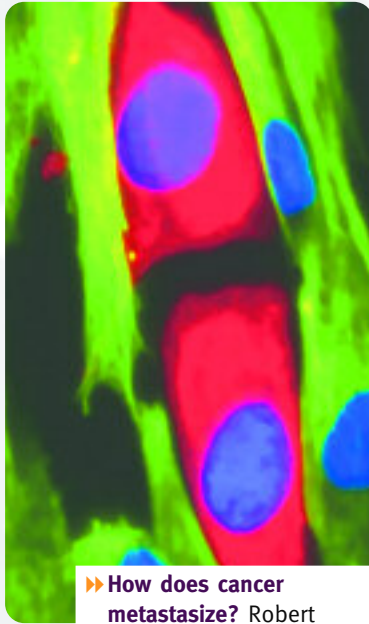
### »» What insights can new biomaging tools deliver?

Paul Matsudaira's lab and the Whitehead-MIT BiImaging Center make discoveries based on powerful images such as this nucleic acid map highlighting the distribution of DNA and RNA within a cell.

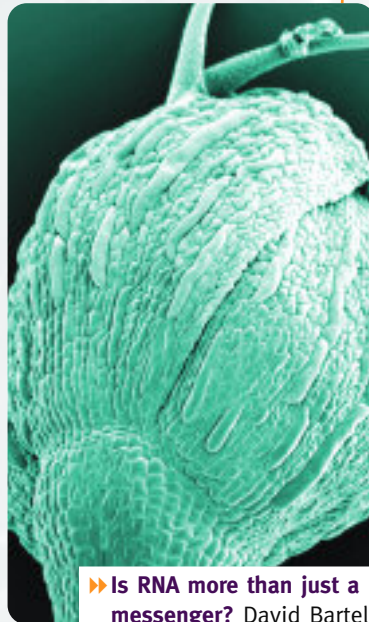
## DISCOVERY BEGINS BY ASKING QUESTIONS:



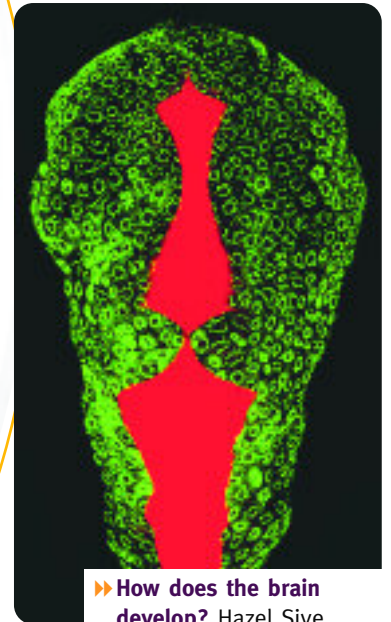
» **What can yeast tell us about Alzheimer's?** The laboratory of Susan Lindquist uses yeast cells as living test tubes to analyze the role of protein misfolding in disease and health.



» **How does cancer metastasize?** Robert Weinberg's lab studies how tumors replicate themselves in different parts of the body.



» **Is RNA more than just a messenger?** David Bartel and colleagues have found that microRNAs influence and help regulate most of the human genome, and play a key role in other organisms such as the moss here.



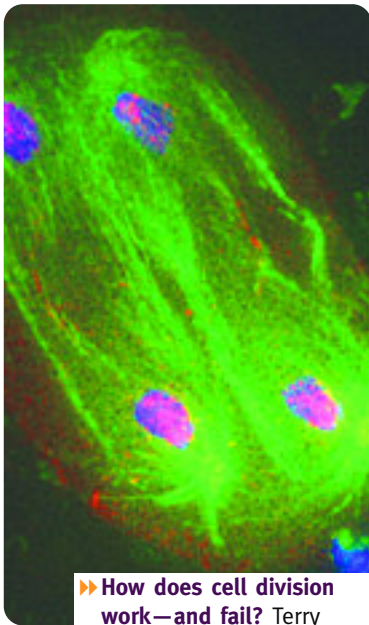
» **How does the brain develop?** Hazel Sive researches the mechanisms of very early brain development in zebrafish, work that sheds light on how the process works in mammals.

## CURIOSITY AND COLLABORATION DRIVE THE SCIENCE

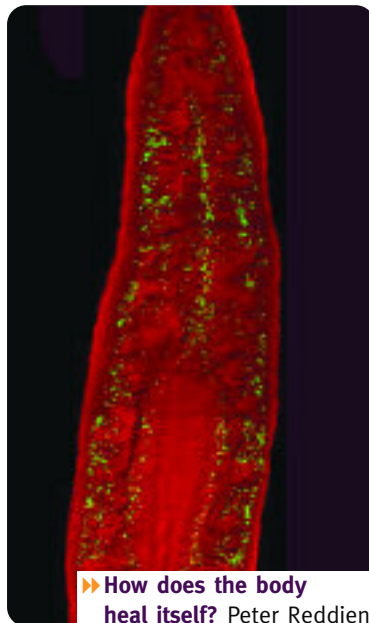
Over the last year, Whitehead scientists have identified many pivotal biological processes, laying a foundation that others in the world of biomedicine will continue to build upon. These discoveries have provided deep insights into embryonic stem cells, microRNAs, protein misfolding, pathogenic fungi and other phenomena. More precisely:

- Researchers in Harvey Lodish's lab developed a protein cocktail that caused a 30-fold increase of mouse blood stem cells, an accomplishment that may increase the effectiveness of bone marrow transplants and gene therapy.
- Scientists in Susan Lindquist's lab identified the precise structure of amyloid fibers—the plaque found in neurons of people with neurodegenerative illnesses such as Alzheimer's and Creutzfeldt-Jacob disease.
- Researchers from the Richard Young and Rudolf Jaenisch labs have begun to map the molecular circuitry in human embryonic stem cells that gives them such extraordinary ability to create almost any adult cell.

- In a move that offers a potential compromise in the embryonic stem cell debate, the Jaenisch lab created an embryo-like entity in mice that cannot develop into a fetus but can yield perfectly normal stem cells.
- Scientists in the Jaenisch lab also showed that stem cells derived from cloned embryos are identical to those derived from fertilized embryos—ending one part of the stem cell debate.
- Robert Weinberg's lab showed that melanoma is such a deadly form of cancer because it is born with full metastatic capacity.
- David Page's lab sequenced the chimp Y and compared it to the human Y, providing insight into the evolution of this unique chromosome.
- Gerald Fink's lab has identified a process by which pathogenic fungi—the kind that often cause fatal hospital infections—can change their shape and thus evade immune system detection.
- The Lindquist lab has identified a mechanism that enables pathogenic fungi to quickly evolve resistance to drugs.
- David Bartel's lab demonstrated that tiny microRNA molecules shape the evolution of the majority of the human genome. These findings are causing the biological community to completely rethink both the role of RNA and the mechanics of genome regulation.
- A collaboration among investigators from the Lodish and the Lindquist labs showed that the protein ultimately responsible for mad cow disease also helps to sustain blood stem cells.



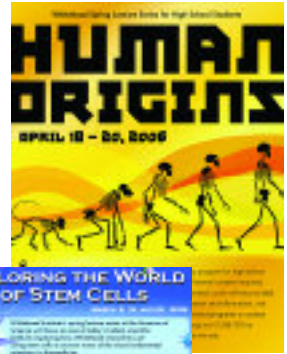
▶▶ **How does cell division work—and fail?** Terry Orr-Weaver's lab studies how chromosomes divide, a process that can lead to cancers and other deadly diseases if it goes awry.



▶▶ **How does the body heal itself?** Peter Reddien investigates the astonishing ability of planarians to regrow complete organisms from tiny fractions of tissue—research that may one day aid regenerative medicine.

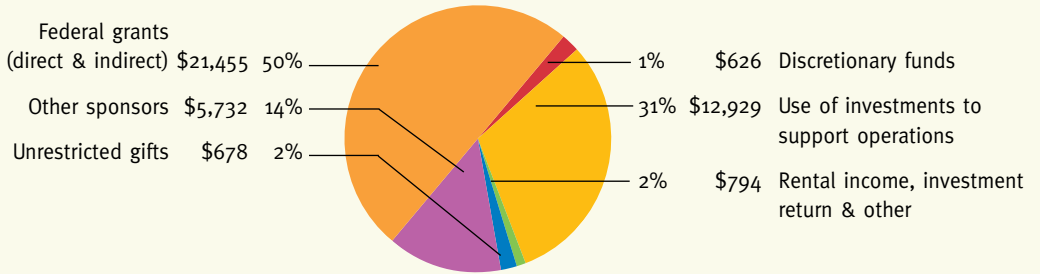
## THE PUBLIC IS ENGAGED

One of Whitehead's core missions is to help the public grasp both the potential and the implications of this astonishingly dynamic field. Outreach and education programs include the Whitehead Symposium, the Whitehead Institute/Boston Museum of Science Spring Lecture Series, the Whitehead Lecture Series for High School Students, the Whitehead Seminar Series for High School Teachers and the Whitehead Annual Press Seminar. The Institute's *Paradigm* magazine highlights advances in biomedical science while the *BiologyWeek* newsletter alerts readers to local scientific talks.

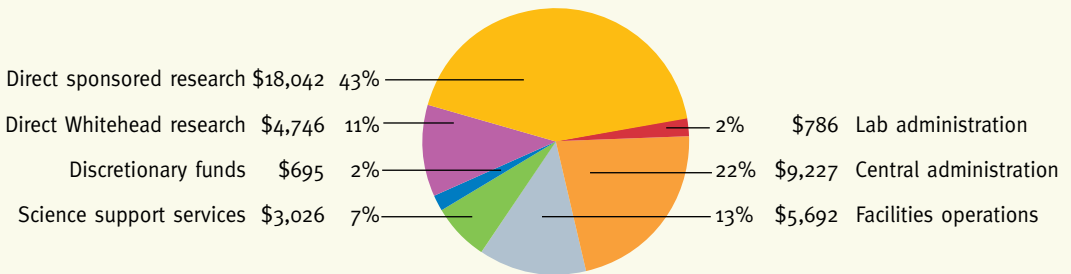


## FUNDING IS CRUCIAL

### Sources of funds (\$000) Total \$42,213



### Uses of funds (\$000) Total \$42,213



Fiscal year 2005

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### FACULTY AND FELLOWS

Whitehead faculty also are members of MIT's Biology department or other MIT departments. The Whitehead Fellows program gives exceptionally talented young scientists the opportunity to set up their own independent research programs without undertaking the full range of normal faculty duties.

### FACULTY ACHIEVEMENTS

Whitehead faculty include the recipient of the 1997 National Medal of Science (Weinberg), eight members of the National Academy of Sciences (Fink, Jaenisch, Lander, Lindquist, Lodish, Orr-Weaver, Page and Weinberg), seven Fellows of the American Academy of Arts and Sciences (Fink, Jaenisch, Lander, Lindquist, Lodish, Ploegh and Weinberg) and three Howard Hughes Medical Institute Investigators (Bartel, Lindquist and Page).



WHITEHEAD INSTITUTE FOR BIOMEDICAL RESEARCH

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