Lecture 09
The emergence of biotechnology
DNA and Polio

Introduction (the first time we will look at 20th scientific breakthroughs):
- did not start to see inside human body to see what is going on until the 20th C.

Genetics to 1950:
- with Darwin and evolution (1860), know there must be some mechanism that allows for both the transmission and change of the characteristics of living things
- Gregor Mendel (1866, rediscovered in 1900) establish the rules for transmission and change
- 1902, American, Sutton, links genes to chromosomes
  * chromosomes could be seen, knew we essential parts of cell nucleus
- by early 20th C. also were gathering information about the chemistry of cells
  * nucleic acids discovered in the 19th C.
  * early 20th C. had isolated four base components
    > adenine
    > guanine
    > cytosine
    > thymine
  * also had distinguished between deoxyribonucleic and ribonucleic acid
- discovery of transforming principle (early 1940s, Avery):
- bacteriophage experiments (key one, 1952, St. Louis Phage group)
  * phage discovered in 1919, not seen until 1940
  * 1952 experiment
- one other related strand: in 1951, Linus Pauling discovered the proteins are chains of amino acids in a helical band
  * key method was X-ray crystallography
The Double Helix

- 1952, James Watson, who had been working with St. Louis phage group decides to go to England to work on DNA structure
  * worked mostly with Francis Crick, PhD student at Cambridge
  * gathered data from many sources, perhaps not in strictly ethical ways, especially from the crystallographer, Rosalind Franklin
  * put data on bases, etc. together to come up with double helix theory
  * published results in Nature in March 1953

- solution
  * DNA is made up of paired bases
    > adenine-thymine
    > guanine-cytosin
Introduction - The Conquest of Polio

The defining event in 1954:

- The conquest of Polio
  • Jan 1954, Salk and Francis begin field tried on 1.5 M children
  • Spring of 1955, announced the results in Rackham
  • within a year, we were inoculated, the number of cases declined

- Impact of the disease and announcement of cure is hard to imagine
  • childhood disease
  • vaccine changed all of this, literally wiped out the disease as far as public
    in US was concerned
  • second great medical miracle, the first being penicillin during the war

Early history of Polio

- discovery and early history
  • recognized in Europe, early nineteenth C.
  • first U.S. epidemic 1894
  • 17 epidemics over next decade
  • first systematic studies begun in 1907 by Simon Flexner, Rockefeller
    Institute, NY

- Flexner's solution, the basis of a Nobel Prize
  • 1908, Swedish scientist used emulsion of spinal cord of victim to transfer
    disease
  • between 1909 and 1914, Flexner
  • received Nobel prize, set pattern for next 25 years of research

- period of no progress follows
  • were not sure what a virus was
    • first virus not crystallized until 1935; tobacco virus, isolated by
      Wendell Stanley
  • needed new equipment to study

New patterns of private funding,

- Franklin D. Roosevelt, support of polio research
• was himself a polio victim, ca. 1919
• 1926, sets up Warm Springs, Georgia, polio treatment center
• 1932, elected President, uses Birthday balls as polio fund raiser
• Birthday ball research had one unfortunate side effect
• 1937, Roosevelt turned attention to founding National Foundation for Infantile Paralysis

- National Foundation for Infantile Paralysis - new patterns of funding
  • were very successful in raising funds
  • set pattern for major attack on disease, under Thomas Rivers, new head of RI
  • move private funding in a new direction
  • new emphasis on training researchers for the future, rather than focusing only on funding existing researchers
  • also develop the concept of indirect costs

- the National Foundation approach to funding and the conquest of a disease will be picked up by federal government after the war and become the pattern used today

**History, 1937 - 1955, the final breakthroughs**

- the work sponsored by the Foundation slowed by WWII

- late 1930s, early 1940s, start to demonstrate that vaccines are effective against viruses
- by 1950, had demonstrated that there were 3 strains of polio
- 1949, John Enders, Harvard, successfully grew polio virus on nonnervous tissue
- 1950-51, demonstrate that virus travels through blood and not directly
- Jonas Salk then puts pieces together
- January 1954 field trials begin, conducted by Thomas Francis,
- two weeks after announcements, several vaccinated children died of polio
- 1961, Sabin oral vaccine was approved and went into production

- Government (PHS) involvement develops very slowly