

ENGR 192/292 A
Entrepreneurial Opportunities in
Healthcare and Life Science

September 29, 2009
Course Overview



Tonight's Objectives

- Introductions
- Course Objectives, Requirements, Assignments and Grading
- A Brief History of Medicine

Introductions

- Faculty
- You
 - Year (undergrad or grad)
 - Major
 - Why you took this course

Faculty and other Factoids

- Robin Campbell
 - Former Executive at Amgen
 - Current or former CEO of three early stage companies
 - Ph.D. in Microbiology/Immunology
 - Office Hours: 3-5 PM Tuesdays or by appt.
 - Trailer 937 outside Broida Hall
 - Phone: 805-796-6898
 - Email: rdcampbell77@gmail.com
- Course Website: www.ucsbengr192.com
 - Course information and presentations

Course Objectives

- 1. Understand the healthcare delivery process and the various industries and business models involved in the delivery of goods and services to patients.
- 2. Looking at a number of healthcare and non-healthcare industries, understand the concept of “disruptive technology”, how it leads to innovation and entrepreneurial opportunities, and how it might change the healthcare landscape in the future.
- 3. Understand the impacts of potential healthcare reform on the future of healthcare delivery.

Requirements and Expectations

- 192 and 292 A
 - Class attendance is mandatory
 - HOWEVER: If you have a documented case of a contagious illness (like Swine flu) you will be excused.
 - Take home exams
 - 10/13 and 11/10 ; due the following week
 - Based on lectures and readings
 - Team Assignment
 - Teams of no more than 5
 - Teams picked by 10/27, product idea by 11/10
- 292A: Individual Paper

Team Assignment

- Identify an innovative new healthcare business opportunity (that your team has thought of) and based on the course reading, speakers and class discussions, present a concise analysis of why this could be a success and the challenges that will need to be addressed and overcome.
- Oral presentations of 15 minutes in length will take place during the last scheduled class , and each member of the team will be expected to participate in the presentation.
- Teams must be established and names submitted to Robin Campbell by the start of class on October 27, and team product ideas must be submitted by start of class on November 10
- Templates for the presentations will be supplied at a later date

Individual Assignment

- No more than 4 pages in length. Topic TBA.

Grading

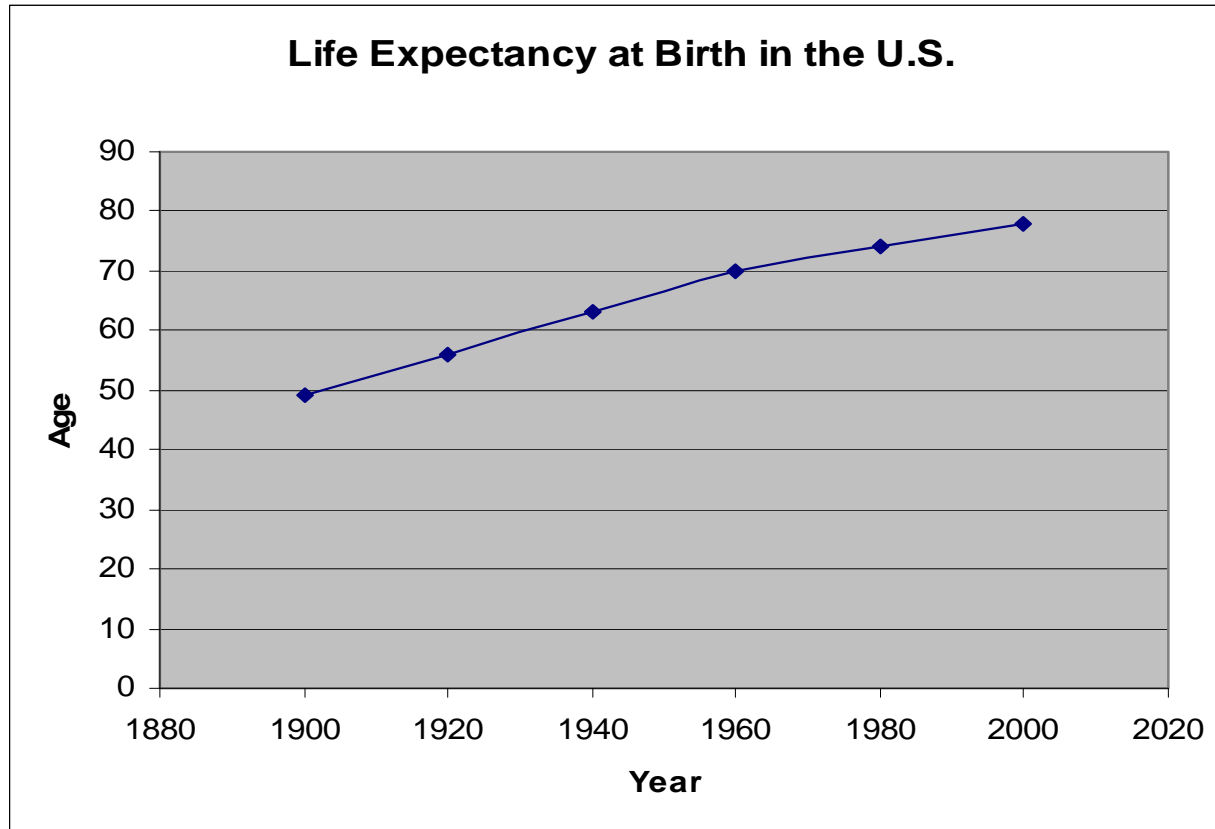
- 192A
 - 33.3% Class Attendance and Participation
 - 33.3% Take home exams
 - 33.3% Team Assignment
- 292A
 - 30% Class Attendance and Participation
 - 20% Take home exams
 - 25% Team Assignment
 - 25% Individual Paper



Class 1: A Brief History of Medicine



Life Expectancy is a Measure of Health Improvement



Being born used to be a huge risk...

Year	Percentage of Children Dying before Age 5
1730-1749	75%
1810-1829	32%
1900	13%
2004	<1%

Contributors to Improved Life Expectancy

- Public health and sanitation
- Discovery of the germ theory of disease
- Improved surgical techniques
- Understanding of the molecular basis of disease
- Improved access to health care



Public Health

Before the industrial age, cities were breeding grounds for pandemics...



“The Great Plague” was possibly the worlds greatest pandemic...

- Estimated 100 million deaths in less than 5 years
- Reduced Europe’s population by 30-60%
- Causative agent: *Yersinia pestis*
- Vector: Fleas carried by rats via trade routes
 - Amplifying factor: eradication of cats in the 1200’s and 1300’s
- Huge impact on future sanitation and vermin control

Cause of the plague was poorly understood

- Knew that rats were involved
- The more overcrowded the living conditions, the faster the spread
- Quarantine of whole towns reduced mortality
- No understanding of bacteria or germ theory

Keys to better public health

- Clean air, clean water, vector control
 - Reduction in air pollutants reduces lung disease
 - Control of contamination of water supplies
 - Sewage treatment/sequestration
 - Later, water treatment and development of municipal water supplies
 - Reduction in disease carrying vectors: rats, mice, insects
- Food handling
 - Preservation, refrigeration
- Public Policies
 - Vaccination programs
 - Reportable diseases
 - Clean air/water laws
 - Food handling laws

The Germ Theory of Disease



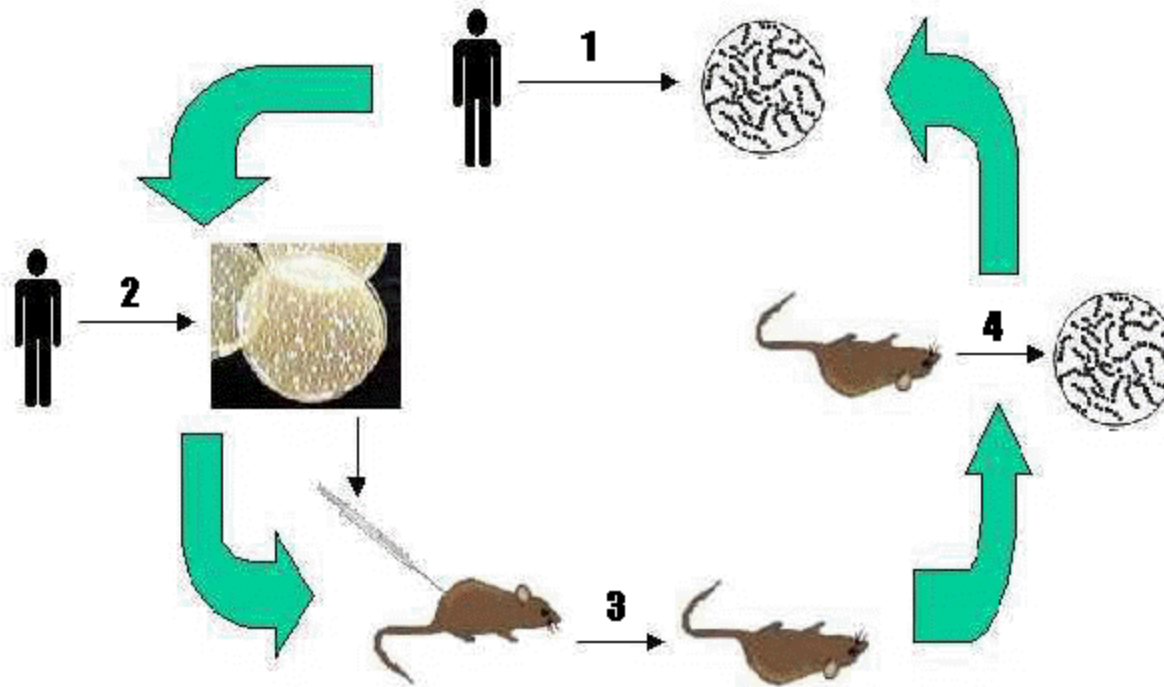
- Antonie van Leeuwenhoek discovered “animalcules” in pond water with his microscope in the 1600’s
- Even then, no one connected these to diseases
- The common theory of “animalcules” in diseased tissue was “spontaneous generation”

The final “connection”...



Pasteur and Koch confirmed the idea that “germs” cause disease in 1870s and 1880s

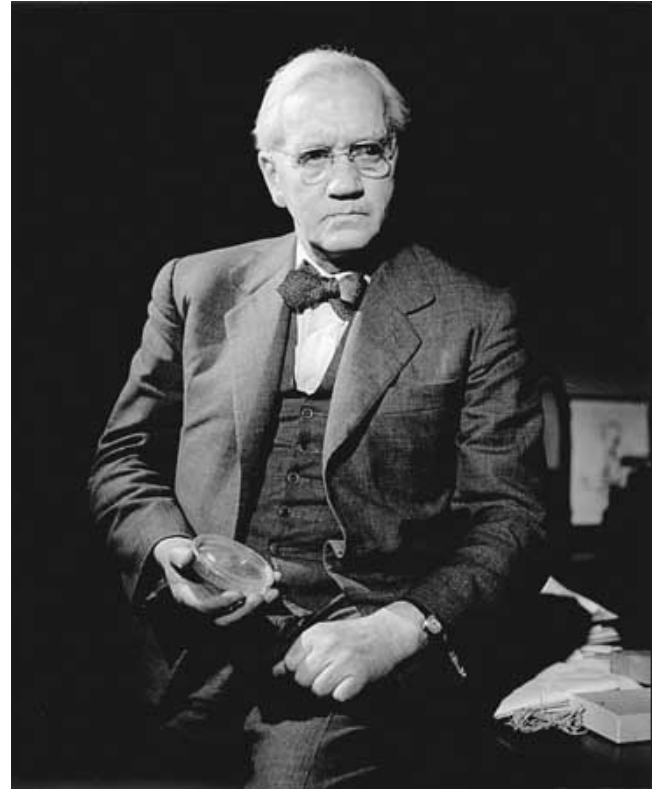
Koch's postulates became the manner in which infectious diseases, and their causes, were categorized



Rapid (sort of) development of antibiotics followed...

- Erlich, early 1900s: First chemical antibiotic
- First practical antibiotic, sulfanilamide, 1932
 - Saved many lives during World War II

Sir Alexander Fleming discovers penicillin in 1928, mass produced in 1945



Modern vaccination programs begin in the 1950's

- Polio, 1950's
- Diphtheria, Tetanus, Pertussis (whooping cough), 1950's
- Measles, Mumps, and Rubella: 1960's
 - 1958: 764,000 cases of measles in U.S., 552 deaths
 - 2008: 64 suspected cases, no deaths
- Pneumonia and meningitis, late 1980's

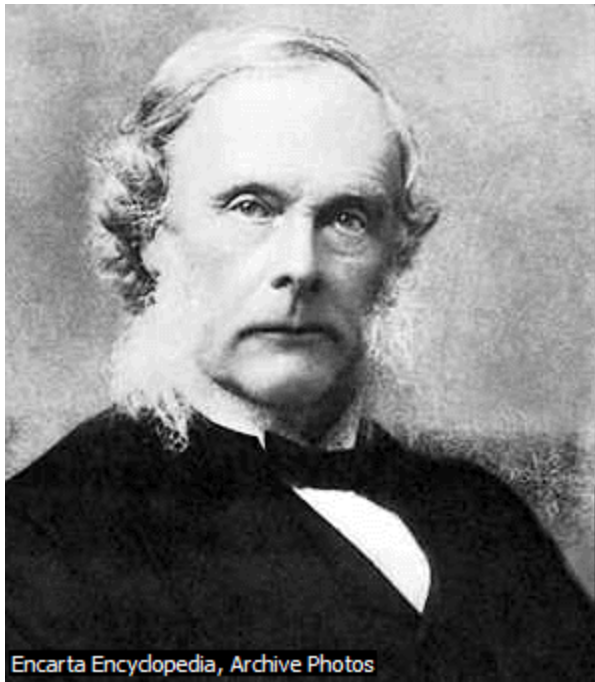
Surgery moved out of the barber shops and into the modern hospital



Effective anesthesia made practical in the 1840's by William Morton



Joseph Lister advanced sterile surgery and antiseptics in the 1860's...



- Prior to his work, surgeons didn't even wash hands (or see the need to)
- Built upon Pasteur's early work, used carbolic acid (phenol) to disinfect instruments and hands

Today...

- Minimally invasive surgery reduces hospital stay and complications
- Microsurgery/robotic surgery provides methods to get to heretofore inaccessible tissues
- Joint replacements are routine; increase mobility and reduce pain

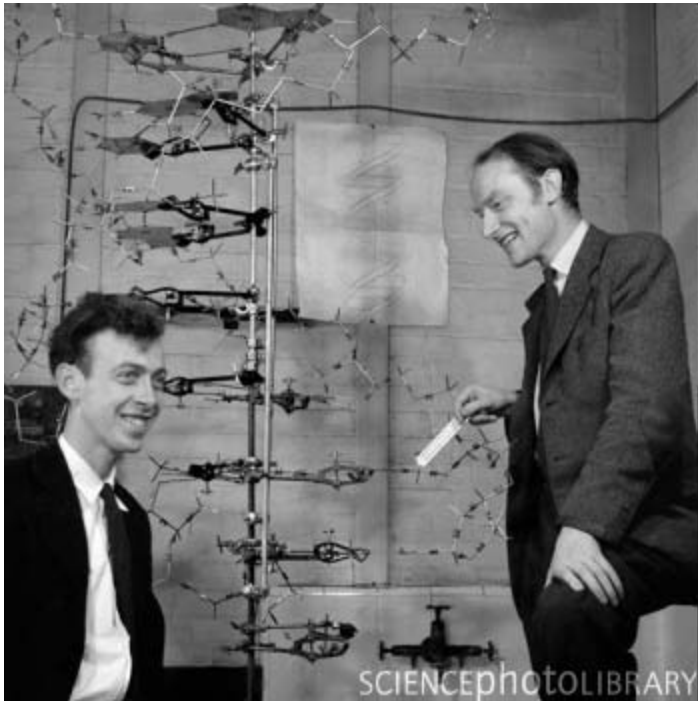
**The “Molecular Era” truly began
in the 1940’s**



How genes work became the basis of modern medicine...

- Avery, MacLeod, and McCarty discovered that DNA was the material of genes and chromosomes in 1944
- Barbara McClintock discovered how chromosomes and genes turn traits on/off in the late 40's

Watson and Crick discovered the structure of DNA in 1953



- Jump-started the fields of molecular genetics and molecular biology
- Unified the various theories of how genes might work
- While they got the structure of DNA right, they were wrong about RNA

Understanding the molecular basis of disease has led to many modern therapies...

- Chemotherapy and molecular therapies for cancer
- Anti-depressants
- Monoclonal antibodies and receptor antagonists for rheumatoid arthritis
- Agonists for asthma, antagonists for high blood pressure
- Improved diagnostics that are predictive of outcomes with certain treatments



**Access to healthcare has
improved...**



From the country doctor to outpatient surgery...

- Modern physicians can treat many illnesses without hospitals
- Many surgeries can be performed in specialty outpatient clinics
- Improved trauma care reduces mortality due to accidents
- Modern communications allow long-distance consultations
- Retail pharmacies allow easy access to medications
- The internet has created much more informed patients

So what has all this done for life expectancy?

- Top 10 causes of death in 1900
 - Pneumonia
 - Tuberculosis
 - Diarrhea/Enteritis
 - Heart disease
 - Stroke
 - Kidney Disease
 - Accidents
 - Cancer
 - Senility
 - Diphtheria
- Top 10 causes of death in 1998
 - Heart Disease
 - Cancer
 - Stroke
 - Chronic Lung Disease
 - Accidents
 - Pneumonia
 - Diabetes
 - Suicide
 - Kidney Disease
 - Liver Disease

Overall deaths/100,000 dropped from 1,720 to 864

Why are the patterns of life expectancy important to understanding the future of healthcare?

- Until the 1960's or so, medicine revolved around treating “acute” diseases?
 - The healthcare delivery model based on this: physician offices, hospitals, insurance
 - Acute diseases were why people died
- Now, chronic diseases are the biggest utilizers of healthcare
 - Diabetes and consequences
 - Asthma and chronic lung disease
 - Heart disease
 - Dementia
 - Cancer

As we age, we become more and more expensive to care for...

- The last years of our lives are by far the most expensive
- Healthcare delivery is still by and large operating as if we die of acute illnesses
- The future of healthcare will be how we deal with chronic illnesses that slowly steal our ability to have high quality of life
- Many of the greatest innovations will come from dealing with this new paradigm

Next Week

- Healthcare Delivery in America; How, where, why, and why many want reform