**Course Goals:**

**1) To learn about Epithelial Cells, their development, components & functions**

**2) To investigate properties of epithelial cell: Type II Lung Alveolar Cells**

**Overarching skill development goals**

**S1) To expand your ability to identify, read & discuss textbook & primary literature**

**S2) To practice your ability to design and execute well-controlled experiments**

**S3) To learn laboratory techniques involved in mammalian cell culture and biochemical analyses based on fluorometric and luminescent detection**

**S4) To develop skills required for statistical analysis *&* interpretation of data**

**S5) To develop skills & comfort communicating experimental findings.**

**S6) To add to the current body of scientific knowledge**

**To meet Goal 1:** By the end of the semester the group will have collected and discussed information that answers the questions found at the end of this syllabus (S1 & S5). We will develop informational webpages that communicate this information to a wider audience (S5).

**To meet Goal 2:** You will read posters and final papers of previous research students and identify a research question that builds upon their research. You will read primary literature in that area (S1) and design experiments that address it (S2). Throughout the semester you will keep a detailed laboratory notebook (S5 & S6) and will compile an annotated bibliography (on Refworks) containing at least 8 articles related to your experimental question (S1 &S5). Beginning with first week’s meeting you be responsible for maintaining your lung cell cultures and will use them in your experiments (S3). Data collected will be analyzed and the results placed back into the context of the field in the form of lab meeting presentations and a research poster (S1, S4, S5 &S6)).

**My expectations:**

**I expect that you are dedicated and excited about this research opportunity and this topic.** *If you are not it will be a long semester—don’t sign up.*

**To meet our class goals you will:**

++ Dedicate at least 10- 15hr every week to your research project. You will keep a time log in the back of your notebook

++ Keep in progress and completed webpage components in the appropriate Louise/Public folder and be respectful of others work.

++ Keep a detailed research notebook that records your activities. Notebook entries will include the date, ‘question’, plan/approach, and detailed notes describing what was actually done, side observations or notes about equipment, the data that were collected, where that data is stored (and backed up), analysis of the data and conclusions drawn. Data file must be stored on Louise/Public to insure access

+++Be proactive in making sure that your understanding extends beyond the mechanics of the protocols and the surface ‘answers’ to the questions

We work in shared space with shared equipment. You must use all scientific equipment and facilities conscientiously, obeying all safety regulations, reporting problems with equipment, maintaining supplies and cleaning lab and glassware.

**Technical skill set**

+Mammalian cell culture maintenance including preparing and thawing frozen stocks, feeding, cell counts, splitting and seeding experimental cultures

+ Metabolic rate manipulation via thyroid hormone treatments

+Externally induced oxidative stress manipulation via ozone exposure (including generating ozone and calculating exposure levels through gas flow rates)

+Analysis of cell viability and type of death (trypan blue staining, cytoplasmic protease marker, mitochondrial activity), necrosis (protease marker), and apoptosis (caspase 3/7 activity)

+Analysis of cellular redox state (total glutathione, GSSG and GSH levels)

+Statistical Analysis including calculation of error propagation, standard deviation and measures of statistical significance (Using Excel or other statistical programs) and graphical presentation of those analyses

+Website design and authoring (Dreamweaver)

+General lab maintenance including all solution preparation, pipetting, weighing, maintaining tips, glassware and other laboratory stocks

**Important note:** In addition to routine maintenance and prep, experimentationwill require *blocks* of time that are experiment dependant [Ex. Ozone exposure experiments require cells are seeded on one day (1hr) exposure is set up and completed one day (~3hr) and data collection begins 20-24hr later (2.5hr). ] Be certain that you have allowed for the multiday facet of the experiments within your schedule.

The timing of experimentation is flexible however, for safety and access reasons you are *only* allowed to generate ozone and complete an exposure between 8am-6pm

**Schedule**

Monday 2-4pm Epithelial Question Discussions and Group Meeting

Additional time scheduled as needed for cell maintenance and experiments

|  |  |
| --- | --- |
| 8/23 Wk 1 | **Literature research approaches Discussion**:  **Introduction to Cells/ Cell culture; Feeding cells**  *Begin reading previous projects* |
| 8/30 Wk2 | **Epithelial cells / Epithelium Discussion:** *BRING information*  **Counting and Splitting cells**  *Schedule time for research question discussion*  *Attend Poster Session Thursday 9/2 Lily Gallery 7-9* |
| 9/6 Wk3 | **6 types of Epithelial Cells Discussion:** *Present information about your subtype*  **Continue stock maintenance throughout semester**  *Individual research question discussions* |
| 9/13 Wk4 | **DUE Group Epithelial Cell introduction page and individual**  **cell-subtype webpages**  **Present research question to group** Plan experimentation |
| 9/20 Wk5 | **Epithelial Morphogenesis Discussion:** *BRING information*  *Pairs for next week chosen*  **Continue data collection until 11/8** |
| 9/27 Wk6 | **Epithelial Components Discussion:** *Pairs provide reading and lead discussion*  **Lab notebook check** |
| 10/4 Wk7 | **DUE: Epithelial Components Webpages**  **“Restock the lab” week** |
| 10/11 Wk8 | **Fall Break : *Don’t forget your cells need to eat over break***  **DUE: Annotated bibliography** |
| 10/18 Wk9 | **Lab meeting: 10min presentations of data to date** |
| 11/1 Wk10 | **Continue research** |
| 11/8 Wk11 | **Data collection ends by 11/12** |
| 11/15 Wk12 | **Individual meetings to present analyzed data and what it means (by 11/19)**  *Provide feedback for practice talk by Maddie Chalfant* |
| 11/22 Wk13 | **DUE before midnight Monday: Poster draft**  Thanksgiving break |
| 11/29 Wk14 | **DUE before midnight** **Wednesday: Poster final Draft**  *Attend Maddie Chalfant’s Thesis Defense 12/3 3pm* |
| 12/6 Wk15 | **Present poster**  **Turn in lab notebook** |

**Epithelial Cell Biology Topics and Areas to Begin Discussion**

**Wk 2: Epithelial cells/ Epithelium: Gathering Basic definitions**

What are they?

What structural and functional characteristics cause these cells to be called ‘epithelium’ and not some other cell type?

**Wk 3: The 6 types of Epithelial Cells**

|  |  |
| --- | --- |
| Simple Squamous epithelium | Simple Cuboidal Epithelium |
| Simple Columnar Epithelium | Ciliated Columnar Epithelium |
| Glandular Epithelium | Stratified Epithelium |

*For each type*

What is it?

Where is it found? (Examples (at least 2) of locations in body or within organs)

What does it do? (Examples of functions that go with the locations and how/why the epithelial nature is important to that function)

Images: at least one microscope image and one *self-drawn* diagram that illustrate characteristics of ‘your’ epithelial cell type

**Wk 5: Epithelial Morphogenesis**

Areas to investigate: Where do epithelial cells come from?

How do epithelial cells develop? Do different types develop different ways?

**Wk 6: Epithelial Components**

Polarity: Minimal areas to investigate: What is it? Why is it important? How does the

body ‘use’ it? Do other cell types have polarity?

Tight Junction: Minimal areas to investigate: What is it, specifically? What are they made of? How do they form? What are other types of junctions or connections between cells? Are they used by epithelial cells? Do non- epithelial cells use tight junctions?

Transcytosis: Minimal areas to investigate: What is it? How does it work? What is it used for? What about other types of transport? Do epithelial cells use those other types? Do non-epithelial cells use transcytosis?