**Topic D.3: Functions of the Liver**

**Essential Idea: The chemical composition of the blood is regulated by the liver.**

**Statements & Objectives:**

**D.3.U1 The liver removes toxins from the blood and detoxifies them.**

Define “detoxification” as related to liver function.

**(Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

Explain the role of the liver in the detoxification of alcohol (including role of ethanol dehydrogenase).

(**Explain**: Give a detailed account including reasons or causes)

Outline the role of the liver in the detoxification of ammonia (and formation of urea).

(**Outline** Give a brief account or summary.)

**D.3.U2 Components of red blood cells are recycled by the liver.**

State the length of a typical red blood cell life span.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

**D.3.U3 The breakdown of erythrocytes starts with phagocytosis of red blood cells by Kupffer cells.**

Explain how the structure of Kupffer cells fits their endosymbiosis function.

(**Explain**: Give a detailed account including reasons or causes)

Create a flowchart to illustrate the steps and products of the splitting of hemoglobin

**D.4.U4 Iron is carried to the bone marrow to produce hemoglobin in new red blood cells.**

Explain how and why iron is transported to the bone marrow bound to transferrin.

(**Explain**: Give a detailed account including reasons or causes)

List three anatomical structures that have transferrin receptors on their cell membranes.

(**List** Give a sequence of brief answers with no explanation.)

Outline the storage of iron in the liver and spleen (including the role of ferritin).

(**Outline** Give a brief account or summary.)

**D.3.U5 Surplus cholesterol is converted to bile salts.**

Outline the roles of hepatocytes in the conversion of excess cholesterol into a component of bile.

(**Outline** Give a brief account or summary.)

Explain the synthesis of VLDL cholesterol by hepatocytes for transport of triglycerides.

(**Explain**: Give a detailed account including reasons or causes)

Describe how the amount of saturated fat in a diet affects the amount of VLDL cholesterol synthesis by the liver.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**D.3.U6 Endoplasmic reticulum and Golgi apparatus in hepatocytes produce plasma proteins.**

Define and list examples of “plasma proteins.”

**(Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

Explain why hepatocytes have a lot of RER and Golgi.

(**Explain**: Give a detailed account including reasons or causes)

**D.3.U7 The liver intercepts blood from the gut to regulate nutrient levels.**

Explain the storage and release of glucose (including the role of glycogen, insulin and glucagon).

(**Explain**: Give a detailed account including reasons or causes)

Outline the role of the liver in protein metabolism (and resulting nitrogenous waste formation).

(**Outline** Give a brief account or summary.)

**D.3.U8 Some nutrients in excess can be stored in the liver.**

List four example nutrients that can be stored by the liver.

(**List** Give a sequence of brief answers with no explanation.)

**D.3.A1 Causes and consequences of jaundice.**

Outline the function and source of bilirubin.

(**Outline** Give a brief account or summary.)

Explain the role of hepatocytes and glucuronic acid in the conversion of bilirubin.

(**Explain**: Give a detailed account including reasons or causes)

List components of bile.

(**List** Give a sequence of brief answers with no explanation.)

Outline the role of bile ducts and gall bladder in the transport and storage of bile.

(**Outline** Give a brief account or summary.)

Describe when, where and why bile is secreted during digestion.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

Define and list causes and symptoms of jaundice.

**(Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

Describe the use of UV light as a treatment for jaundice.

**(Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**D.3.A2 Dual blood supply to the liver and differences between sinusoids and capillaries.**

Draw and label a diagram of the liver, including the left and right lobes, hepatic portal vein, hepatic artery and the hepatic vein.

**(Draw**: Represent by means of a labeled, accurate diagram or graph, using a pencil. A ruler(straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted (if appropriate) and joined in a smooth curve. )

Compare liver blood supplies in terms of blood source (arrives from…), blood destination (flows towards…), and relative oxygen concentration.

(**Compare** Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.)

Draw a labeled diagram of a sinusoid, inclusive of: bile canal cells, bile duct, hepatocytes, Kupffer cells, arterioles and venules.

**(Draw** :Represent by means of a labeled, accurate diagram or graph, using a pencil. A ruler(straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted(if appropriate) and joined in a smooth curve. )

Compare sinusoids to capillaries.

(**Compare** Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.)

Outline the relationship between liver lobes, lobules and sinusoids.

(**Outline** Give a brief account or summary.)

**D.3.NOS Educating the public on scientific claims—scientific studies have shown that high-density lipoprotein could be considered “good” cholesterol.**

Compare and define LDL, HDL, IDL, VLDL chylomicrons.

(**Compare** Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.)

Explain the structure of lipoproteins, including the types of molecules found in the hydrophobic core and hydrophilic surface.

(**Explain**: Give a detailed account including reasons or causes)

**Key Terms**

Liver

​red blood cell

​hemoglobin

​cholesterol

saturated fat

glycogen

​jaundice

​sinusoid

​venules

​IDL

​microvilli

​heme

detoxification

​erythrocytes

​iron

​bile salts

plasma proteins

​insulin

​glucuronic acid

bile canal cells

liver lobes

chylomicrons

interlobular vein

​ferritin

​ethanol dehydrogenase

​Kupffer cells

​bone marrow

​VLDL cholesterol

​endoplasmic reticulum

​bilirubin

​gall bladder

​hepatic portal vein

​​lobules

​lipoproteins

​gut

​albumin

ammonia

​phagocytosis

transferrin

​hepatocytes

​Golgi apparatus

​glucagon

​hepatic artery

​bile duct

​LDL

​hydrophobic

​retinol

​

urea

​endosymbiosis

​spleen

​triglycerides

glucose

​nutrients

hepatic vein

​arterioles

​HDL

hydrophilic

​calciferol