

# Science Education & Communication

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# Biology

- The framework for understanding the function of an organism
- The "theology" of our profession

# Mentorship

New, multidisciplinary,  
rigorous approach to the  
education of the  
physician-scientist

# Biology

An elegant expression of  
chemistry, physics, and  
mathematics

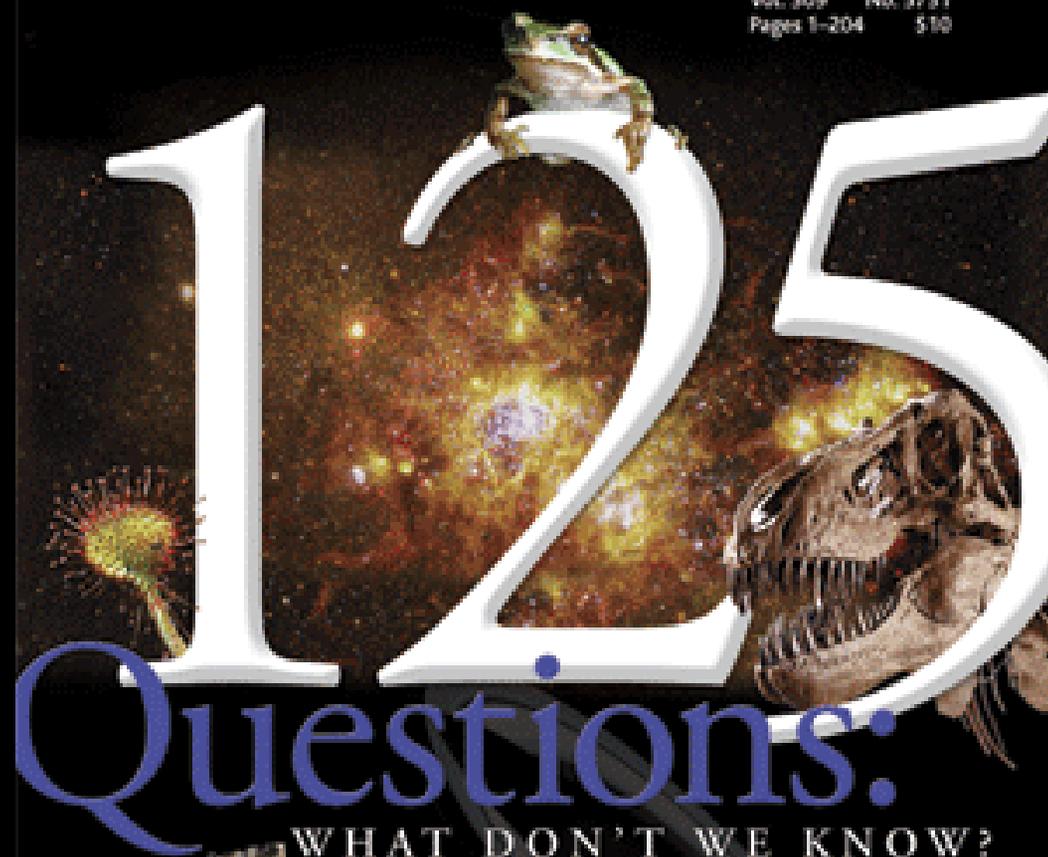
# Science

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# 125

Questions:  
WHAT DON'T WE KNOW?

A central graphic featuring the number '125' in large, white, 3D-style font. A small green frog is perched on the top of the '2'. The background is a dark space filled with a vibrant, multi-colored galaxy. To the left of the '1' is a green, spiky virus-like structure. To the right of the '5' is a brown dinosaur skull. Below the '125' is the word 'Questions:' in a blue, serif font, followed by 'WHAT DON'T WE KNOW?' in a smaller, white, sans-serif font. At the bottom left, a portion of a Mars rover is visible. A large, dark, circular shape, possibly a planet or moon, is partially visible in the lower right.

AAAS

What is the biological basis of consciousness?

Why do humans have so few genes?

To what extent are genetic variation and personal health linked?

How much can human life span be extended?

What controls organ regeneration?

How can a skin cell  
become a nerve cell?

How does a single somatic cell  
become a whole plant?

What genetic changes made us  
uniquely human?

Is an effective HIV vaccine  
feasible?

What is the nature of gravity?

Are there limits to rational  
chemical synthesis?

Can we predict how proteins  
will fold?

How many proteins are there in humans?

How do proteins find their partners?

How many forms of cell death are there?

What keeps intracellular traffic running smoothly?

What enables cellular components to copy themselves independent of DNA?

What roles do different forms of RNA play in genome function?

What role do telomeres and centromeres play in genome function?

Why are some genomes really big and others quite compact?

What is all that "junk" doing in our genomes?

How much will new technologies lower the cost of sequencing?

How do organs and whole organisms know when to stop growing?

How can genome changes other than mutations be inherited?

How is asymmetry determined in the embryo?

How do limbs, fins, and faces  
develop and evolve?

What triggers puberty?

Are stem cells at the heart of all  
cancers?

Is cancer susceptible to  
immune control?

Can cancers be controlled rather than cured?

Is inflammation a major factor in all chronic diseases?

How do prion diseases work?

How much do vertebrates depend on the innate immune system to fight infection?

Does immunologic memory  
require chronic exposure to  
antigens?

Why doesn't a pregnant woman  
reject her fetus?

What synchronizes an  
organism's circadian clocks?

How do migrating organisms  
find their way?

Why do we sleep?

Why do we dream?

Why are there critical periods  
for language learning?

Do pheromones influence  
human behavior?

How do general anesthetics  
work?

What causes schizophrenia?

What causes autism?

To what extent can we stave off  
Alzheimer's?

What is the biological basis of  
addiction?

Is morality hardwired into the  
brain?

How are memories stored and retrieved?

How will big pictures emerge from a sea of biological data?

How far can we push chemical self-assembly?

Can we selectively shut off immune responses?

# Physician-scientist Education

- Begins in undergraduate programs
- Understanding of the human organism is the ultimate goal

# Undergraduate Education of the Future Physician-scientist

- Chemistry, physics and mathematics departments need to come together and teach biologically relevant content, in a **RIGOROUS** way.
- Strengthen requirements in science for medical school admission

Systems biology is the “study of biological processes using a combination of mathematics, computation and empirical observation.”

- Peter Sorger, Harvard Medical School

# Physician-scientist Education

- MD - 17,000/year
- MD/PhD - 200/year
- Other – new programs to embed rigorous scientific training in MD matriculants

# Physician-scientist Education

- Complement traditional MD and MD/PhD training by informing the study of the human organism
- New leaders of “translational” research
- Multidisciplinary approach
- More rigorous education in defined scientific discipline (a major)
- 5-6 year program

# Physician-scientist Education

- The next generation of physician-scientists, whatever degree or degrees we impart on them, must be unquestionably credible and credentialed.
- The focus on the human organism should **NOT** be an excuse for warm and fuzzy science.

# Physician-scientist Education

- The training of the physician-scientist does not begin and end in the classroom and laboratory
- The greatest inspiration for the inquiring mind should be the clinical setting

Physician-scientist trainees,  
with wonderful inquiring  
minds, enter a busy  
residency program and see a  
necessity to suspend  
intellectual curiosity.

Search results for: **Intellectual Function, Altered**

**Adult Medicine, Obstetrics and Gynecology** (1 title)

Most Relevant Topics:

- Just Rx Mrs. Jones and get her out of the hospital

No matter how creative we  
are in educating the  
physician-scientist, all will  
be for naught if we do not  
regain for them their most  
precious resource:

the patient

# Time for reflection

**Nobelprize.org**

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By Year | Nobel Prize in Physics | Nobel Prize in Chemistry | **Nobel Prize in Medicine** | Nobel Prize in Literature | Nobel Peace Prize

Medicine

## The Nobel Prize in Physiology or Medicine 2005

"for their discovery of the bacterium *Helicobacter pylori* and its role in gastritis and peptic ulcer disease"



Photo: C. Northcott

**Barry J. Marshall**

1/2 of the prize



Photo: U. Montan

**J. Robin Warren**

1/2 of the prize

Printer Friendly  
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The 2005 Prize in:  
Medicine

Prev. year

The Nobel Prize in Physiology or Medicine 2005

Prize Announcement  
Press Release  
Presentation Speech  
Illustrated Presentation

**Barry J. Marshall**

Autobiography  
Curriculum Vitae  
Nobel Lecture  
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Documentary  
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By Year | Nobel Prize in Physics | Nobel Prize in Chemistry | **Nobel Prize in Medicine** | Nobel Prize in Literature | Nobel Peace Prize

Medicine

## The Nobel Prize in Physiology or Medicine 1985

"for their discoveries concerning the regulation of cholesterol metabolism"



**J. Vane**

**S. Hammarström**

Medicine is more than simply the compassionate application of received wisdom, it is also the challenging of old customs, and the development of new insights.

Communication of  
science to the  
public, Congress,  
and the press

Training new physician scientists will be a hollow achievement without society's understanding, celebration, and investment in their endeavors.

A large, dense crowd of people, likely at a public event or festival, is shown in the background. The crowd is diverse in age and appearance, with many people wearing light-colored clothing. The text is overlaid on this background.

# The Good News

**2/3 of the public  
supports increasing  
public funding for  
biomedical research**



# The Bad News

Less than 10% of the public can identify a research institution in their area



2/3 of Hill  
staffers  
don't know  
where NIH  
funding  
goes

So who is to blame for this  
appalling lack of  
understanding of the  
investment in biomedical  
research?

We have to take much of  
the blame.

Media reporting presents two sides to every argument, giving the impression that there is a balanced debate about science, when in fact equal time, space, or credibility is given to a minority point of view.

# Solutions

- Make education of the public about science an equal priority with the education of the physician scientist.
- Let our trainees know that it is not only alright to educate the press, but a responsibility.
- Equip our trainees with skills to write and communicate their science not only to their peers, but to the lay public.