



Glomeruli Filtration

Anika M. Lynch
Northwest High School
Germantown, MD
Summer 1999

Research Host:
Susan Mulrone, Ph.D.
Georgetown University School of Medicine

GLOMERULI FILTRATION

SUGGESTIONS FOR TEACHERS

Purpose: to produce a physical model of the glomeruli filtration. This activity is intended for a college-level *Anatomy and Physiology* (grades 11-12) class.

Objectives:

Students will be able to demonstrate knowledge of the following:

Semi-permeable membrane	kidney anatomy
Glomerulus	Bowman's Capsule
Homeostasis	filtration
Diffusion	osmosis
Nephron	concentration gradient

Students will be able to demonstrate the following process skills:

Applying prior knowledge	making analogies
Communicating ideas	making predictions
Collecting data	observing
Testing hypothesis	

Materials:

Students will work in groups of 3 or 4. Each group will need the following:

Dialysis tubing (5" long)	1L distilled/deionized water
1L beaker	poster board/ newsprint
markers	4 test tubes

The following materials should be available to all groups on a main table:

Powder eggs solution	<i>Ensure</i> (nutrition drink)
Gelatin solution	glucose solution
Sugar solution	corn starch solution
Albumin solution	graduated cylinder
500 ml beakers	funnels

Solutions should be brought to 1L volume. The concentration of these solutions is up to the teacher but should be labeled on the stock solution.

Testing indicators:

Biuret Solution	Benedict's Solution
Iodine	

All of the above materials can be ordered from a biological supply company and/or a grocery (w/pharmacy) store.

Preparation:

The following activity can be used as the "Elaborate" component of the **5 "E" Learning Cycle**. The following is an outline of the other Learning cycle components.

Engage: Personal Diet and Urination Log over 48 hours (weekend)

Explore: Class discussion- identifying trends in class data from Diet/ Urination logs

Explain: Lecture on renal function, homeostasis and glomeruli filtration

Elaborate: Glomeruli filtratoin model

Evaluate: Have students assess how well their model represents the physiology of the glomerulus.

Activity will take three to four -45 min periods. Stock solutions should be made the same day as the model building takes place. Teacher and student should make sure that the solutions remain "in solution" during the testing period.

Procedure:

Day 1

1. Have students gather lecture notes and textbooks and any other reference materials they may need.
2. Show the students the available items and materials.
3. Have students individually brainstorm (10-15 min) how they will use the available materials to construct a working Filtration model.
4. Place students in groups of 3 or 4 people and give 20 min to share and compare their individual brainstorm ideas
5. The students will then draw their model on the provided work sheet, labeling all materials and demonstrating (using arrows) how the filtration will take place.
6. Student will turn in model design proposal to teacher for approval
7. If time permits, each group can present their proposal and have students give feedback to each group.

Day 2

1. Make all solutions, labeling all containers with solution name and concentration.
2. Have all other materials and equipment on a central, accessible table.
3. Return the proposals to groups so they can make adjustments as needed (10 min)
4. Have students begin constructing their model using the above materials.
5. Guide students to focus on building and testing their model, reminding them of time constraints.
6. Remind students that they will have to **PROVE** with **DATA** that their model works.

Students might need another 45-min period to complete testing

Day 3 (4)

1. Have groups present their model on poster board/ newsprint. Have them include the following: general construction plan, materials used, test used and data from test. (Assessment item)
2. Have the students, individually critique other groups model on how the model was constructed; testing procedure used, how well does the model represent filtration. (Assessment item)
3. Have each student critique their own groups model in paragraph form: in what ways does the model represent glomeruli filtration and in what ways does it fail. (Assessment item)

Safety Concerns:

Students should wear aprons when test solutions with the model. Remind students to label their individual test tubes for each solution. Remind students no solution is to be ingested.

Questions to Ask:

As students are brainstorming and building their model the following questions can be used to keep them focused on their task:

How will you test that this will work?

How will you know this works?

How can you improve your model so that it better represents filtration?

What data will you record that proves that this works?

Where to go from here:

After this activity it is suggested that both digestive and excretory system be reviewed and assessed.

References:

Marieb, Elaine Human Anatomy and Physiology 4th ed. 1998

Pg 896-898, 972-975.

Suggestion for Assessment: See Day 3(4).

Names _____

GLOMERULI FILTRATION

MODEL DESIGN

Group Proposal

Objective: to design a model of glomeruli filtration.

Directions:

1. Review notes and textbook on glomeruli filtration.
2. Construct a schematic drawing of the glomeruli and the flow of fluid through it.

3. Given the material below, circle or highlight which material your group should use to construct this model.

Dialysis tubing (5" long)

1L distilled/deionized water

1L beaker

poster board/ newsprint

markers

4 test tubes

Powder eggs solution

Ensure (nutrition drink)

Gelatin solution

glucose solution

Sugar solution

corn starch solution

Albumin solution

graduated cylinder

500 ml beakers

funnels

Biuret Solution

Benedict's Solution

Iodine

4. Compare each group member's individual ideas. Draw and label a model that represents filtration using the materials circled above. Use the back of this page if necessary. This proposal is due at the end of the period.

GROUP MODEL PRESENTATION

Student Evaluation

Group Members _____

Directions: You are to evaluate the above students as a group, using the criteria below. Circle the number that best demonstrates the group's model and presentation. The number 1 (one) represents the presentation lacks the criteria where as the number 5 (five) represent the presentation completely and clearly exhibits this criteria.

Criteria:

Group uses material correctly	1	2	3	4	5
Model demonstrates filtration	1	2	3	4	5
Group tested model correctly	1	2	3	4	5
Data from test is valid and reliable	1	2	3	4	5
Verbal and Visual explanation is clear	1	2	3	4	5
Overall Model is well design	1	2	3	4	5

Student Name _____