Using Online Resources

MISSOURI S&T

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Using Available Online Resources to Facilitate the Flipped Classroom and Increase Student Engagement

Presentation Outline

- Defining The Flipped Classroom
- Online Resources
- Examples

The Flipped Classroom Defined

- The **flipped classroom** is a pedagogical model in which the typical lecture and homework elements of a course are reversed. Short video lectures are viewed by students at home before the class session, while in-class time is devoted to exercises, projects, or discussions.
- From Educause.edu

Flipped Classroom vs. Flipped Learning

> Flipped Learning requires four pillars:

> Flexible Environment
> Learning Culture
> Intentional Content
> Professional Educator

> From the Flipped Learning Network. FlippedLearning.org

My Motivation

- Observations
- Lab students not well prepared
- Distracted during in-lab demonstrations
- Limited opportunity for creativity
- How to improve preparation
- How to enable creativity

- Lecture students most engaged in review session
- How to simulate in classroom

My Approach

- Record lab presentations and demonstration
- Explain background
- Show techniques
- Students choose techniques, plan own experiments
- Resulted in better prepared, engaged participation
- How about the classroom?
- Don’t just flip to flip

Online Resources in Biology

- Howard Hughes Medical Institute
  - Holiday Lectures
  - Biointeractive
- iBiology
- TED Ed
- National Center For Case Study Teaching

Ted Ed – Ed.Ted.Com

Watch

Think

Dig Deeper

Discuss

Customize This Lesson 88

Create and share a new lesson based on this one.

iBiology – www.ibiology.org

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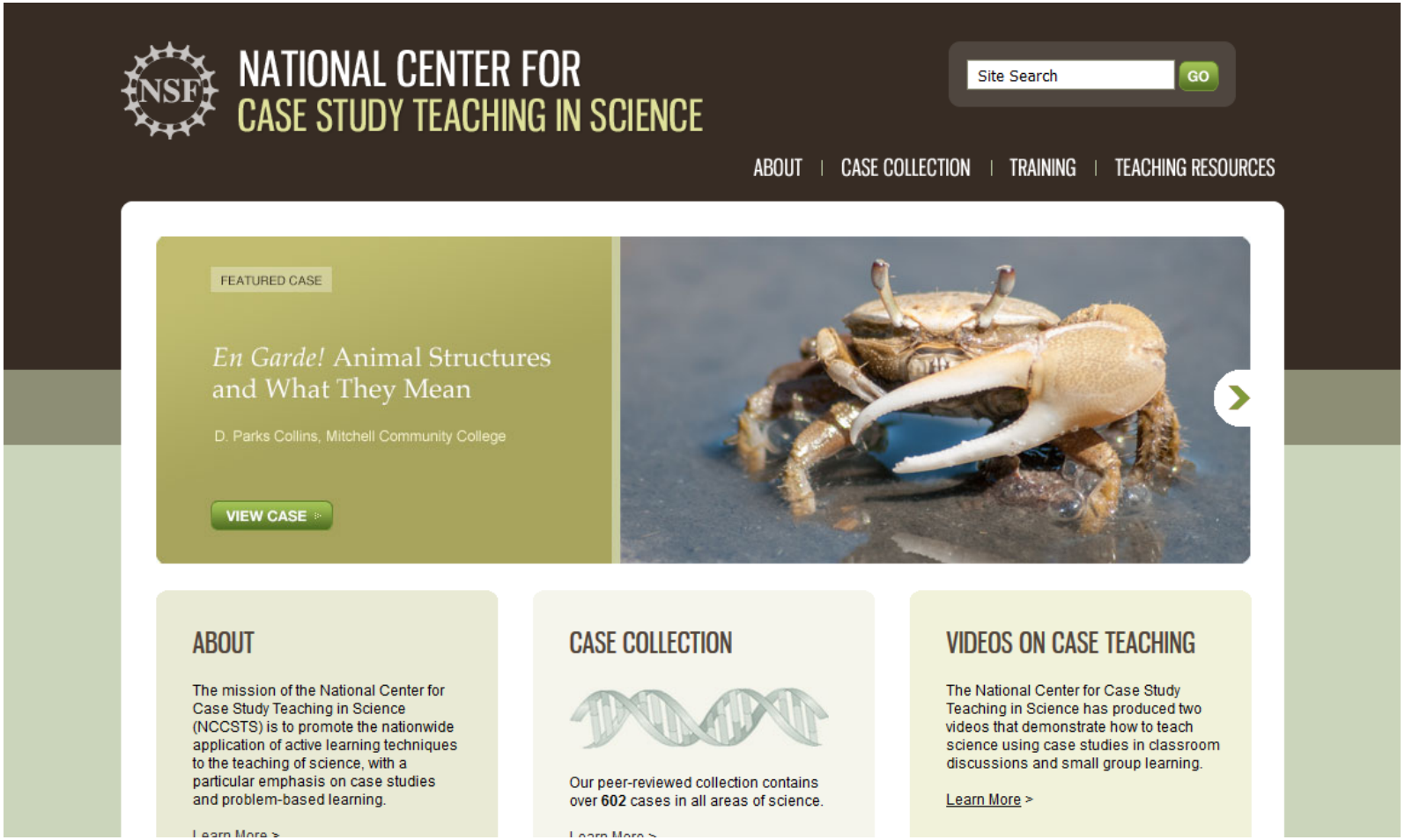
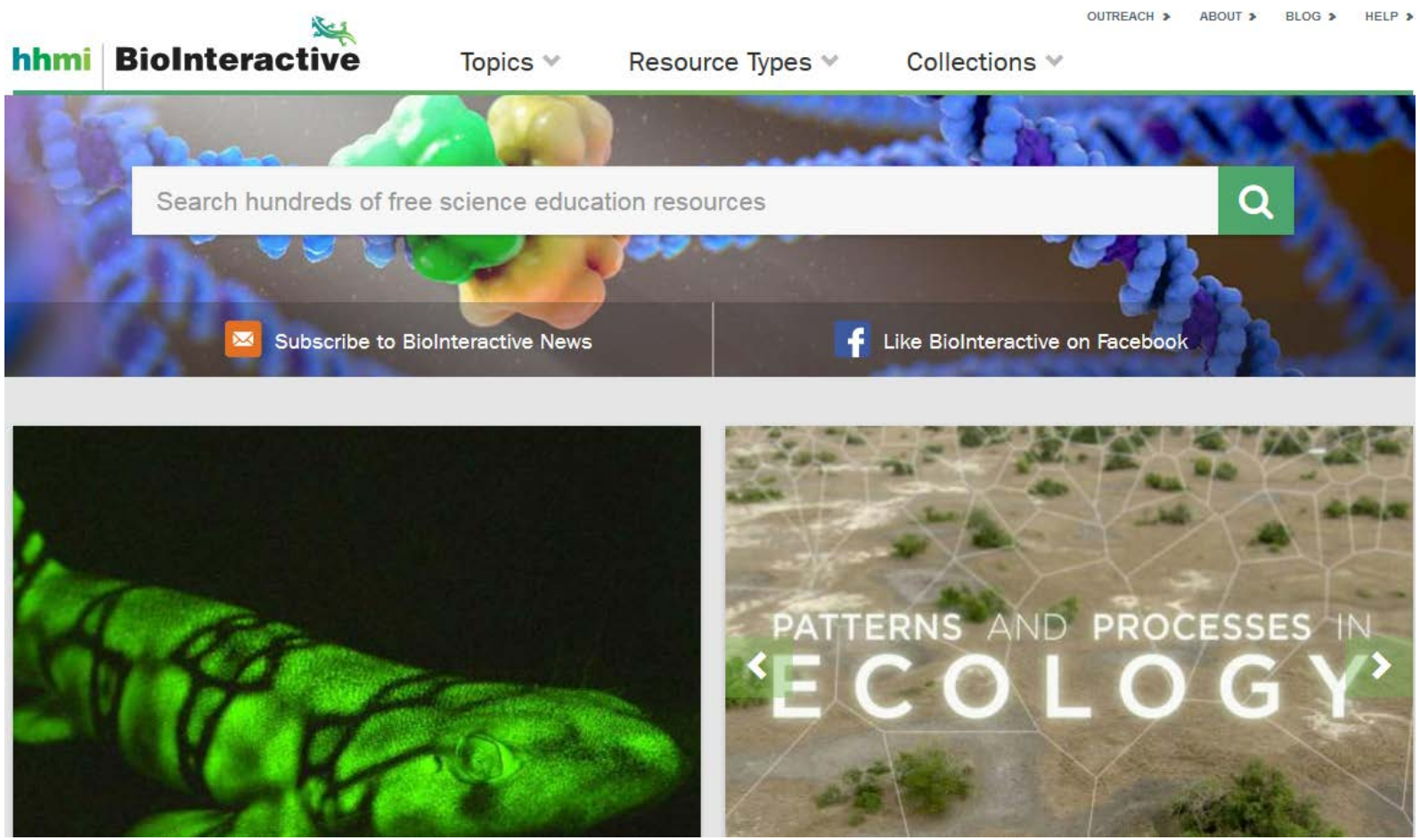
National Center for Case Study Teaching

Sciencecases.lib.buffalo.edu



Howard Hughes Medical Institute

www.hhmi.org/biointeractive



Selecting online resources

> Focus on learning objectives

Microbial Evolution

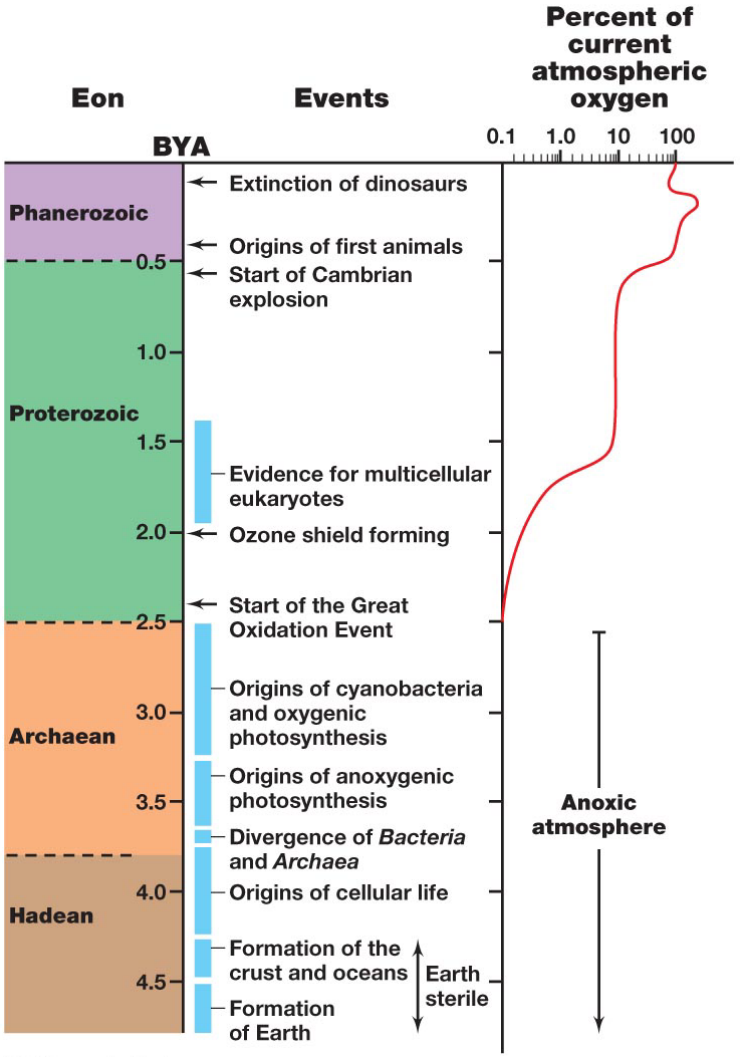
Learning Objectives

- Describe evidence for evolution of microbial diversity.
- Predict the outcome from exposing microorganisms to various environmental factors.
- Explain the impact of microorganisms in elemental cycles.

Early life

- Pre-Watch
  - Changing Planet: Past, Present, Future.
  - Sections 15 to 27

History of the Earth



Studying life over time

- How do we know certain organisms are related to each other?
- How do we identify common ancestors?

Fossil record of microbes?

Cross section of stromatolite

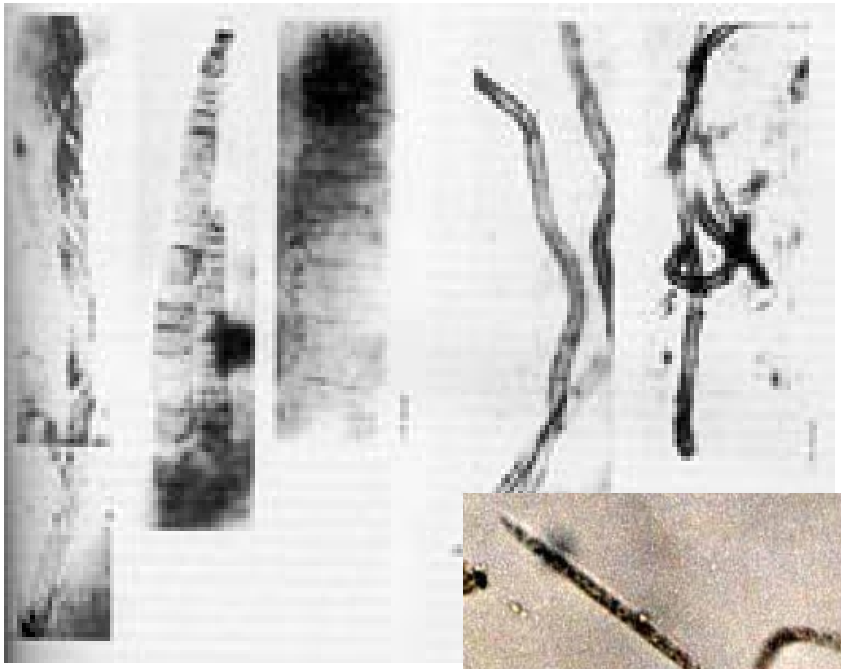
Stromatolites

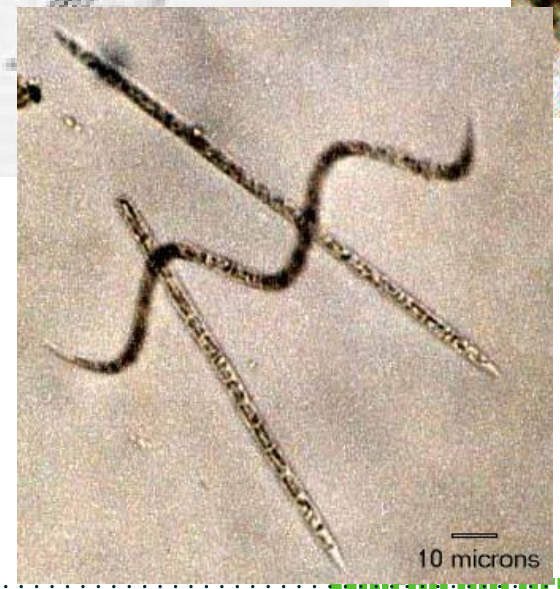
- Fossilized microbial mats of filamentous prokaryotes and trapped sediment
- Found in rocks 3.5 billion years old or younger
- Comparisons of ancient and modern stromatolites
  - Anoxygenic phototrophic filamentous bacteria formed ancient stromatolites
  - Oxygenic phototrophic cyanobacteria dominate modern stromatolites

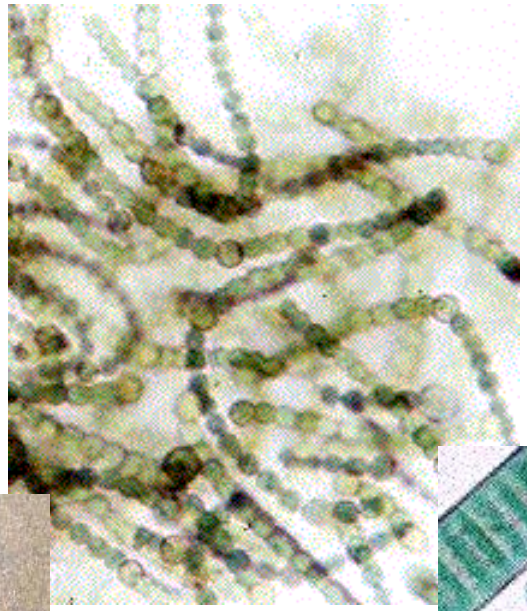
Modern, living stromatolites

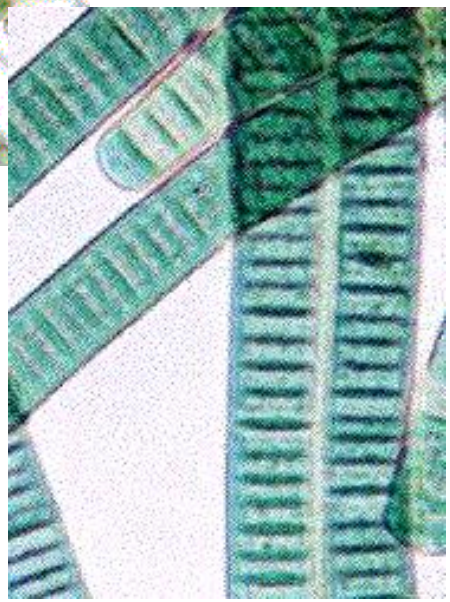
http://cas.bellarmine.edu/tietjen/Evolution/stromatolites2.htm

Stromatolite fossils and extant microbes









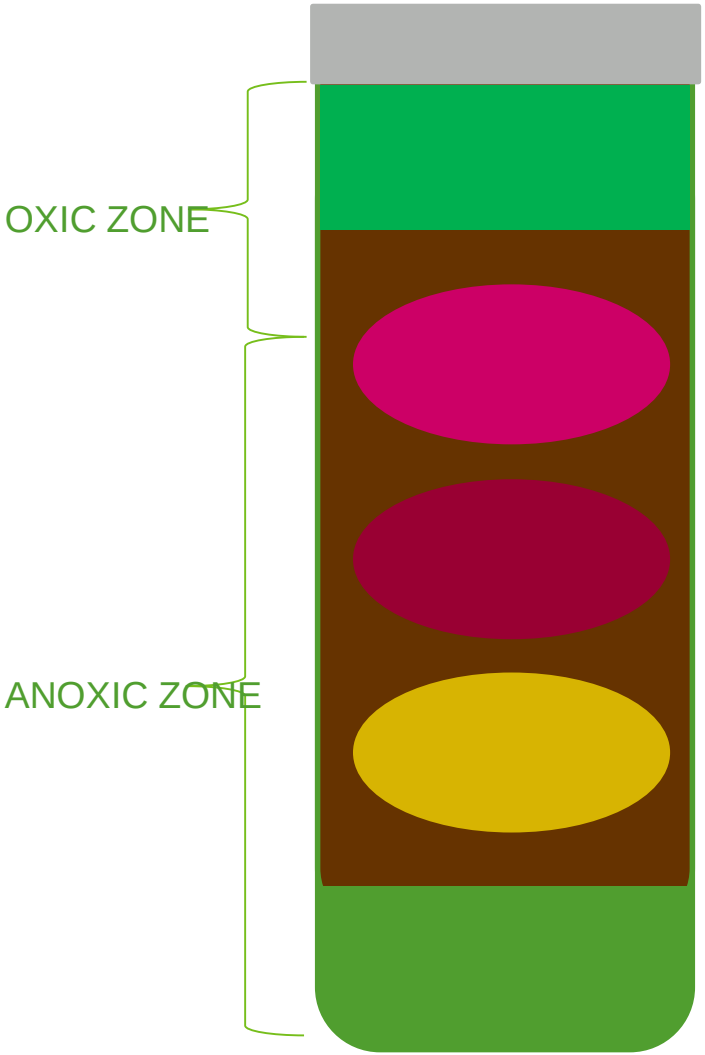
How do stromatolites form?

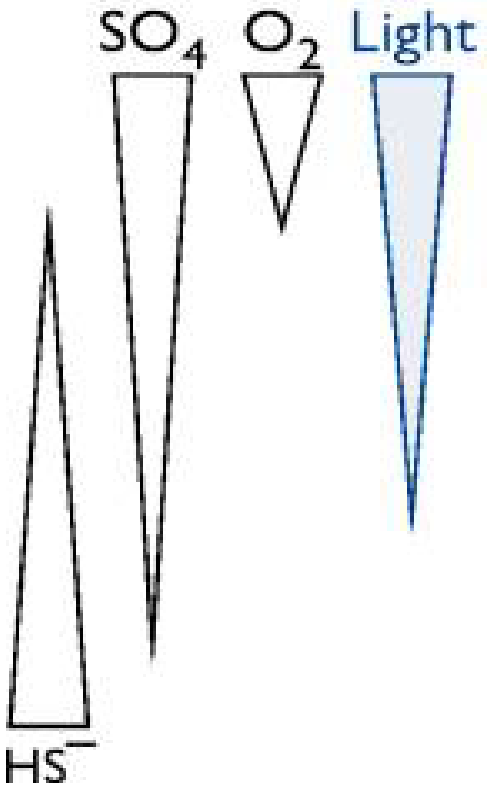
Microbial Mats

Microbial Mats

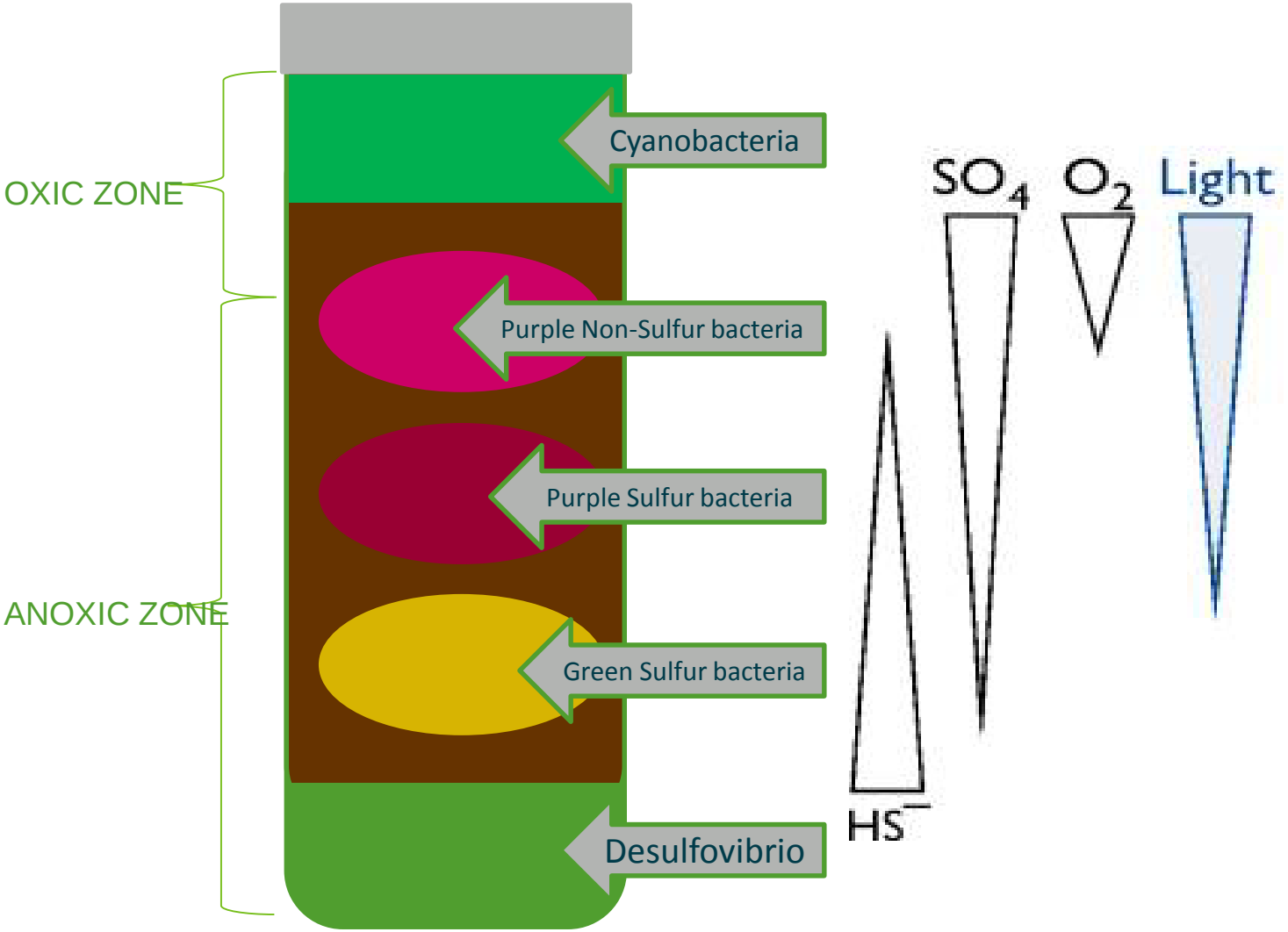
> What factors might be responsible for the layering effect?

Winogradsky Column



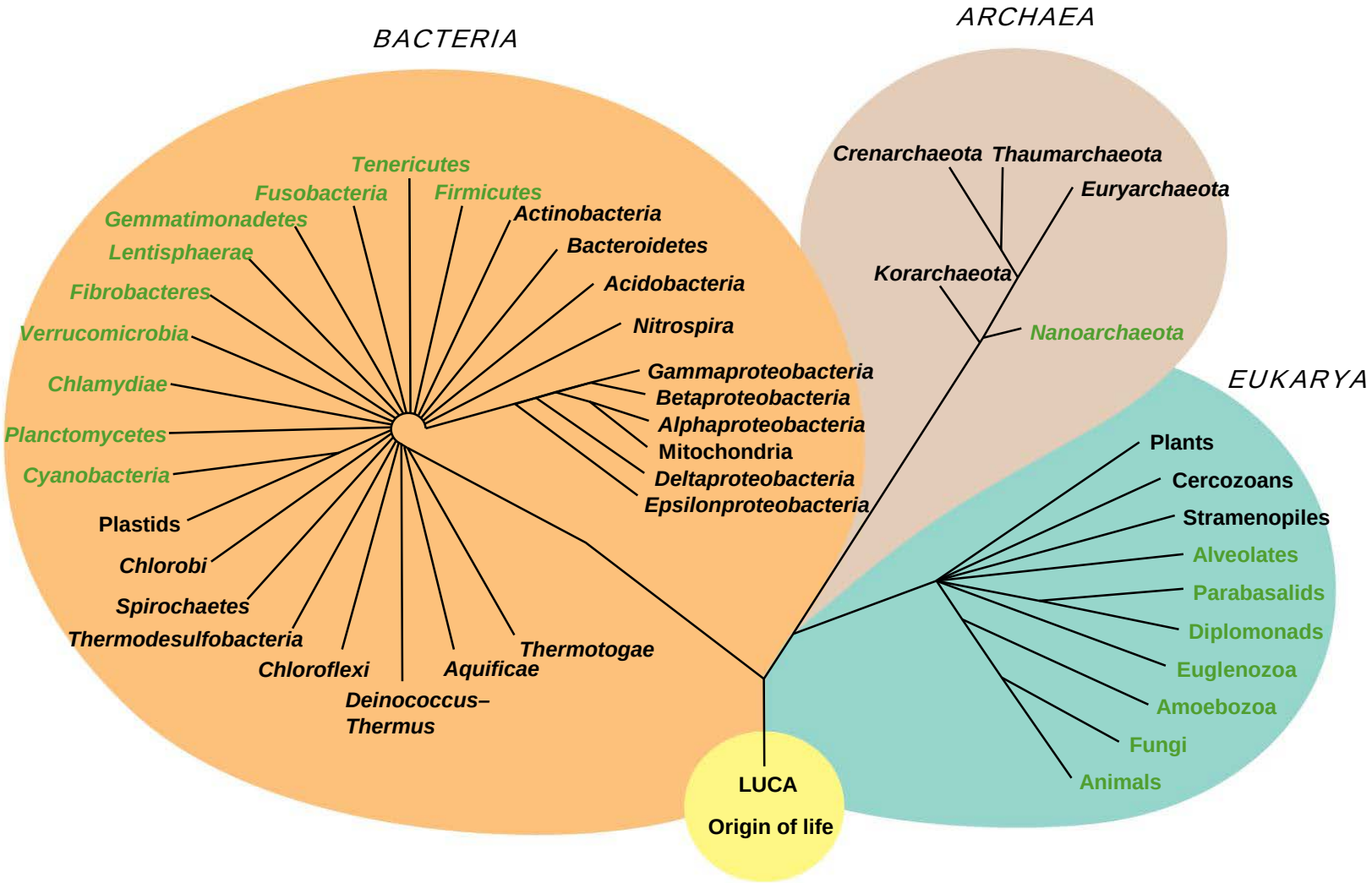


Winogradsky Column



Winogradsky Column

Tree of Life


BACTERIA
ARCHAEA
EUKARYA
Tenericutes
Fusobacteria
Firmicutes
Gemmatimonadetes
Actinobacteria
Lentisphaerae
Bacteroidetes
Fibrobacteres
Acidobacteria
Verrucomicrobia
Nitrospira
Chlamydiae
Gammaproteobacteria
Betaproteobacteria
Planctomycetes
Alphaproteobacteria
Mitochondria
Cyanobacteria
Deltaproteobacteria
Epsilonproteobacteria
Plastids
Chlorobi
Spirochaetes
Thermodesulfobacteria
Thermotogae
Chloroflexi
Aquificae
Deinococcus–
Thermus
Crenarchaeota
Thaumarchaeota
Euryarchaeota
Korarchaeota
Nanoarchaeota
Plants
Cercozoans
Stramenopiles
Alveolates
Parabasalids
Diplomonads
Euglenozoa
Amoebozoa
Fungi
Animals
LUCA
Origin of life

In Class Activity from BioInteractive

Learning Objectives

- experimental design
- data analysis
- differentiation and gene expression
- microarrays as a research tool
- embryonic development and the germ layers

Stem Cells and Diabetes - The Future

Diabetes Research – What is Known

- β cells are not generated from adult stem cells in the pancreas.
- It is unlikely that a cure for diabetes will come from adult stem cells.
- Embryonic stem cells have been shown to generate insulin-producing β cells.

What Has Been Tried: Whole organ pancreas transplants

- Problem: not enough organs to meet the demand
- Problem: must take powerful immunosuppressants

What Has Been Tried: Injections of pancreatic islet cells

- Problem: less than 8% of these transplants have been successful
- Problem: immunosuppressants are required

Possible Next Step: Inject β cells into the patient's pancreas

- Problem: There is much work to be done before this technique will be ready—if it is ever ready.

Possible Next Step: Activate β cells in the patient's own pancreas

- Problem: There may be no β cells left in the pancreas of a patient to activate.

Possible Next Step

- Provide type l diabetics with transplants of β cells derived from embryonic stem cells

What We Need to Know

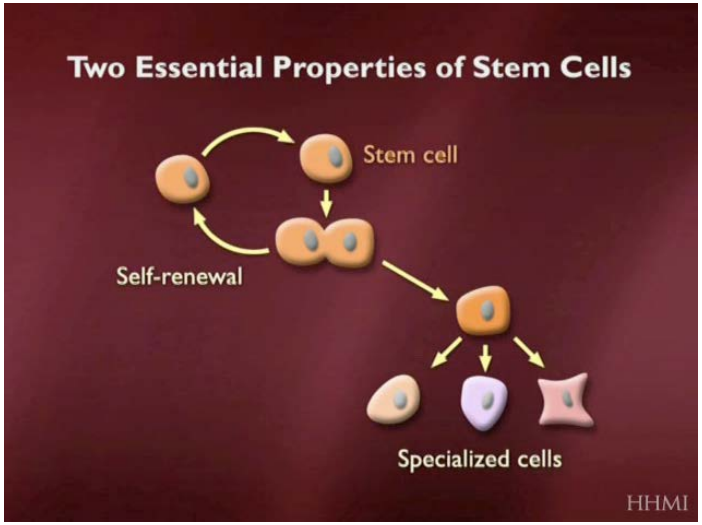
- What properties make embryonic stem cells unique?
- Where do these cells come from?
- How are they involved in the formation of the pancreas, β cells, and other tissues?

Where do they come from?

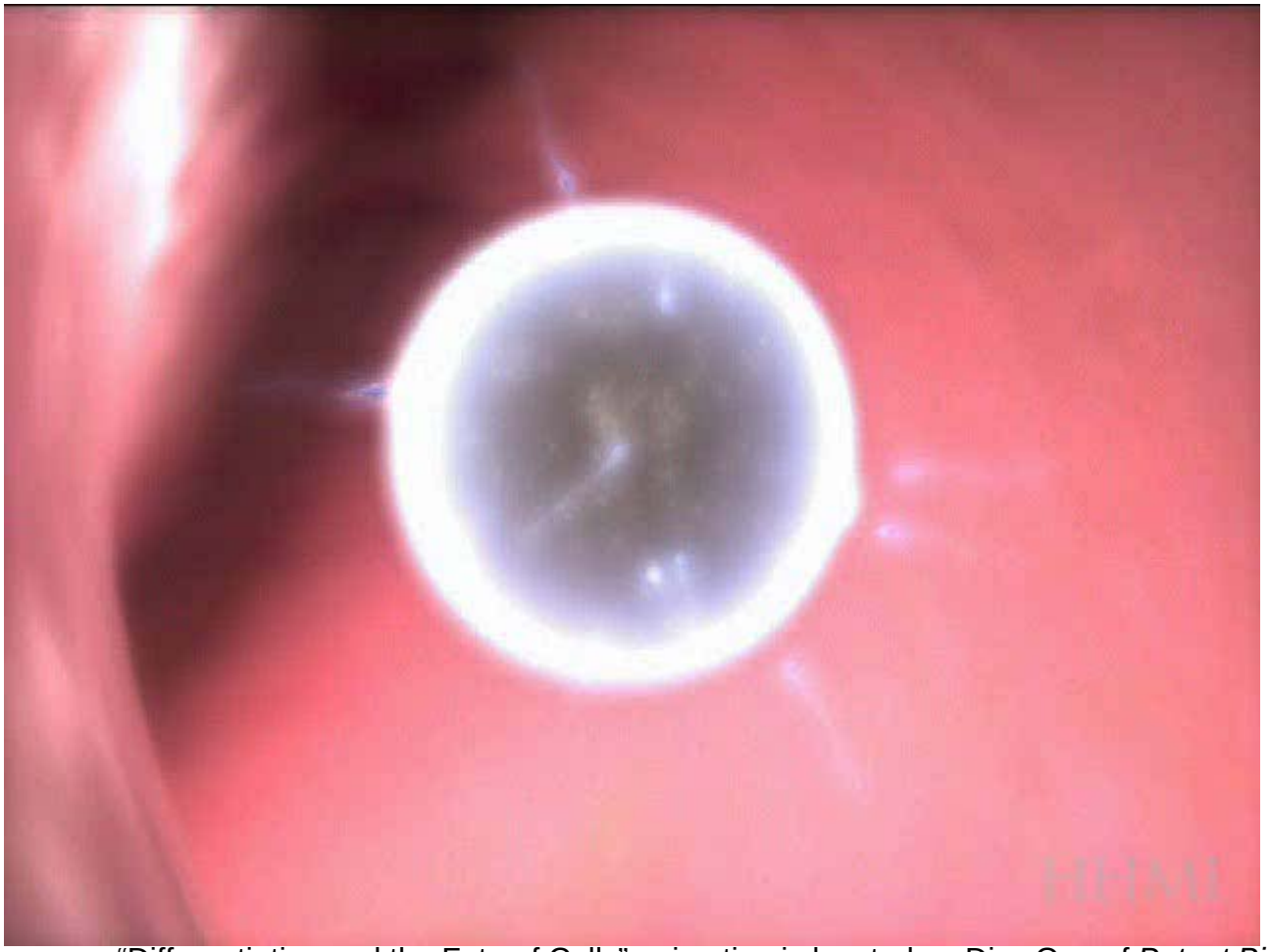
"Human Embryonic Development" animation is located on Disc One of *Potent Biology* DVD and here: http://www.hhmi.org/biointeractive/stemcells/human_emb_dev.html

What makes them unique?

- can regenerate an infinite number of times
- can be grown in culture indefinitely
- are classified as pluripotent
- are able to differentiate into specialized cells as needed

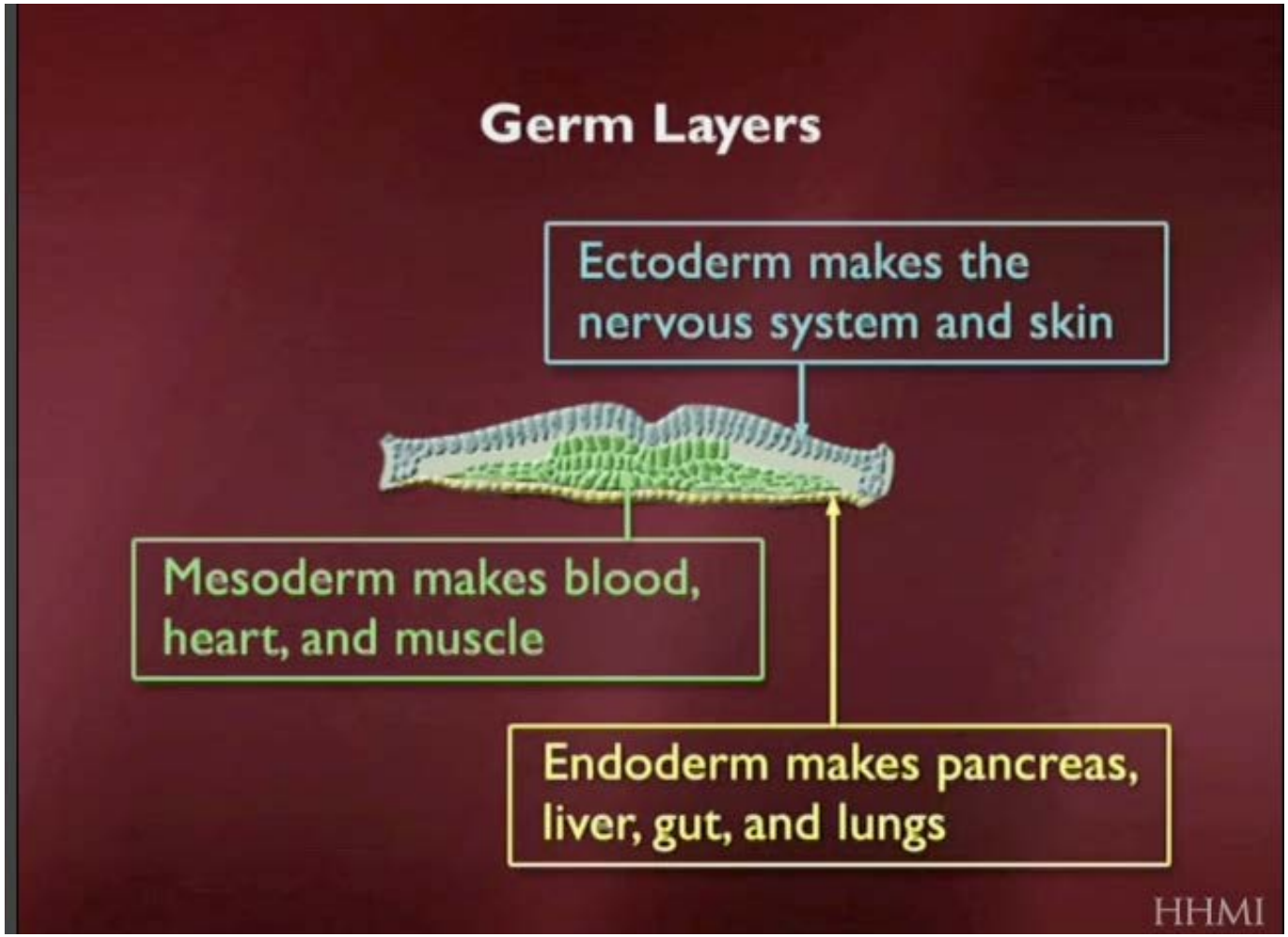


How are stem cells involved in the formation of the pancreas, β cells, and other tissues?

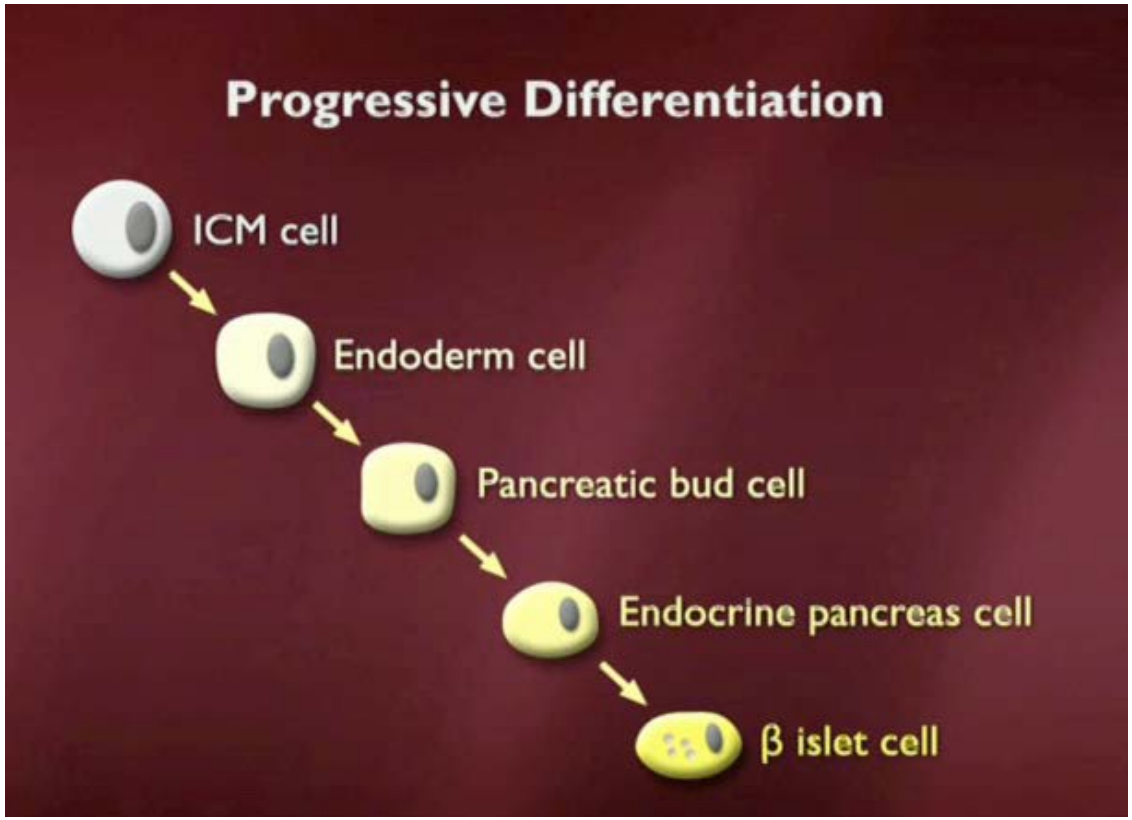


“Differentiation and the Fate of Cells” animation is located on Disc One of *Potent Biology* DVD and here: http://www.hhmi.org/biointeractive/stemcells/differentiation.html.

Germ Layer Differentiation

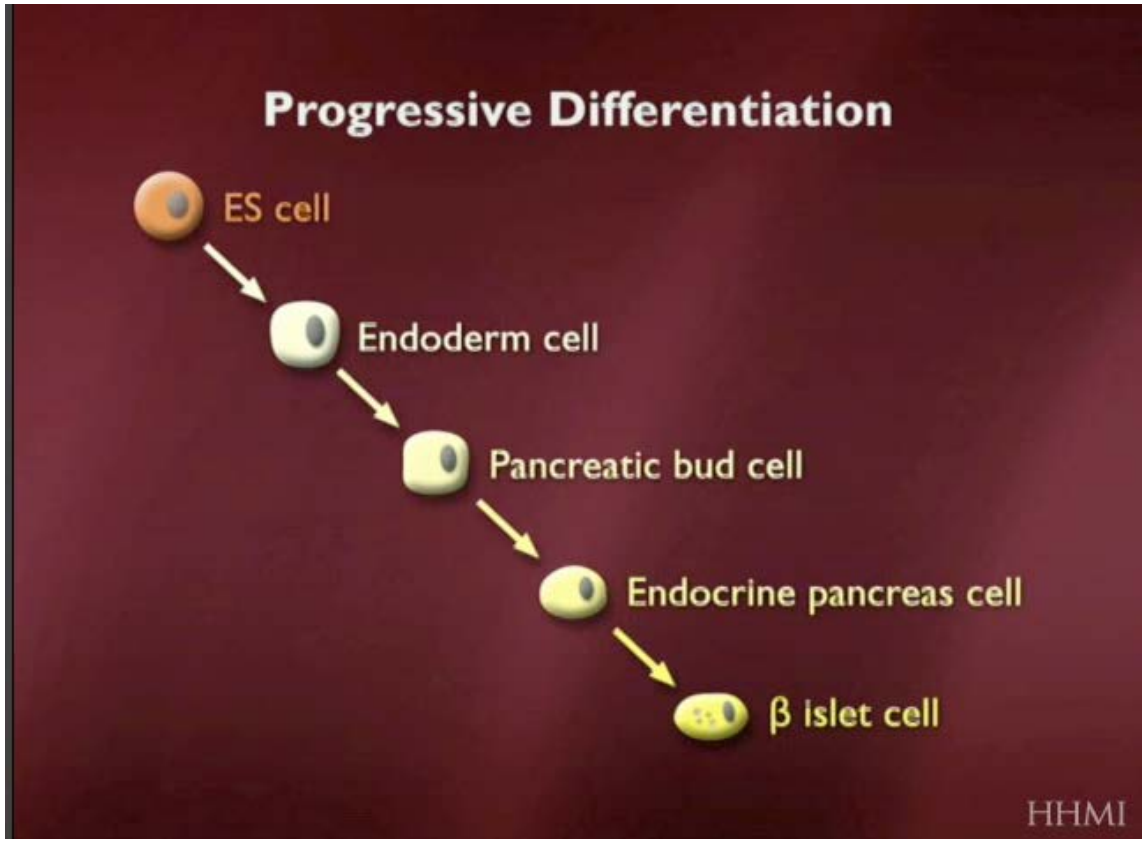


Forming Specialized Cells



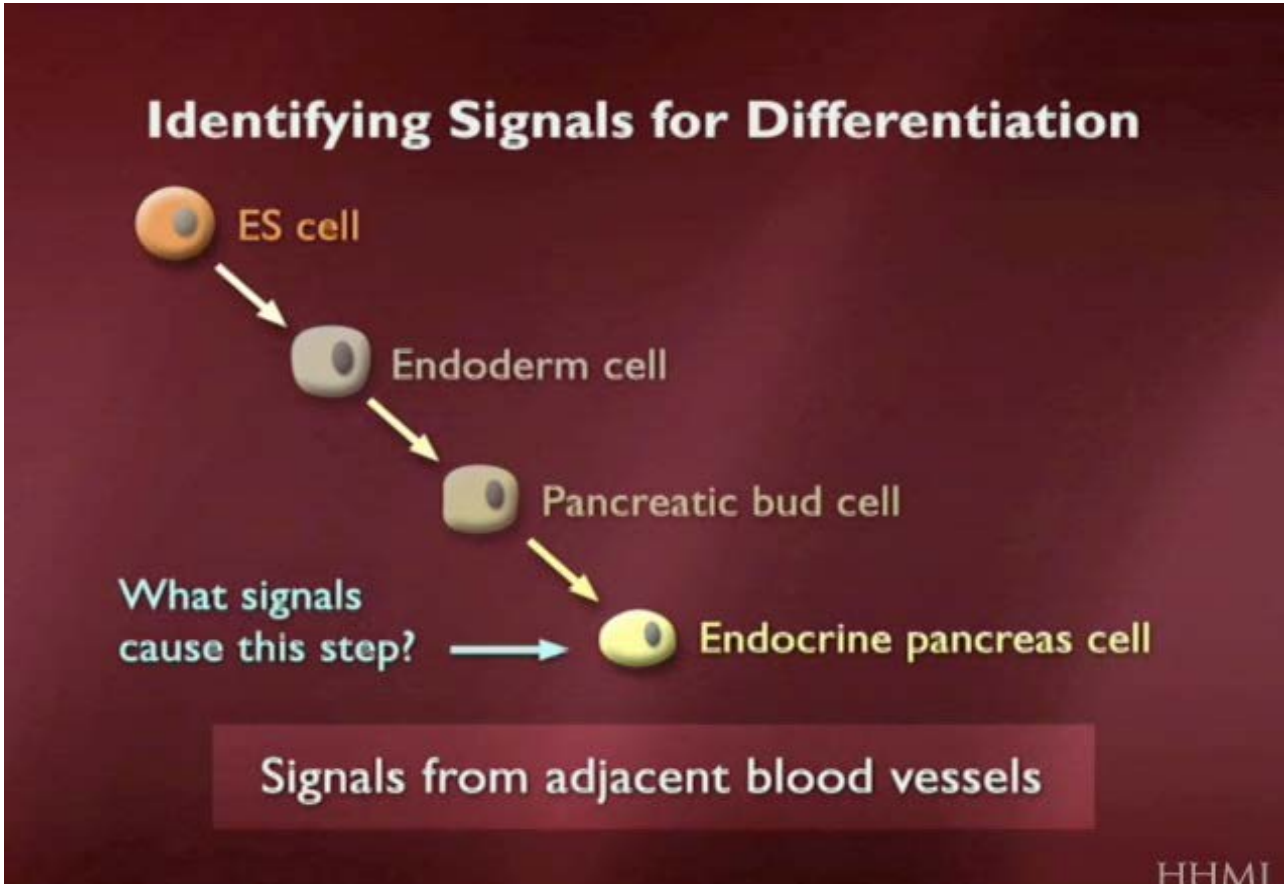
Growth factors and other signals tell a stem cell when to differentiate and what type of cell to become.

Forming Specialized Cells

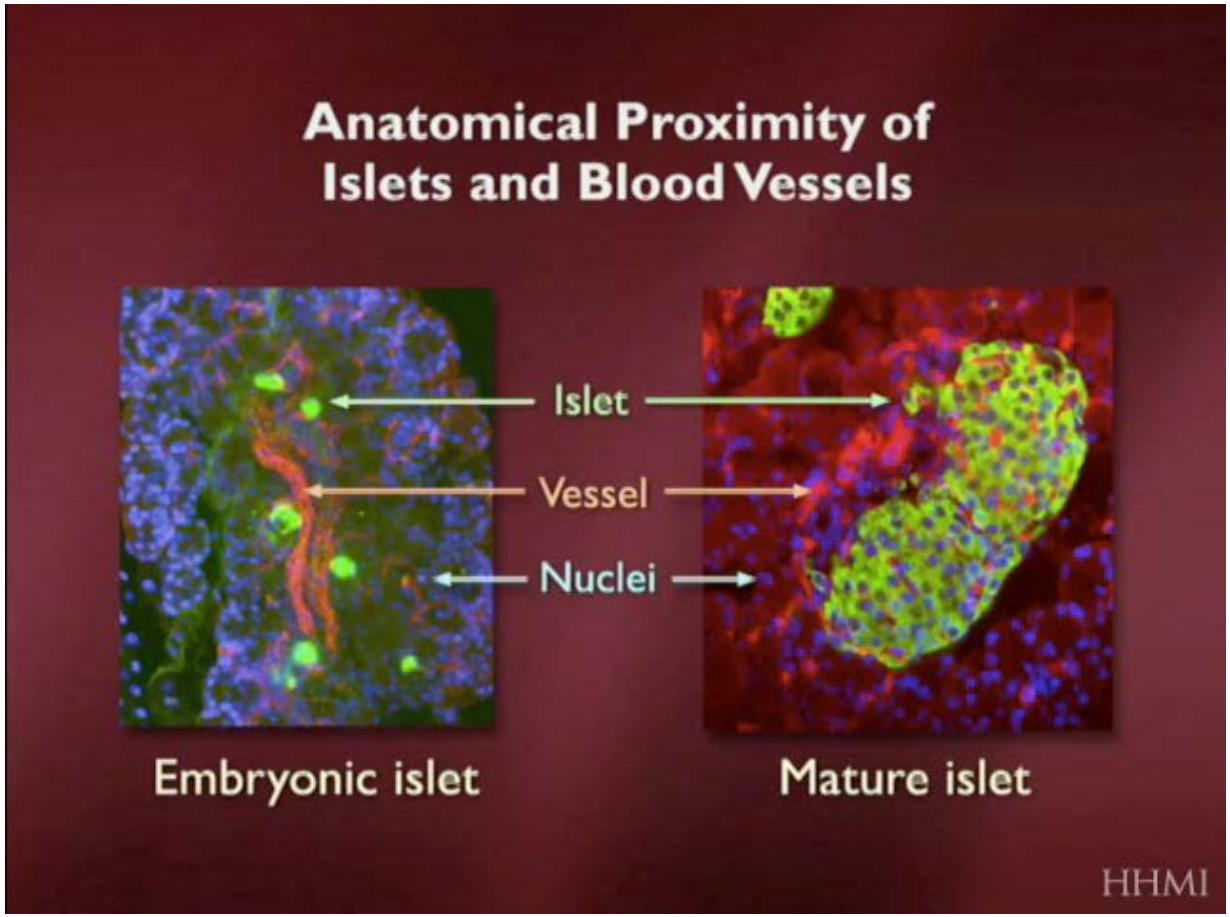


The same growth factors and signals could be used to direct the differentiation of human embryonic stem cells grown in culture.

What is Known



Role of Location in Differentiation



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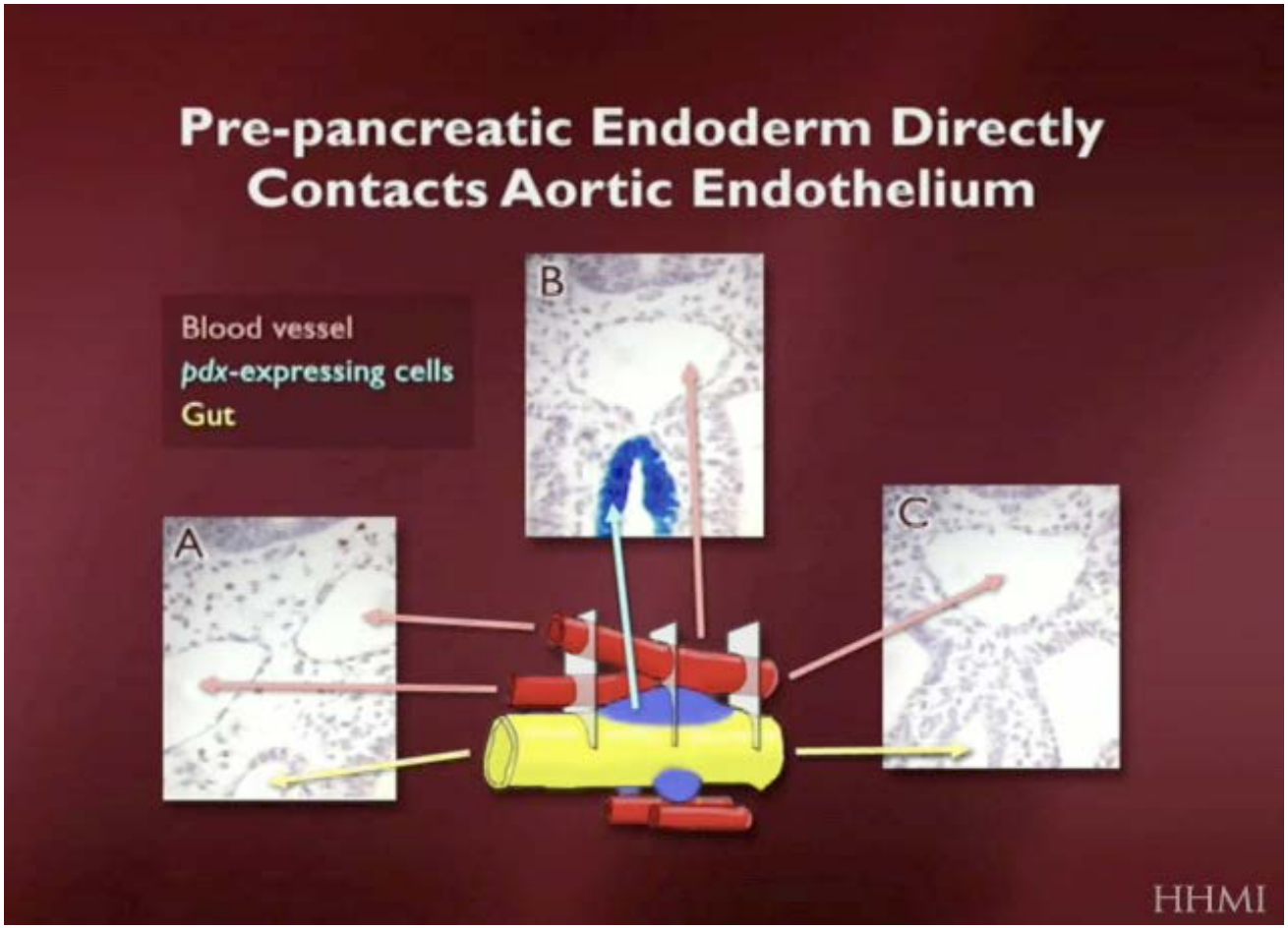

The Task:

> Guiding cultured embryonic stem cells to become insulin-producing β cells

Questions?

Support Bacteria!

It's the only culture some people have!