



# RESEARCH METHODOLOGY

AUTUMN SEMESTER, 2021

**AMITABHA LAHIRI**

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

LECTURE N+6 10-12-2021

# MORALITY VS ETHICS

- ✿ **Morality is a person or society's idea of what is right or wrong, especially in regard to a person's behavior**
  - ✿ People who act purely out of self-interest are often thought of as immoral or selfish
- ✿ **Ethics are closely related to morals**
  - ✿ Often used as a set of moral principles applied to a narrow area of activity
- ✿ **Ethics refer to community values rather than personal values**
- ✿ **A system of values determined by a community**
- ✿ **Ethical issues in research are often related to how society views the research**
  - ✿ Society as a whole, as well as community of scientists

# SOCIAL IMPACT OF RESEARCH

- **Medical discoveries and inventions have direct impact**
  - Malaria parasite (Ross)
  - Penicillin (Fleming)
  - Polio vaccine (Salk)
  - ORS (De, Mahalanabis)
- **Saved billions of lives**

# SOCIAL IMPACT OF RESEARCH

## ➤ Technological discoveries and inventions

- Electricity generation and transmission (Edison, Tesla)
- Wireless communication (Radio, TV)
- Aircraft (Wright)
- Transistors (Bardeen, Shockley, Brattain)
- MOSFET (Atalla, Kahng)
- Artificial Satellites (Weather, communication)

# SOCIAL IMPACT OF RESEARCH

- Theoretical discoveries satisfy intellectual curiosity
- **Fermat's Last Theorem**
  - $a^n + b^n = c^n, \quad a, b, c, n \in \mathbf{N}$
  - **Theorem:** There is no solution for  $n > 2$
  - 1637 – 1995
- **Cosmological theories and discoveries**
  - Origin of the Universe
  - Big Bang
  - Star/Galaxy formation, dark matter ...

# SOCIAL IMPACT OF RESEARCH

- Theoretical discoveries satisfy intellectual curiosity
- Astronomical discoveries
  - Distant galaxies, nebula – Hubble space telescope (big science)
  - Exoplanets
- Discovery of elementary particles
  - Higgs boson – Large Hadron Collider (also big science)
  - String theory
- Gravitational waves – LIGO (also big science)

# UNETHICAL RESEARCH

- Gives science a bad name
- Erodes public trust in scientists
- Human Medical Experiments (state-sponsored)
  - Nazi Germany
  - Soviet Union
  - United States of America
  - Japan, Great Britain, North Korea, China?

# NAZI HUMAN EXPERIMENTS

- Concentration camps 1940-45
- On Romani, Sinti, ethnic Poles, Soviet POWs, disabled Germans, and Jews
- Crimes tried in Doctors' Trial at Nuremberg
  - US military courts, not International Military Tribunal
- Defence was “military necessity”
  - Victims compared to collateral damage in allied bombings
- Auschwitz – Josef Mengele – twins
- Frozen, given diseases, gas, , poison; sterilization and fertility experiments



# SOVIET HUMAN EXPERIMENTS

- Not a lot of information
- Poison experiments
  - Different poison gases tried on prisoners from the gulags
- Human Ape breeding
  - Did not work
- Experiments with dogs
  - Unethical animal experiments (will not discuss)

# U.S. HUMAN EXPERIMENTS

- Throughout U.S. history, but most in the 20<sup>th</sup> century
- Many sponsored by CDC, Military, CIA, or corporations tied to the military
  - Usually kept a secret, often for many years afterwards
  - Done without knowledge of people's representatives
  - Often violated U.S. law
  - Always done without consent or knowledge or informed consent of subjects
- Many done on children, or sick, or mentally disabled
- A large portion on the poor, or prisoners, or racial minorities

# U.S. HUMAN EXPERIMENTS

- Surgical experiments enslaved black women (1840s)
- Spinal taps on children to see if they were harmful (1890s)
- Experiments on children with cerebral palsy (1950s)
- Tuskegee Syphilis experiment on black males (1932-72)
- Deliberately infecting people to study diseases
- Human radiation experiments
- Chemical experiments
- Psychological and torture experiments