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RE: Science Olympiad 2017 - 2018 – Anatomy and Physiology

This year the topic of "Anatomy and Physiology" has been narrowed to (3) *three systems of the body*. We will adhere to this limitation. You will also be allowed to use both sides of a (1) 8 x 11 sheet of paper containing any information you deem relevant. Directions say that you will also be able to bring in and use calculators. You will not need them.

(3) Three systems of focus.

1. *Digestive*
2. *Respiratory*
3. *Immune*

OVERALL INFORMATION:

1 - The questions will be formed from written questions, models, viewing through microscopes and/or photographs. For example, a model of the Digestive system with arrows drawing your attention to a specific region/part for identification, function or some other similar question.

2. - **All Stations will be timed.** (approximately 3 minutes each depending on the number of stations), when the time has lapsed, you will "physically" move to another station. (This is called a "lab practical")

3. - **Teams of 2 only**

Digestive System

MODELS:

- 1. Face/Head** – showing Salivary Glands and their location
- 2. Digestive System** – Showing all the primary and secondary organs/glands
- 3. Intestine** – Showing the (4) four layers, villi, lacteal etc.

SPECIFICS:

- a. Types of Digestion (Mechanical/Chemical) and what is involved in achieving/accomplishing it. Where is it completed (in the GI tract))
- b. Types of teeth and the primary function of each tooth type.
- c. Four (4) layers of the GI tract with their tissue composition and function.
- d. Components of the digestive (alimentary, GI) tract. Such as small intestine, cecum etc.
- e. Chemical digestion: enzymes involved, enzyme substrates, products and glands producing them. Also, where does this occur for different macromolecules.
- f. Accessory glands/organs/structures associated with the digestive process. (Teeth, Liver, Gall Bladder, Pancreas). How they function, enzymes released, hormones released, bilirubin, urobilinogen (urobilin, stercobilin) jaundice etc.
- g. Knowledge of Ulcers, Polyps (cancer) Diarrhea, Lactose Intolerance, Celiac Disease, Hepatitis, Appendicitis, Diverticulitis (google works good for this)

***Attached is a list of the Chemical Digestion specifics that I would like you to be familiar with.**

RESPIRATORY:

MODELS:

- 1. Thoracic Cavity**
- 2. Larynx (containing Hyoid Bone)**

SPECIFICS:

- a. Parts of the respiratory system. (and "sub" parts if there are, such as Primary, Secondary, Tertiary Bronchi)
- b. Parts of the Larynx
- c. Tissue that comprises the various respiratory passage ways.
- d. Sinuses
- e. Muscles of Inspiration and Expiration
- f. Lung Volume (ie Tidal Volume, Vital Capacity etc)
- g. Four (4) divisions of Respiration (pulmonary, external, internal, cellular)
- h. Three (3) tonsils (with location) associated with the pharynx
- i. Diseases and/or malfunctions associated with the respiratory system.
 - a. Sinusitis
 - b. Metaplasia
 - c. Asthma
 - d. Surfactants
 - e. Emphysema
 - f. Pneumonia
 - g. Pulmonary Embolism
 - h. Bronchitis
 - i. Pneumothorax
 - j. Hemothorax
 - k. Apnea
 - l. Eupnea
 - m. Pleurisy
 - n. Upper and Lower Respiratory Tract

IMMUNE SYSTEM:-

This system is going to be difficult to assess in a lab setting since most of it is theory. Although NOT in concrete, we will more than likely make it as practical and possible. What is here is "VERY" pliable. I will not go beyond the scope contained here and if changes are made, I will update Annie who will, in turn, notify the coaches.

MODELS:

- 1. WBCs**
- 2. Blood Clot**

PHOTOMICROGRAPHS/ILLUSTRATIONS

Common Viruses
Proteins sites on host cells
Antigen/antibody complex

SPECIFICS:

Be "Very" familiar with these terms in regards to definition and/or function and/or how they fit into immunology

- a. Innate Immune System vs. Acquired (Specific) Immune System
- b. Cytokines
- c. Complement Cascade....Complement System
- d. Phagocytes (Macrophages, Neutrophils, Dendritic Cells)
*Other WBCs: Basophil, Eosinophil, NK Killer Cells, 'T' cells
- e. Anatomical Barriers (skin, peristalsis and cilia in GI tract, mucous, floral balance and competition and tears)

- f.* Know what is involved in Inflammation: Macrophages, dendritic cells, histocytes, Kupffer cells and mastocytes
- g.* Chemical factors during inflammation: Histamine, bradykinin, serotonin, leukotrienes and prostaglandins
- h.* Factor 'X', prothrombin, fibrinogen, fibrin and thrombocytes

***i.* ADAPTIVE/ACQUIRED/SPECIFIC IMMUNITY**

Immunological Memory

Vaccination

Lymphocyte "adaptation" and the changing of genome

B – Memory cells

T – Memory Cells

Mode of Action

Lymphoid Organs what are they and what cells are found there.

3 Stages of Differentiation

Naïve Cells

Effector cells

Memory Cells

Exogeneous Antigen

Endogeneous Antigen

'T' Helper cells

'B' cells

Regulatory 'T' cells

'B' Lymphocytes – antibody production = Humoral Immunity 5 types

A, D, E, G and M

Plasma Cells

Passive Memory

Active Memory

REFERENCES:

Any collegiate text dealing with Anatomy and physiology would be acceptable. I might steer away from an Advanced Placement one in that they have the tendency to over simplify concepts.

Human Physiology by Fox is easy reading and contains the nuts and bolts of the discipline of physiology

Anatomy and Physiology – by McKinley, this is the text I use for my course

Introduction to the Human Body (Anatomy and Physiology) by Tortora is also easy to read and just released, so I am not sure of the availability

Anatomy and Physiology by Marieb is a classic. Has everything you want to know, care to know, may not want to know.

Vander Human Physiology by Widmaater, is extremely high level, difficult to read but has everything you ever need to know about physiology

Anatomy and Physiology by Sealey. Another Classic

Anatomy and Physiology by Martini. Another Classic

Anatomy and Physiology by Saladin. Again another Classic

Anatomy and Physiology by Van De Graaff. Same

Human Form/Human Function by McConnell. This is a new one on the block. It comes with the lab/study guide

Since the human body has not changed form in thousands of years, there are numerous editions from the same authors and that information has obviously not changed. The “Big” names in the field are listed here. The only knowledge that is dynamic is in the field of physiology. We are constantly learning more about “Hormones and enzymes” and how the body systems control homeostasis. Any of the above reference books will help you in your journey to understand the subject of Human Anatomy and Physiology.

Feel free to contact me if you need more direction. If you would like to see some of the models I might use, go to "photo bucket" **user name** anatomytissue and the **password** is biology31. AND/OR you can go onto facebook and in the search bar type in "supplemental instruction". You do NOT have to be "Friended" on this one in order to gain access. Recently, my students just launched another facebook page titled "Bio 31 Anatomy". This DOES require you to be "friended" (as with most facebook accounts) and when you ask, Jerry or Sunny will "friend" you if you tell them you are involved in Science Olympiad. This account has narrated video clips showing models, dissections etc.

Lastly, with this set of instructions, you have my office phone and email. If you have any questions OR would like to arrange a time to come to my lab and physically look at the models I might use, feel free to contact me.

This year I will have Thi Ngo, the AP - A & P instructor from Lincoln High, help running this event. She is extremely knowledgeable and available to help before the event day with any questions you may have. Additionally, she will have access to my lab to allow you an opportunity to view models that may appear during the competition.

Attachments:

STOMACH: *Gastric Glands (3 types of Exocrine Cell types)*

1. **Parietal Cells** – Produce Intrinsic Factor which triggers absorption of B12 and production of HCl.
2. **Chief Cells (Zymogenic)** – Produce Pepsinogen + Gastric Lipase. Parietal Cells + Chief Cells = Gastric Juice
3. **Enteroendocrine ('G') Cells** – Produce Gastrin (hormone) that triggers the release of gastric juice

PANCREAS: *Endocrine and Digestive functions*

1. ***Pancreatic Amylase*** – catabolism of sugars
2. ***Trypsin*** – catabolism of proteins
3. ***Chymotrypsin*** – Catabolism of proteins
4. ***Carboxypeptidase*** – Catabolism of carbohydrates and proteins
5. ***Ribo + Deoxyribonuclease*** – catabolism of Nucleic Acids
6. ***Elastase*** – Catabolism of proteins
7. ***Pancreatic Lipase*** – Catabolism of lipids

SMALL INTESTINE:

1. ***Goblet Cells*** – secrete mucous
2. ***Absorptive Cells*** – simple columnar epithelium
3. ***Paneth Cells*** – secrete lysozyme and are phagocytic
4. ***Enteroendocrine Cells*** – ('S' and 'K' Cells) – secrete hormone "Secretin"

Secretin triggers cholecystokinin (CCK) to be released which in turn causes bile to be secreted by the gall bladder.

- Glucose-dependent insulintropic peptide (GIP)

5. **Duodenal Glands (Brunner's gland)** secrete alkaline mucus to bring pH back up towards 7

INTESTINAL JUICE: is a series of enzymes released by the intestine for catabolism of chyme.

1. **Brush Border Enzymes** – triggered by microvilli –
 - a. Catabolism of carbohydrate fragments (maltase-maltose, sucrase-sucrose, lactase-lactose etc.)
 - b. Catabolism of Proteins (peptidases)
 - c. Catabolism of Nucleotides (nucleosidases and phosphatases)
 - d.
2. **Epithelial cells** secrete bicarbonate to help make Alkaline

Miscl.

1. Pepsin (from pepsinogen) breaks peptide bond
2. Gastric Lipase – breaks triglyceride bonds (children)
3. Lingual Lipase (from mouth) breaks triglycerides in adults.
4. **BILE:**
 - a. Produced by hepatocytes and results from cholesterol + phospholipids + bilirubin
 - b. Unconjugated (not soluble in plasma) binds to albumin
 - c. Conjugated (is soluble) and binds to glucuronic acid