

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 trial 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