

7.342 How to Build an Animal: Cell Fate and Identity in Development and Disease Week One

Introductions

- Write on the notecards your name, email address, course, year, previous relevant biology classes, whether you've had experience with primary literature, and any extracurricular activities, hobbies, or interests.
- Go around the table to share
- Pass in the cards

Overview of syllabus and expectations

- The primary objective of this course is to learn how to read, analyze, and discuss primary scientific literature.
- Attendance and participation in each week's discussion is mandatory.
- There will be two assigned papers to read for each week's class.
- Each week, you should come to class having read both papers and be prepared to discuss and critique each paper. This could entail articulating the paper's main question and hypothesis, presenting a figure from the paper, and/or commenting on whether the paper's data sufficiently supports its claims.
- In addition to the mandatory weekly reading, there will be one written assignment due Week 8, and one final oral presentation during our last class meeting (Week 15).
- More details on these assignments are within the syllabus.
- This course is graded pass/fail. Attendance and participation, the written assignment, and the final presentation will all be components of your final grade.

Primary research

- What constitutes a primary scientific research article?
 - novel data published within a peer-reviewed journal
 - i.e., not a review, not a news article, not a Wikipedia page
- Articles have a typical structure; knowing this structure ahead of time can help orient the reader
- Different journals use slightly different structures, so take the time to note the structure before diving in
 - Abstract (think: what's an abstract?)
 - Introduction/background
 - Main questions, hypothesis, and rationale for study
 - Results (containing both written text and figures)
 - the figures are the meat of the research article
 - Conclusions/Discussion (think: what's the difference between the results and the discussion?)
 - Methods
 - References
 - Supplementary Data
- Where do we find primary research articles?
 - Pubmed, google scholar, web of science
- How to read a paper:
 - Identify the big-picture question within the field
 - Go through the background, see if you can summarize the big points in your head
 - Identify the specific questions/goal of the paper
 - Identify the approach
 - Break down the results sections, bit by bit (cycle between the figures and text)
 - Compare the results to the author's conclusions
 - Take notes! Annotate, underline, highlight, summarize.

Thinking about cell fate and identity

-There are many different cell types that we're familiar with and that scientists have characterized. How many specific cell types can you name? (Examples: Stem cell, germ cell, etc. Types of brain cells (neurons, astrocytes, oligodendrocytes, microglia), types of immune cells (T cells, B cells, dendritic cells, macrophages), types of bone cells (osteoclasts, osteoblasts), types of epithelial cells, etc.)

-How do scientists identify and classify different cell types?

-Imagine more basic and more complex ways of identification:

- What does the cell look like? (microscopy)
- What does the cell do over time? (microscopy, functional capabilities)
- What genes are transcribed?
- What proteins are present?
- What signals does the cell express and/or secrete?

-Germ cells are the specialized haploid cells that fuse and give rise to the next generation (sperm and egg). Somatic cells are everything else.

-An important facet of a cell's identity is its potency.

Potency is the degree to which a cell is able to give rise to other cell types.

Levels of potency: Totipotency, Pluripotency, Multipotency, Oligopotency, Unipotency.

Totipotency – embryonic and extraembryonic tissue

Pluripotency – all three germ layers (endoderm, mesoderm, ectoderm)

Endoderm: interior stomach lining, gastrointestinal tract, the lungs

Mesoderm: muscle, bone, blood, urogenital

Ectoderm: epidermal tissues and nervous system

Sperm + Egg = Zygote (totipotent) → → → Blastocyst (pluripotent inner cell mass; "embryonic stem cells")

-Waddington's landscape

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