Life Science Standard **LS1D**

Content Standard:

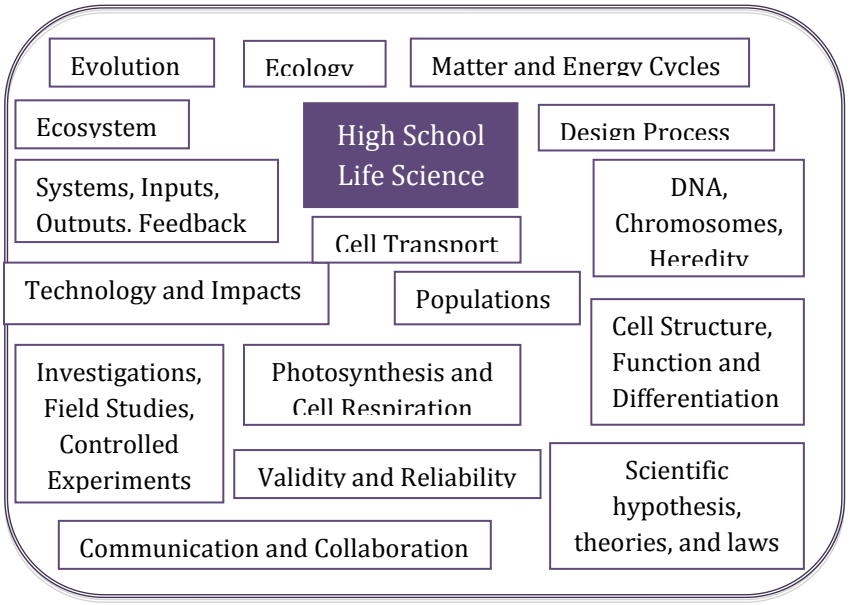
The cell is surrounded by a membrane that separates the interior of the cell from the outside world and determines which substances may enter and which may leave the cell.

Performance Indicators:

Describe the structure of the *cell membrane* and how the membrane regulates the flow of materials into and out of the cell.

Item Specifications:

- Describe the structure of the cell membrane as a bilayer, with embedded proteins capable of regulating the flow of materials into and out of the cell.
- Describe the process (es) (i.e., active transport, passive transport, osmosis, facilitated diffusion) that allows substances to pass through the cell membrane.



Reflective Questions for Students:

- How does the structure of the cell membrane support its functions?
- How do active and passive transport complement each other?
- What is facilitated diffusion and give examples in the human body?

When you think about the answers to these questions, think about models that you could develop.

Assessment Information

http://www.k12.wa.us/Science/Assessments.aspx

Quick Links for Students:
Use the following links to explore your understanding of the cell membrane and its function.

An interactive link regarding cellular transport:

http://www.teachersdomain.org/resource/tdc02.sci.life.cell.membraneweb/

Teacher Center
Elements of Effective Science Instruction

Disciplinary Core Ideas

Essential teaching components leading to the big ideas:

- Active transport requires energy; passive transport does not.
- Osmosis, diffusion, and facilitated transport are examples of passive transport.
- Some cellular transport involves proteins that are imbedded in the cellular membrane (active transport and facilitated transport).
- Some cellular transport involves small, neutral molecules (ie. CO_2, H_20, O_2) passively moving though the phospholipid bilayer

Additional supports and extensions for understanding how students grasp the concept:

- Here is a site that provides background mostly on organelles, but towards the bottom http://www.rpdp.net/sciencetips_v2/L12B1.htm
- This has some background and some labs and lessons: http://www.biologylessons.sdsu.edu/classes/lab5/lab5.html
- (See link in "Quick Links for Students" above)
  Here is an applet that allows you to change concentrations, insert channels and gates, and open the channels and gates: http://phet.colorado.edu/en/simulation/membrane-channels

Cross Cutting Ideas:
Designing for Learning

Strategies to reveal student understanding include:

- Paige Keeley's Formative assessment probes available through nsta.org
- Teacher's Toolkit: Misconceptions in the science classroom, Science Scope at www.nsta.org
  This article in Science Scope offers suggestions for identifying science misconceptions in general.
- Osmosis occurs when there are different amounts of water across the membrane, rather than different concentrations.
  - Preconceptions: http://www.biologylessons.sdsu.edu/classes/lab7/altern.html

Prerequisite knowledge required:

- All matter is made of atoms
- Polar vs. non-polar molecules
- Covalent Bonding

Learning progressions include:

- Gather evidence of selective permeability, such as the investigation located here: http://www.darienps.org/teachers/otterspoor/notes/DialysisTubingLabandReport.pdf
- Show examples of the transport of molecules, such as O_2, CO_2, H_2O, glucose, starch, protein, Na+, and K+. This site is an interactive site to aid in teaching facilitated transport, active transport, passive transport, diffusion, and osmosis: http://www.teachersdomain.org/resource/tdc02.sci.life.cell.membraneweb/

Scientifically oriented questions focused on clarifying and extending student understanding include:

- What does a membrane look like? What molecules does a membrane contain?
- What is the difference between active transport and passive transport?
- What is facilitated diffusion and give an example of this happening in the human body
- Describe why the process of osmosis occurs.

Activities supporting opportunities for students to make claims, use evidence and communicate reasonings include:

- **SYSTEMS (EALR 1):**
  - Comparing and contrasting active vs. passive transport. Do an energy transfer diagram for the active transport so the students can see that the chemical energy (of ATP) is transforming into [kinetic energy of the imbedded protein???] to work as a pump for a specific molecule.
- **INQUIRY (EALR 2):**
  - Turn the following investigation into a limited inquiry lesson, where the mv, rv, and most materials are provided for the students, but the design is completely up to them. http://www.darienps.org/teachers/otterspoor/notes/DialysisTubingLabandReport.pdf
  - Another inquiry lab involving diffusion and selectively permeable membranes, but also includes a second lab involving osmosis in Elodia, salt, and a microscope: http://www.rpdp.net/adm/uploads/science/422LabOsmosisDiffusion.pdf
- **APPLICATION (EALR 3):**
  - Here is a scenario of a girl with hyponatremia due to Ecstasy use. This site covers concentrations, different types of transport, etc. http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=485&id=485
- **LIFE SCIENCE (EALR 4):**
  - A cell structure and transport project: http://www.rpdp.net/adm/uploads/science/424ProjectandRubricEukaryoticCell.pdf
  - Insulin Signaling (looking at facilitated diffusion): http://vcell.ndsu.edu/animations/insulinsignaling/index.htm

Cross Cutting Ideas: *Sense Making*	**Cross Cutting Ideas:** *Classroom Culture and Environment*
Planning time in the lessons to support time for students to make sense of what they are learning include:	**Activities that show how this content standard relates to students' everyday lives include:**
Strategies to focus on student conversations, interactive notebook prompts, model-building include:	**Activities that show how scientists think and do science in relationship to this content standards include:**