
AP Biology Research - Cell Signaling Diseases Project

INTRODUCTION

Communication between cells is important in order to ensure that all cells are performing their required functions. Cell to cell communication usually takes the form of a signal transduction pathway. You can think of such a pathway as a row of dominoes, all standing on their ends. Push one domino over, and the rest fall, due their direct or indirect association with the first one you pushed over.

Some signals that cells send only work over a short distance. For example, in the brain, neurotransmitters allow one neuron to excite its neighbor. The signal travels no further. Other signals, however, do travel a further distance. Hormones, for example, are secreted by a source organ and travel to target cells, equipped with specialized receptors, in remote regions of the body. Unfortunately, signal transduction might go awry. Because there are so many players and so many steps in the process, it is easy to see how this might happen. To complete this project you will need to

Review information about how problems in cell signaling can lead to diseases:

1. understand the methods of local and long distance signaling in animals.
2. explain the stages of a signal transduction pathway.
3. understand the role of extracellular molecules (or ligands) in signal transduction.
4. recognize the role of protein kinases, cyclic AMP or calcium ions (depending on disease) in the regulation of cellular biochemical pathways.
5. describe what a cell does when it receives a signal (what kinds of cellular processes are altered upon receipt of a signal)

Share this information in a *visual* and *oral* presentation

Your responsibility is to develop a poster that explains the basics of the disease and its relationship to a faulty signal transduction pathway. Much of this research is "cutting edge." Your poster must explain both the "normal" pathway and the "faulty" pathway. Pictures and graphics are also necessary. I do not expect you to work at the graduate level on this project but I do expect you to be able to explain, *in your own words*, the basics of the mechanism and the way in which the failure of the mechanism leads to disease.

Here are some additional good places to start:

- <http://fig.cox.miami.edu/~cmallery/150/memb/cellcomm.htm>
- <http://www.case.edu/pubaff/univcomm/cell-rsch.htm>
- <http://www.cellsignal.com/reference/pathway/index.jsp>
- http://anatomy.med.unsw.edu.au/cbl/GENOME/Genes_Diseases/Signals/signals_overview.htm
- <http://www.news-medical.net/?id=72>
- <http://www.emedicine.com/>
- <http://www.bioteach.ubc.ca/CellBiology/CellSurfaceReceptors/>
- <http://rarediseases.info.nih.gov/>
- <http://www.cellsignallingbiology.org/>
- <http://www.kumc.edu/gec/support>
- <http://www.ygyh.org>
- <http://www.ncbi.nlm.nih.gov/projects/genome/guide/human/>
- <http://medgen.genetics.utah.edu/photographs.htm>
- http://www.sigmaaldrich.com/Area_of_Interest/Life_Science/Cell_Signaling/Scientific_Resources/Pathway_Slides_Charts.html
- <http://www.genome.gov/>

Grading: Total Points - 50

This will be your only grade on this information (cell to cell signaling, signal transduction pathways); it is worth two Research Methods quiz grades

Quiz grade #1: format/content

Format - poster - 10 points (will either stand alone or against a wall)

- Use a "science fair type of poster" - 20" X 30" minimum
- All information must be typed; use headings and appropriate font sizes
- Pictures and graphics included; at least three including
 - A drawing of the chromosome showing the location of the affected gene.
 - A picture or drawing of a person with the genetic disease or a picture or drawing of organs and/or tissues affected by the disease.
 - A picture or drawing of the type of cell signaling pathway(s) involved. (working pathway and/or faulty pathway)
- Neat/colorful presentation - no spelling or grammatical errors
- Include name(s), Course & Block in lower right corner of poster
- Include list of sources used for project (MLA) on back of poster

Content - 30 points

- Disease - basics only - cause and core symptoms
- Cell signaling pathway involved
- Correct mechanism
- Incorrect mechanism
- Graphics of pathway
- Current direction of research

Quiz grade #2: Presentation - 10 points

Presentation - 10 points

- Three - Five minute presentation of poster to class
- Be able to put content into "own words" and explain poster
- No direct reading off poster - both team members (if two) speak and can answer questions asked of them

Disease Choices

Ataxia Telangiectasia (AT)

Heart Disease - Congenital Heart Disease or Cardiomyocyte Hypertrophy

Kidney Disease

Parkinson's disease and calcium channels

Multiple Sclerosis

Pancreatic Cancer

Chronic Myelogenous Leukemia (CML)

Alzheimer Disease

Tuberous Sclerosis

Neurofibromatosis

Alopecia

Diabetes and Insulin Resistance

Cockayne Syndrome

Asthma/Allergies

Cystic Fibrosis

Werner Syndrome

Norrie Disease