

## Model Science – Gastrointestinal (GI) Physiology

<b>LEVEL:</b>	Grades 6 - 8
<b>TYPE OF CONTEST:</b>	Individual/Team
<b>COMPOSITION OF TEAM:</b>	1-2 Students per team
<b>NUMBER OF TEAMS:</b>	Preliminary – Determined by your local MESA Center Regional – 3 of teams per MESA Center
<b>SPONSOR:</b>	Nicole Patterson, Associate Director, UC Irvine MSP

**OVERVIEW:** Students will construct an original model of the human gastrointestinal tract that will *simulate the passage of food* and will answer questions drawn from an assigned list using reading material provided in the MESA Day curriculum. **Participation logistics, limits, and competition facilities may vary by host site. Advisors and students are responsible for verifying this information with their center director.**

**MATERIALS:** The following materials will be provided by student team members:

- Nonperishable materials with which to build the original model
- Nonperishable materials to represent the “food” item for testing

### GENERAL RULES:

- 1) The model must be the original work of the student(s). Commercial models may NOT be used. Judges may ask questions to verify the authenticity of the model. **Violation of this rule will result in disqualification.**
- 2) Only materials that are not perishable may be used in the model’s construction. Nonperishable items are those that will not rot, spoil, or decay without refrigeration. Students are encouraged to fully incorporate a variety of allowable materials in the model. **Violation of this rule will result in disqualification.**
- 3) The model AND accompanying materials table should be clearly labeled with student name(s), grade, school and MESA center. If the model and accompanying materials table is not clearly labeled with student name(s), grade, school and MESA center, a **10** point penalty will be deducted from the total score.
- 4) The model should be no larger than 3 feet high by 3 feet wide by 2 feet deep.
- 5) The model should realistically depict all required structures and demonstrate the passage of food through the GI Tract.
- 6) The passage of food must be initiated by a team member in one single motion. Once the simulation has begun the team may no longer have contact with the model and the simulation should continue uninterrupted. Contact with the model before the simulation

has ended will result in an immediate stoppage and void any remaining points. Maximum time to complete the simulation is 2 minutes.

- 7) The model should account for the time it takes for the food to pass through the GI tract. (See *JUDGING # 5*)
- 8) The representation of the food item is at the student’s discretion, but it must be a nonperishable item.
- 9) Students must provide all materials needed to demonstrate their model. Host center will not provide electrical power, liquids, or any material to use in the demonstration of the model.
- 10) A materials table should be provided with the model. The materials table may be attached to the model or provided separately. If provided separately, it must be clearly labeled with student name(s), grade, school and MESA center.
- 11) The competitors will attempt to answer five randomly selected questions from the attached list, plus unpublished tiebreaker questions if needed.

**JUDGING:**

- 1) Three points will be awarded for the following: (maximum 3 points)
  - a. The model, including the stand and all of its components is no larger than 3 feet high by 3 feet wide by 2 feet deep.
- 2) Five points will be awarded for a COMPLETE display table listing all materials utilized for all structures on the model. (maximum 5 points)

**Sample Materials Table**

Structure	Material
1. Esophagus	Pink tubing
2. Duodenum	Red Balloon

- 3) Points will be awarded for each of the 12 required structures presented on the model as listed below. (maximum 48 points)
  - a. Required structure present: 0 – ½ point awarded
  - b. Required structure correctly labeled: 0 – ½ point awarded
  - c. Realistic depiction of required structure: 0 - 1 points awarded
  - d. Required structure creatively demonstrates the passage of food: 0 - 2 points awarded

Structure	Present (0 - .5 point)	Correctly Labeled (0 - .5 point)	Realistic Depiction (0 - 1 point)	Passage of Food (0 – 2 points)
Mouth				
Esophagus				
Stomach				
Duodenum				
Jejunum				
Ileum				
Cecum				
Ascending Colon				
Transverse Colon				
Descending Colon				
Sigmoid Colon				
Rectum				

- 4) Points may be awarded for the presence of up to 3 additional structures other than the required structures. (maximum 6 points) Additional structures will be judged as follows:
  - a. Additional structure present: 0 – ½ point awarded
  - b. Additional structure correctly labeled: 0 – ½ point awarded
  - c. Realistic depiction of additional structure: 0 - 1 point awarded
- 5) Points will be awarded based on the amount of time it takes for the food item to pass from the mouth to the rectum. Models not able to complete the task will receive 0 points for this portion of the competition. Maximum time to complete the simulation is 2 minutes. (maximum 15 points)

<b>Time</b>	<b>Points Awarded</b>
Unable to complete	0 points
Less than 15 seconds	3 points
15 seconds – 30 seconds	6 points
15 seconds – 45 seconds	9 points
45 seconds – 1 minute	12 points
1 minute and above	15 points

- 6) Points will be awarded for creativity. Do the various structures display characteristics of originality and creativity in terms of overall composition? Are the different structures variable with different colors, textures, and dimensions? Is the use of materials used to depict the different structures creative? (maximum 8 points)
- 7) Judges will determine team order by random drawing and will post the team order prior to the start of the competition.
- 8) Once a team is called they will be given a maximum of 2 minutes to demonstrate the functionality of their GI Tract. Once the judge gives the start order the team will, in one single motion, initiate the passage of food and may have no further contact with the model until the simulation has ended or 2 minutes have passed.
- 9) Students will answer five questions from an assigned list based on the content provided in the MESA Day curriculum. (maximum 15 points) Question/answer portion judged as follows:
  - a. Students will randomly select 5 questions.
  - b. Students will have a maximum of 30 seconds to answer each question.
  - c. Each correct answer will be awarded up to 3 points. Partial points may be awarded.
  - d. There will be a set of 5 previously unpublished tiebreaker questions available on the day of the competition. Each tiebreaker question is worth up to 3 points each.

**AWARDS:**

- Medals will be awarded for 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> place.

**ATTACHMENTS:**

- Specification Checklist
- Questions for Model Science – Gastrointestinal Physiology
- Score Sheet for Model Science – Gastrointestinal Physiology

**Model Science – Gastrointestinal Physiology  
Specification Checklist**

*\*Note: As the name above implies, this list is intended simply as a guide for meeting the required competition specs. It should not be treated as an official judging document.*

- Only nonperishable items used in the construction of the model.
- The model is clearly labeled with student name(s), grade, school and MESA center.
- The model of the GI tract is no larger than 3 feet x 3 feet x 2 feet deep.
- The model is clearly labeled w/ required structures.
- The model simulates the passage of food through the gastrointestinal tract. The simulation is initiated by a team member and continues undisturbed to completion.
- A materials table is included with the model.

**QUESTIONS FOR MODEL SCIENCE – GASTROINTESTINAL PHYSIOLOGY**

2016 – 2017  
Middle School (Grades 6<sup>th</sup> – 8<sup>th</sup>)

**Students MUST be prepared to answer each question with a complete sentence or sentences.**

1. How do nutrients from digested food reach the bloodstream?
2. Name two body organs that lie outside the GI tract and directly aid in the digestion of food.
3. What is mastication?
4. What are at least 3 things that saliva does?
5. Besides eating food, what 3 things can cause saliva secretion in humans?
6. Define peristalsis.
7. Name 3 parts of the stomach.
8. Name 3 functions of the stomach.
9. What is the pH and composition of chyme?
10. Name the 3 parts of the small intestines.
11. What is the primary function of the colon?
12. Name the four main sections of the colon.
13. What is bile?
14. Bile is secreted into the bile duct by what organ? And when not in use excess bile is stored where?
15. Name three important functions of the liver.
16. What is gut flora/intestinal bacteria and how does it aid in digestion?
17. What is the most important function of intestinal villi?
18. What is responsible for the brown color of feces?
19. What is defecation?
20. Define mechanical and chemical digestion.
21. What causes gastroesophageal reflux disease?
22. Digestion and absorption occur in what major portion of the GI tract?
23. What is a peptic ulcer and what are the possible causes?

**SCORE SHEET FOR MODEL SCIENCE – GASTROINTESTINAL PHYSIOLOGY**  
**Middle School (Grades 6<sup>th</sup> – 8<sup>th</sup>)**  
**2016 - 2017**

*Copies of this score sheet will be provided by the MESA Day Host Center.*

Name & Grade: \_\_\_\_\_ Name & Grade: \_\_\_\_\_

School: \_\_\_\_\_ MESA Center: \_\_\_\_\_

**Part I: Model Criteria/Materials Table**

Size (3 points) ..... \_\_\_\_\_  
 Materials Table (0-5 points) ..... \_\_\_\_\_  

**Subtotal for Part I** (max 8 points) \_\_\_\_\_

**Part II: Model Structures**

Required Structures (48 points):

Structure	Present (0 - .5 point)	Correctly Labeled (0 - .5 point)	Realistic Depiction (0 - 1 point)	Passage of Food (0 – 2 points)	Sub Total
Mouth					
Esophagus					
Stomach					
Duodenum					
Jejunum					
Ileum					
Cecum					
Ascending Colon					
Transverse Colon					
Descending Colon					
Sigmoid Colon					
Rectum					
				Total	

Additional Structures (6 points):

Structure	Present (0 - .5 point)	Correctly Labeled (0 - .5 point)	Realistic Depiction (0 – 1 point)	Subtotal
			Total	

**Subtotal for Part II** (max 54 points) \_\_\_\_\_

**Part III: Food Passage Simulation**

Time to complete passage of food: \_\_\_\_\_

Time	Points Awarded
Unable to complete	0 points
Less than 15 seconds	3 points
15 seconds – 30 seconds	6 points
15 seconds – 45 seconds	9 points
45 seconds – 1 minute	12 points
1 minute and above	15 points

**Subtotal for Part III** (max 15 points) \_\_\_\_\_

**Part IV: Overall Creativity of Model**

0 - 2 points each:

1. Creativity in the use of materials to depict colors \_\_\_\_\_
2. Creativity in the use of materials to depict textures \_\_\_\_\_
3. Creativity in the use of materials to depict dimensions \_\_\_\_\_
4. Creativity in the use of materials to depict variability of the different structures \_\_\_\_\_

**Subtotal for Part IV** (max 8 points) \_\_\_\_\_

**Part V: Gastrointestinal Physiology Questions**

0 - 3 points each:

Question 1: \_\_\_\_\_ Question 2: \_\_\_\_\_ Question 3: \_\_\_\_\_  
 Question 4: \_\_\_\_\_ Question 5: \_\_\_\_\_

**Subtotal for Part V** (max 15 points) \_\_\_\_\_

**Labeling Penalty** - \_\_\_\_\_

Deduct **10** points if model and materials table is not clearly labeled with student name(s), grade, school and MESA center.

**GRAND TOTAL** \_\_\_\_\_

(Add subtotals for Part I – Part V; deduct penalty if applicable)  
 Maximum score is **100**

**Tie Breaker Questions (ONLY IF NEEDED)**

0 - 3 points each:

Question 1: \_\_\_\_\_ Question 2: \_\_\_\_\_ Question 3: \_\_\_\_\_  
 Question 4: \_\_\_\_\_ Question 5: \_\_\_\_\_

**Total including tie breakers** \_\_\_\_\_

Judges: \_\_\_\_\_