Chapter 1-3

Scientific Methods

Scientific inquiry

- A scientist makes an **observation**- notices something about our natural world and wonders why it happens or how it works.
  - *Ebola example: People with disease had a threadlike virus in their blood.*

- It all starts with a **problem** in the form of a question….
  - *Ebola example "Is the virus causing the disease?"*

Scientific method

- A **hypothesis** is a reasonable, scientifically testable explanation for an observation.
  - Scientists formulate hypotheses in the form of statements rather than questions.
- A statement that explains observations AND can be tested
  - *Ebolda example: The virus causes the disease.*

- Sometimes a prediction is included with the hypothesis
- **Prediction** – statement of <u>results</u> if the hypothesis is supported

  Ebolda example: next slide

- **Prediction** as part of "if-then" hypothesis
  - *Ebola example: "If the virus causes the disease, then introducing the virus into one of two groups of healthy cells, only the group exposed to the virus will die.*
  - Which part of this example is the hypothesis?
  - Which is the prediction?

- **Experimental design**
  - **Controlled experiment-** comparison of control & experimental group (to determine cause & effect)
  - Identical except for one factor (**independent variable**) which you are testing
  - Independent variable is always applied ONLY to the experimental group
  - Both groups need to be identical in every other aspect

  - *Ebola example: Expose one group of cells to the virus (blood from victim) and one group of cells with no virus (no blood)*

    Remember- Not all scientific hypotheses can be tested under controlled conditions.

- **Perform the experiment**
  - Measure/observe what changes occur between the groups
  - This is known as the *dependent variable*
  - *Ebolda example: The health of the cells was observed/ measured in both groups.*
- **Data collection & recording**
- If there is a difference in what you measure between the 2 groups, you know that difference can ONLY be due to what you are testing

- **Analysis**
- Process of interpretation- what does the data mean?
- If there is a difference in what you measure between the 2 groups, you know that can only be due to what you are testing
  - *Ebola example: The cells in experimental group died, while the other cells remained healthy.*

- **Conclusion**
  - Hypothesis supported or contradicted
  - Data agree with your hypothesis (supported) or it does NOT agree (contradicted)

Goals of scientific investigations

- Create a **model**

- Make an **inference**
  - *Ebola example: The virus is carried by a small, forest-dwelling animal (maybe a bat?). The virus is transmitted when humans interact with the animal.*

- Form a **theory-** broad & comprehensive statement on what is thought to be true
- Unifying explanation from related experiments
  - Based on results of many experiments that have been tested over & over, with supporting data