LECTURE 2

HOW DISEASE IS STUDIED
(How Disease Mechanisms are Investigated)

MAMMALIAN PATHOBIOLOGY
PATB 4130 / 5130

Understatedly, the current knowledge of medicine and disease has increased in leaps and bounds since “The Anatomy Lesson of Nicholas Tulp” was painted by Rembrandt in 1632. The increase in knowledge started with little baby steps but is now proceeding at an astounding rate. From the class assignment for Lecture 1, a Medline search of the terms “agnogenic” and “myeloid” returned 361 scientific articles from 2008 to 1948. Can you imagine how the knowledge of this rare disease has changed over these 60 years? Contrast this with a disease of greater notoriety using the phrase “bovine spongiform encephalopathy”, a disease only known since 1996, which got 2,811 hits. In fact, the pace of new medical discoveries in the past fifty years exceeds the capacity of any single individual or even individuals within a given discipline to keep up with all new discoveries and knowledge and to apply them at the patient level. As a result, new disciplines and subdisciplines within the biomedical sciences are growing. What are advantages and disadvantages? The greatest advantage is obviously an increase in knowledge. The biggest drawback is that new knowledge in the biomedical sciences is becoming fragmented; the proverbial tower of Babylon. A recent search of University of Wyoming eJournal subscriptions containing the word “Surgery” in the title came up with 151 different Journals, 71 for “Psychiatry”, 167 for “Molecular”, 485 for “Medicine”, and 67 for “Pathology”. Amazing to say the least. It seems a miracle that any of the new advances ever get to the bedside.

The goal of this lecture is to provide a basic forum for discussion on how disease is studied and how disease mechanisms are investigated. One fundamental question is asked throughout this lecture, “WHY do we study disease?”

Another fundamental question that begs for an answer: “Before we can study a disease, what must come first?” The answer seems simple; we must first have RECOGNITION, but is it really that easy? Historically, the majority of new diseases have been discovered by careful observations on the part of practicing physicians or others involved in primary care. What these individuals observed was a unique set of symptoms occurring in a unique setting that helped to distinguish the condition in these patients from other recognized diseases. Trial and error: YES, false starts: YES; but eventually the word gets out, leading to contributions from other disciplines. The next step in recognition is a more in depth CHARACTERIZATION of the ‘new’ disease. Again, from a historical perspective, the next step was to define the lesions associated with disease; a process that began in the late 1600’s and continues to this day. As more and more biomedical and basic science disciplines become involved in the study of a new disease, the initial characterization is REFINED. It is amazing how many new diseases have been discovered just in the last 30 years. How many new diseases can you name that have been discovered in
your lifetime? The PowerPoint presentation will cover two diseases, one of veterinary and one of both veterinary and human importance. One is pretty straight forward. The second illustrates some of the pitfalls in studying a new disease.

Defining the cause (etiology) of disease is a further goal of disease investigation. As you will appreciate more and more, there are many diseases of unknown cause (agnogenic, idiopathic). Robert Koch graduated with a degree in medicine from the University of Gottingen, Germany, in 1866. His notable achievements include isolation of the bacteria causing anthrax, tuberculosis, and cholera. He is probably best known for his postulates on the causal relationship between specific microbes and disease published in 1890.

- The microorganism must be found in abundance in all organisms suffering from the disease, but not in healthy organisms.
- The microorganism must be isolated from a diseased organism and grown in pure culture.
- The cultured microorganism must (should) cause disease when introduced into a healthy organism.
- The microorganism must be re-isolated from the inoculated, diseased experimental host and identified as being identical to the original specific causative agent.

Are Koch’s postulates still valid today? Can these postulates be applied to other agents of disease (hereditary, poisons/toxins, nutritional deficiencies or excesses, etc)? If these were test questions, could you defend your answer?

During class we will develop a list of the various scientific or biomedical disciplines that contribute to the study of disease and the tools they bring to these studies. We obviously won’t have time to generate a complete list but this exercise should get you thinking.

Are there disciplines today that are thought to be obsolete or of little direct benefit? Please consider this question and come to class prepared to offer your opinions.

Have any of you heard of the global “One Health” initiative? In short, this concept can be summarized as follows, “The convergence of people, animals, and our environment has created a dynamic in which the health of each group is inextricably interconnected.”

Dr. King goes on to say that of the recognized infectious diseases in humans; approximately 60% are caused by multi-host pathogens able to be transmitted across species lines. “…over the past 3 decades, approximately 75% of new emerging human infectious diseases have been zoonotic”, i.e. transmitted from animals to humans.” What I am trying to say is that there is no place for disciplinary elitism. All disciplines that can contribute to furthering our knowledge of disease deserve equal respect.