Problems Undermining Public Confidence in and Understanding of Research

- Failure to explain the importance of basic biomedical research to advances in medical practice

Top Ten Medical Advances in Heart and Lung Diseases, 1930-1970

- Cardiac surgery
- Vascular surgery
- Drug treatment of hypertension
- Treatment of angina and heart attack
- Cardiac resuscitation
- Oral diuretics
- Intensive care units
- Antibacterial drugs
- Detection of disease at early stage
- Prevention of polio

What Research Led to the Top Ten Medical Advances?

- 140 consultants
- Reviewed over 4,000 articles
- Identified 137 essential bodies of knowledge that made the medical advances possible

Comroe JH, Dripps RD. Science 1976;192:105

Essential Knowledge that Made Cardiac Surgery Possible

Preoperative Diagnosis of Cardiac Defects

- Anatomy/physiology of heart and circulation
- Electrocardiography

Preoperative Care

- Blood groups/transfusion biology

Intraoperative Management

- General anesthesia
- Heart-lung machine

Postoperative Care

- Treatment of infections

Essential Knowledge That Made Heart-Lung Machine Possible

- Basic understanding of the exchange of oxygen and CO_2 between lung and blood
- Basic understanding of the blood's clotting systems, and the development of anticoagulants for therapeutic use

Relative Contribution of Basic and Applied Research to the Top Ten Medical Advances

Basic research: **Author made no mention of any possible diagnostic, therapeutic or other medical application**

Basic research:	**41% of publications**
Applied research:	**59% of publications**

RNA Interference

- Nobel Prize in Medicine, 2006
- Simple and precise technology for turning off the expression of specific genes
- Potential in treating human disease
- Powerful tool for discovering disease-related genes

The Story of a Purple Petunia

Problems Undermining Public Confidence in and Understanding of Research

- Failure to explain the importance of *basic* biomedical research to advances in medical practice
- Failure to explain contradictory results from *applied* biomedical research

Hormone Therapy and Heart Disease

1990's: Observational studies involving millions of patient-years find a nearly 50% *reduction* in heart disease, among users of hormone therapy

2002: Randomized controlled trial finds a 29% *increase* in heart disease, among users of hormone therapy

A New Truth?

- Overnight, the "new truth" emerged: hormone therapy *increases* the risk of heart attacks
- Millions of women stopped hormone therapy—and symptoms of menopause returned in many
- A price worth paying?

The Observational Studies and Randomized Trial Are Both Right: *The Age Effect*

- Estrogen slows the development of atherosclerosis in young women and for 10 years after the start of menopause
- Thereafter, estrogen makes plaques of atherosclerosis more likely to rupture and cause a heart attack
- Therefore: Estrogen *reduces* the risk of heart attack in *younger* women, and *increases* the risk in *older* women

The Observational Studies and Randomized Trial Are Both Right: *The Age Effect*

- Women in the observational studies were in their late 40's and early 50's
- Women in the randomized trial had an average age of 63!
- In the few older women in the observational studies, hormones had little protective effect
- In the few younger women in the randomized trials, hormones had a protective effect