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