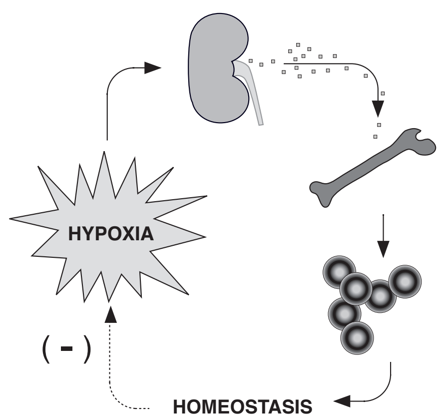
The Blood

A generalized collection of
handouts and illustrations
to accompany lecture



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Contents:

Erythrocyte Metabolism: Glycolysis

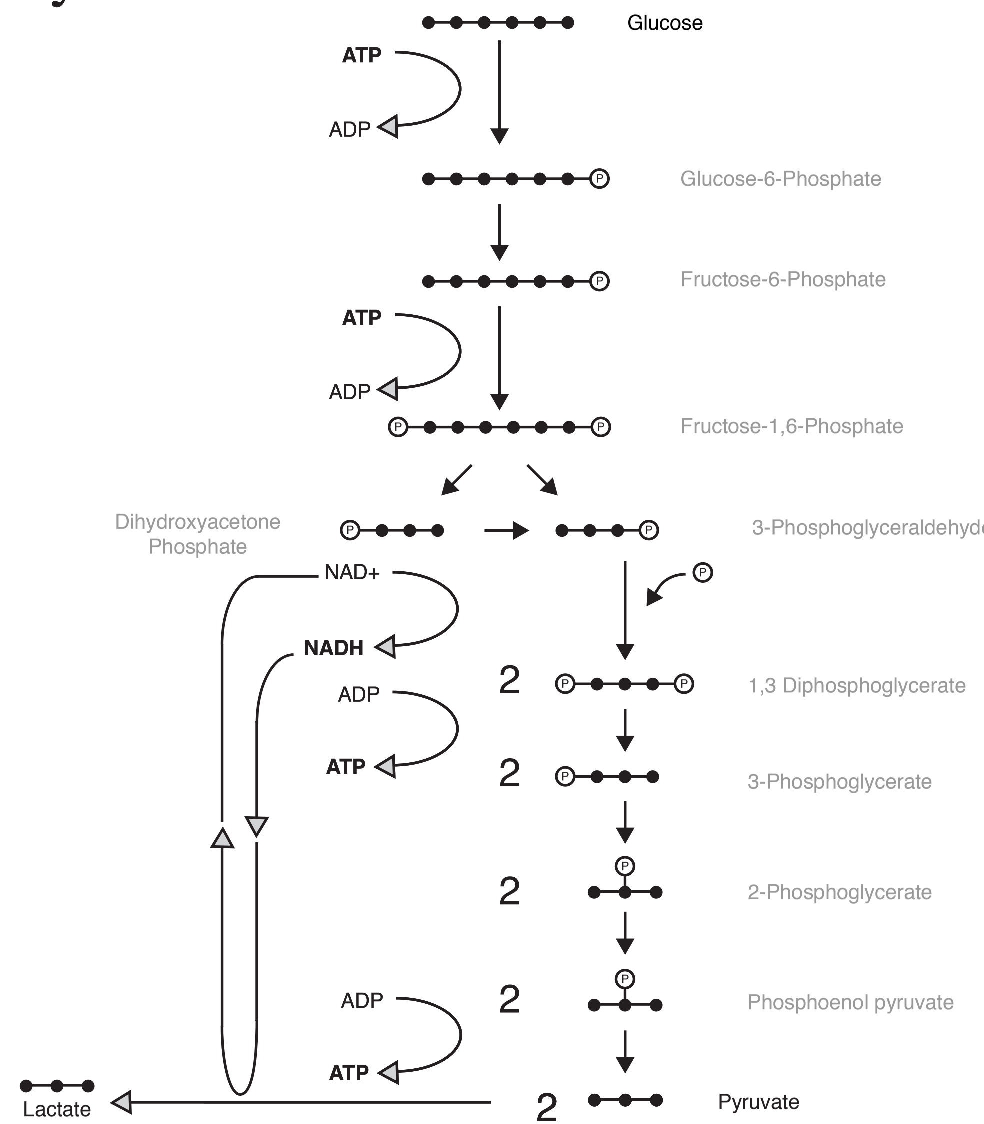
During the ejection stage of erythropoiesis, the mitochondria are eliminated, and with them, the ability to do cellular respiration (transition stage, kreb's cycle, and electron transport chain).

Therefore, the only metabolic pathway remaining for ATP production is that which occurs in the cytoplasm: glycolysis. Although ATP production through glycolysis is modest, the net gain of two ATP per one glucose is adequate for the required metabolic activity of the erythrocyte.

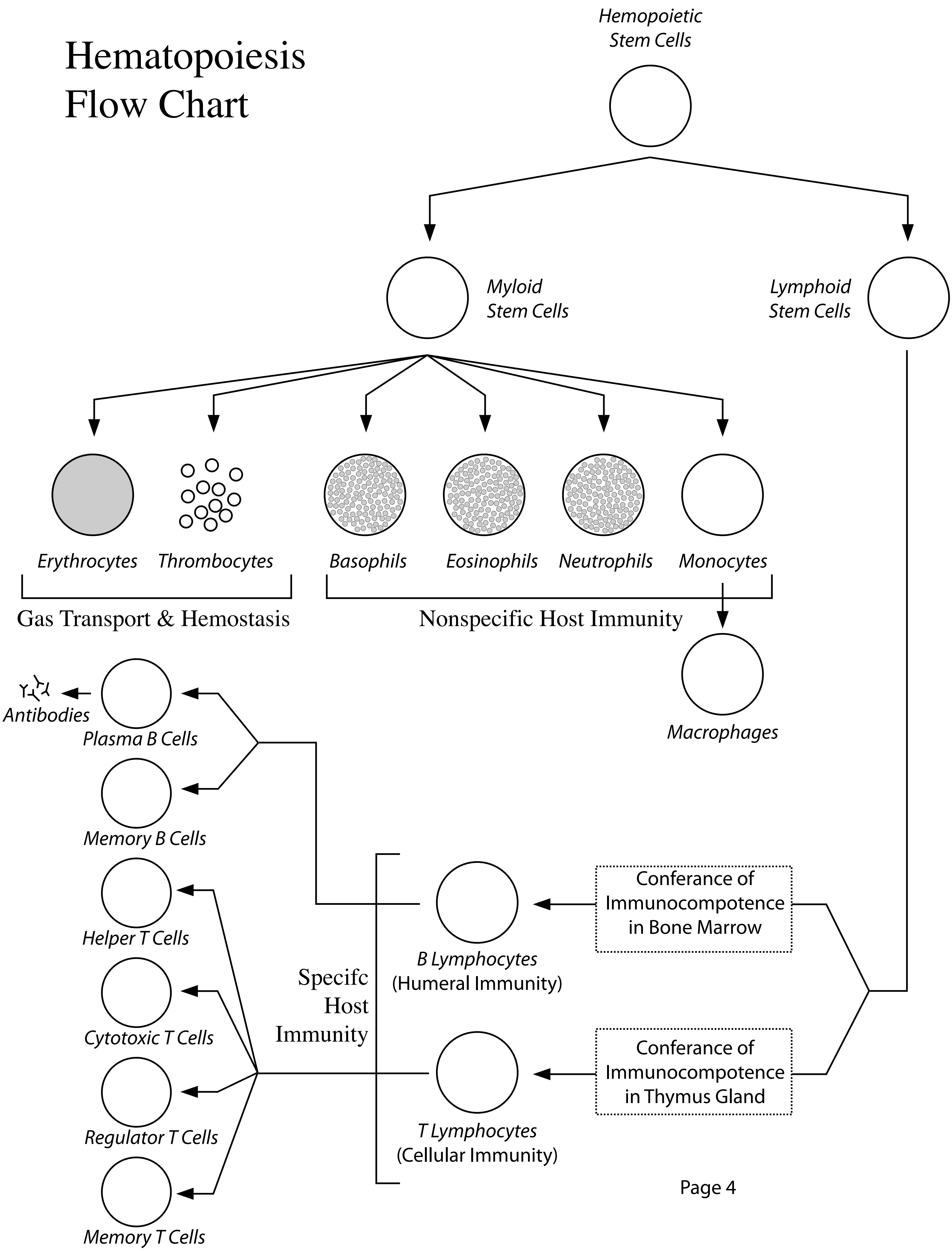
Due to the absence of mitochondria, oxygen is not required nor can it be used. This is beneficial as the erythrocyte does not use its cargo: oxygen and can deliver the goods to the cells that do require oxygen.

In this case, in order for glycolysis to proceed anaerobically, NAD+ must continue to be available to pick up electrons and deposit them somewhere in order to keep this anaerobic pathway going. Therefore, NADH will be oxidized to NAD+ by reducing pyruvate to lactate.

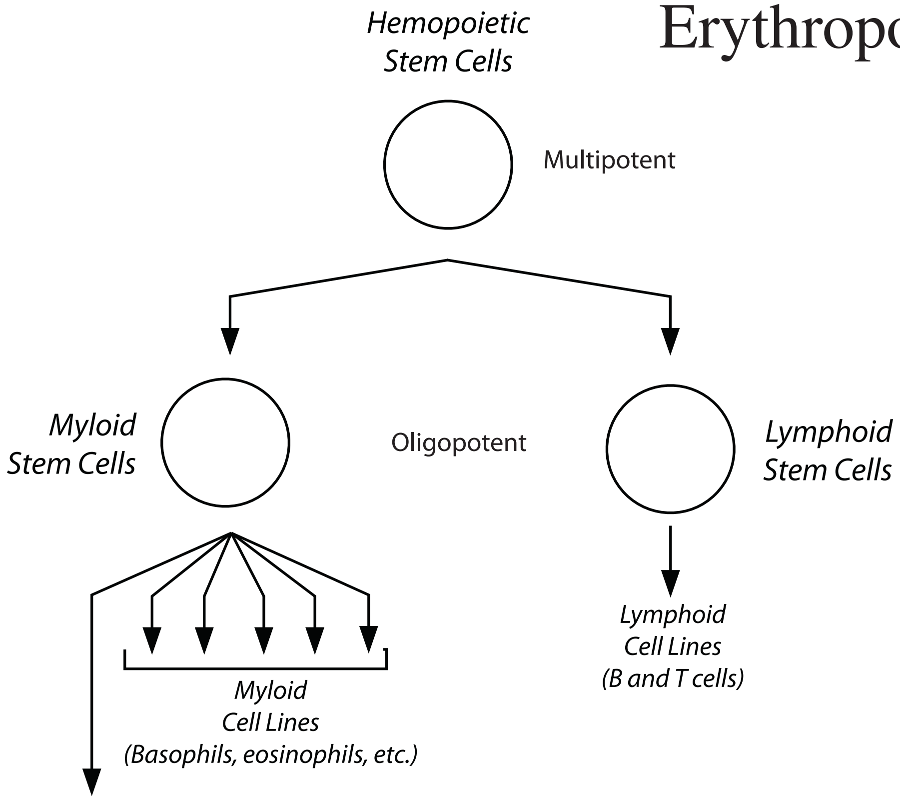
Erythrocyte metabolism is anaerobic. They do not use the oxygen that they carry.



Hematopoiesis Flow Chart



Erythropoiesis

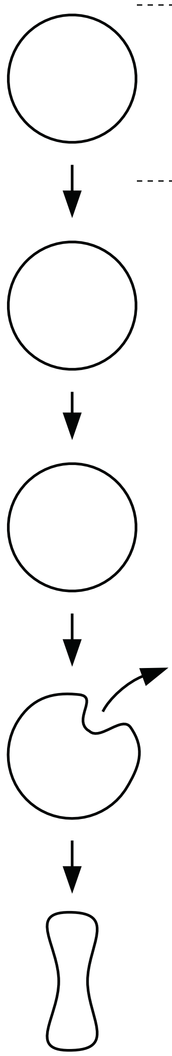


Hemopoietic (or Hematopoietic) Stem cells are Multipotent

Multipotent Stem Cells give rise to Many cell lines

Oligopotent Stem Cells give rise to a Few Cell lines

Unipotent Stem Cells give rise to only One Cell line.



Committed Cell - Cell is committed be differentiating into an erythrocyte

Erythrocyte Development

Stage #1 - **Ribosome Production** (for protein synthesis, ie hemoglobin, enzyme systems, etc.)

Stage #2 - **Hemoglobin Synthesis** (as well as other proteins) Hemoglobin accumulates in the cell.

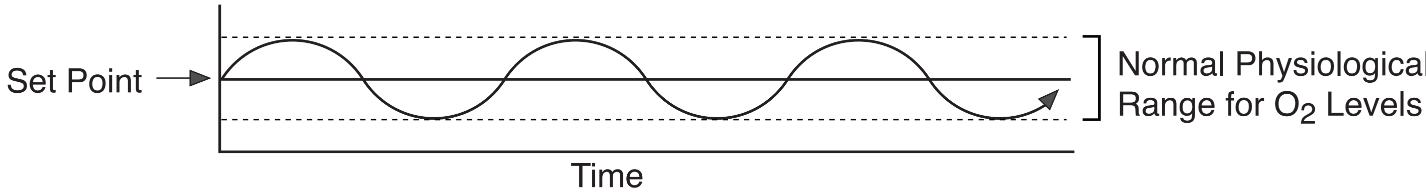
Stage #3 - **Ejection Stage** (Nucleus, mitochondria are ejected)

Mature Erythrocyte - Ejection stage results to collapse of cell, taking on a **Biconcave shape.** This *increases the surface area for gas diffusion*.

Loss of Mitochondria results is loss of ability to do cellular respiration. Respiration is therefore **anaerobic**. RBC will not use it's cargo (oxygen)

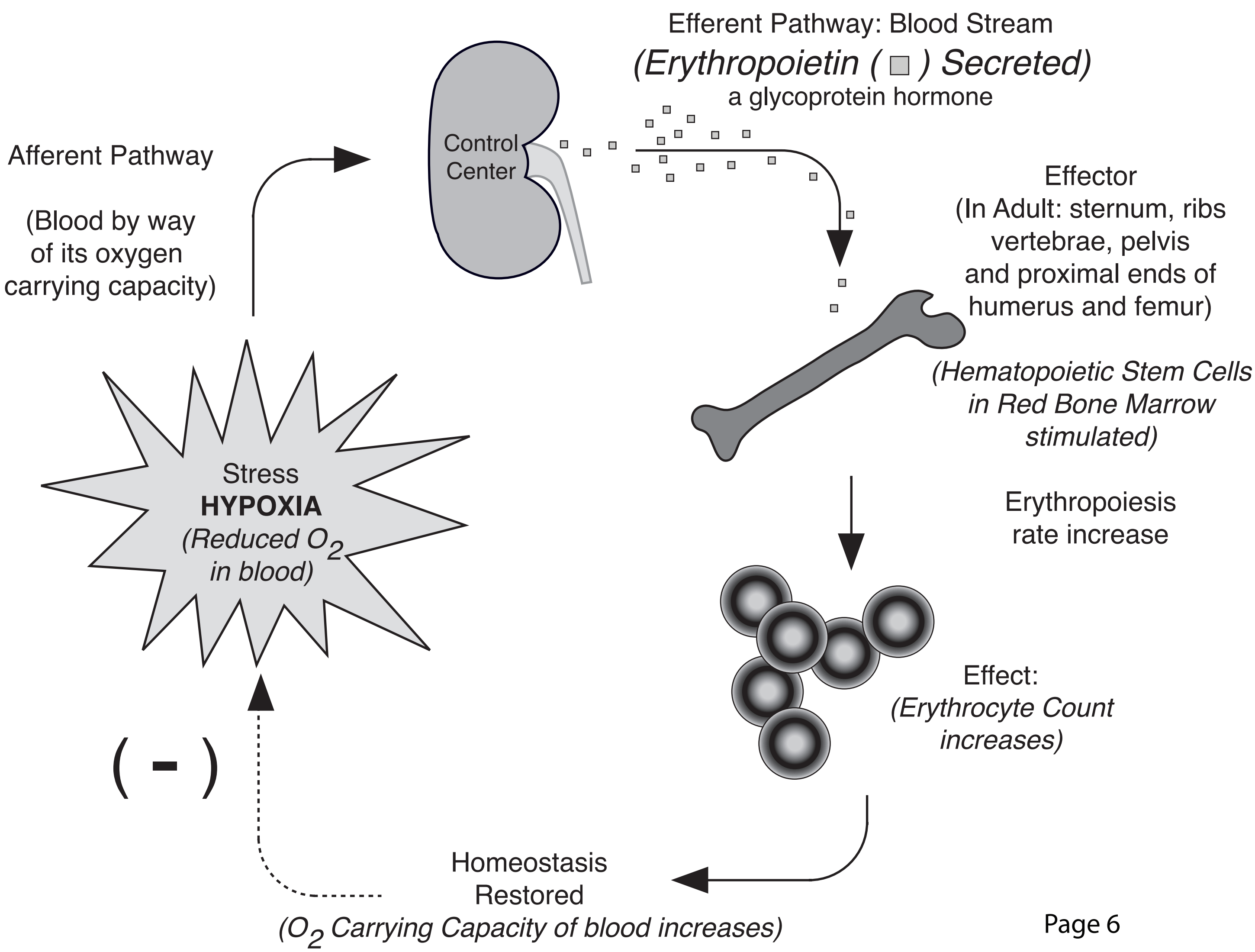
Reference: http://classes.midlandstech.com/carterp/Courses/bio211/chap17/Slide6.JPG

Regulation of Erythropoiesis

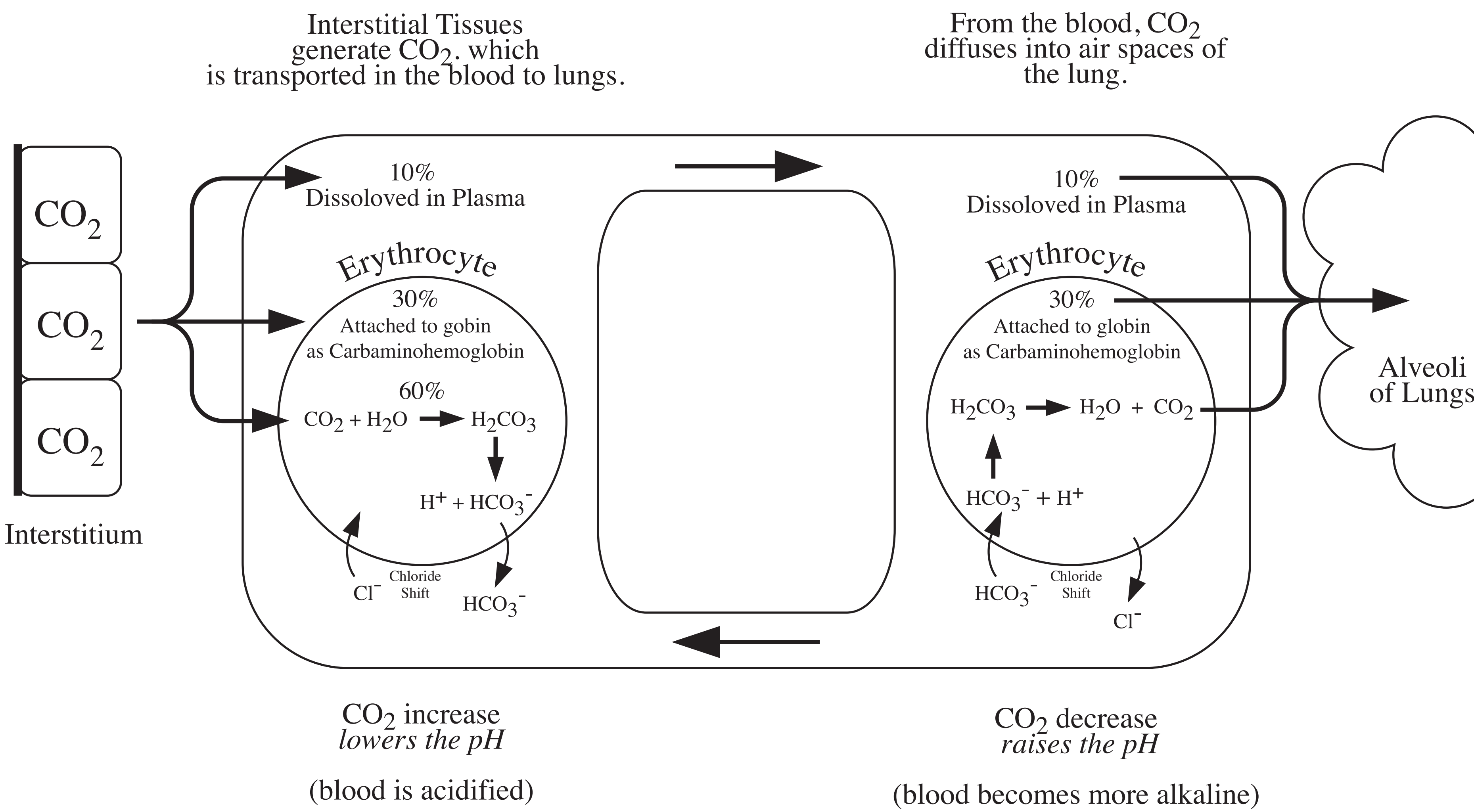


Physiological Stress due to a decreased oxygen carrying capacity of blood may be caused by:

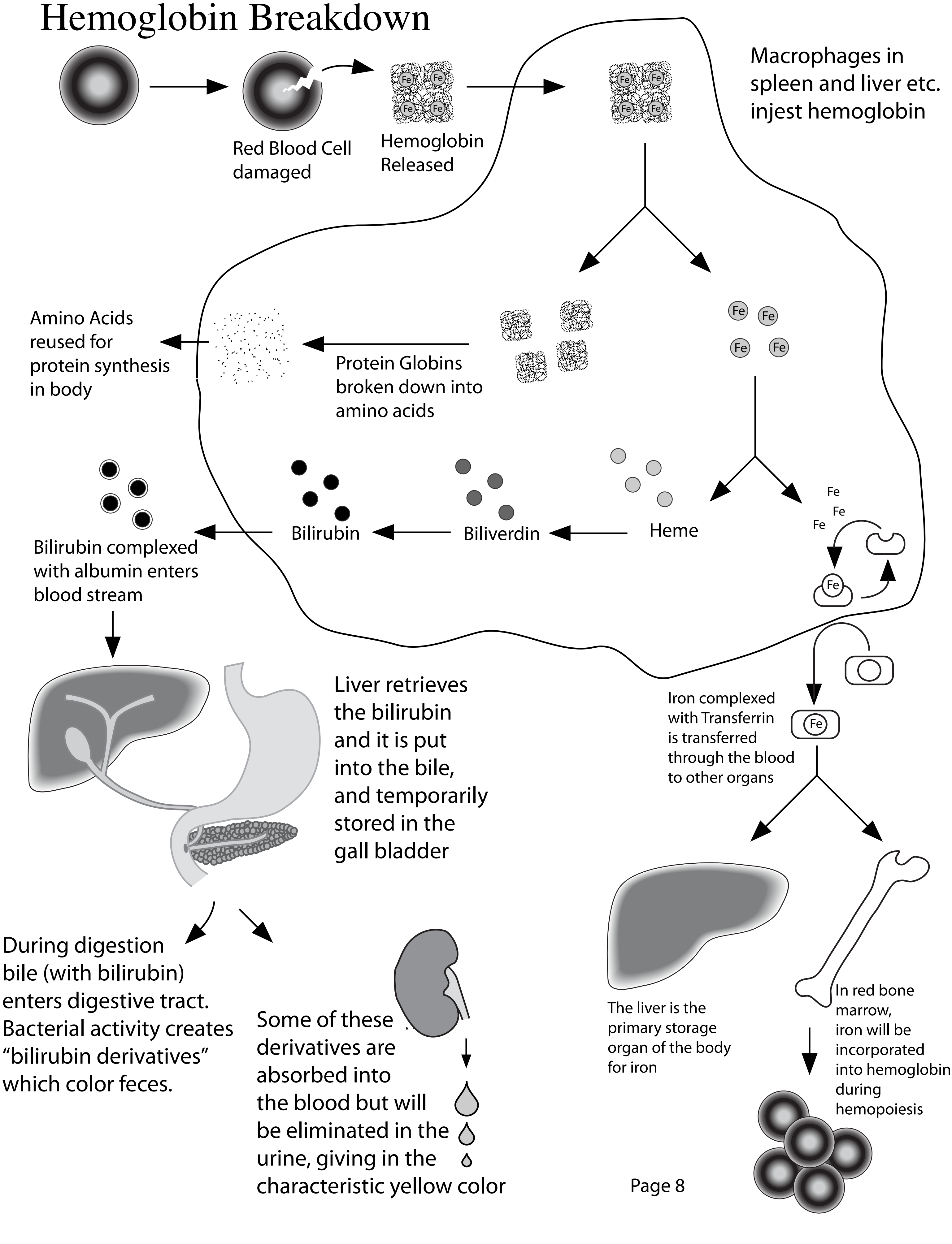
- Reduced O_2 is atmosphere
- Inadequate hemoglobin
- Low red blood cell (erythrocyte) count
- ETC . . .



CO_2 *Transport in Blood*



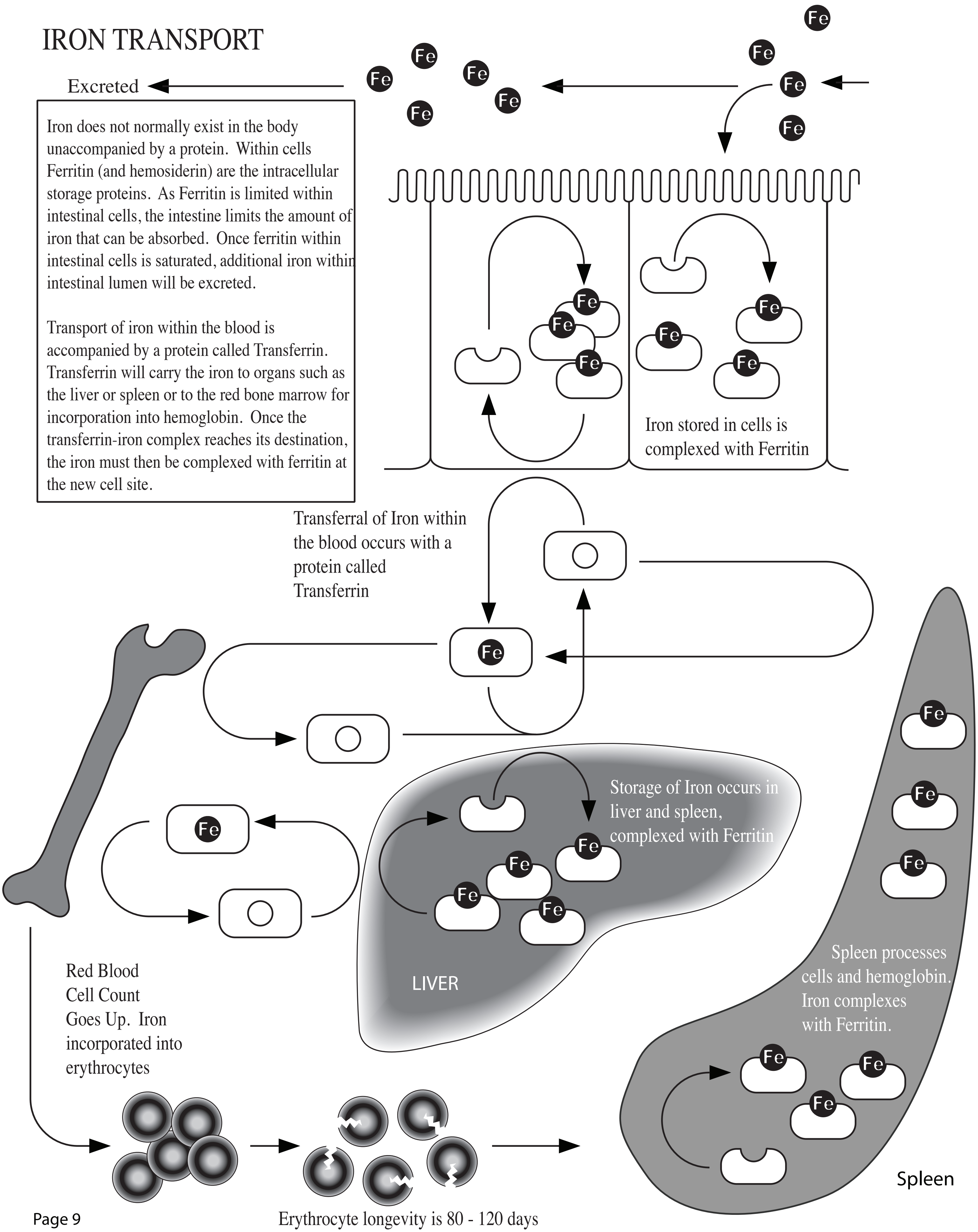
Hemoglobin Breakdown



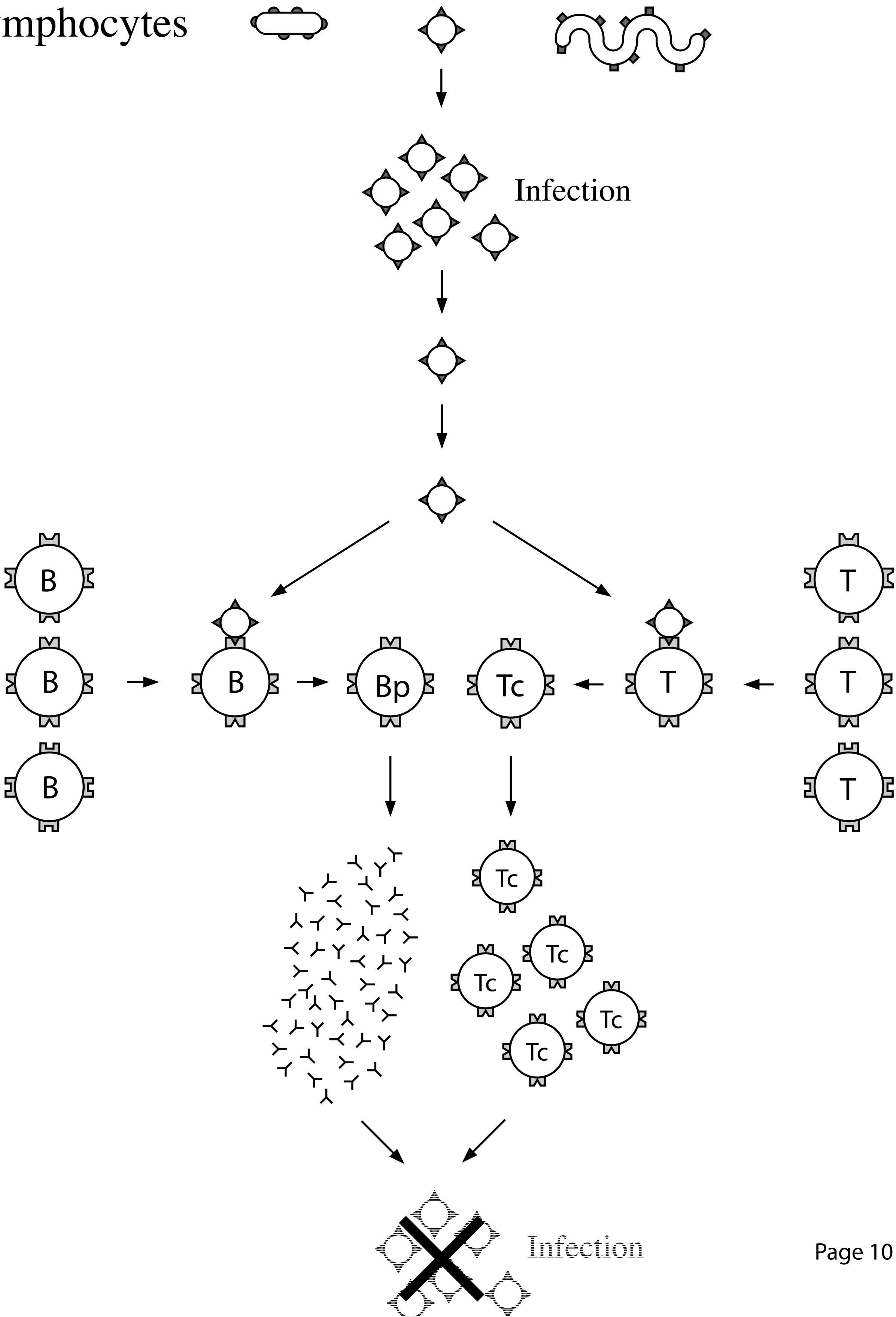
IRON TRANSPORT

Iron does not normally exist in the body unaccompanied by a protein. Within cells Ferritin (and hemosiderin) are the intracellular storage proteins. As Ferritin is limited within intestinal cells, the intestine limits the amount of iron that can be absorbed. Once ferritin within intestinal cells is saturated, additional iron within intestinal lumen will be excreted.

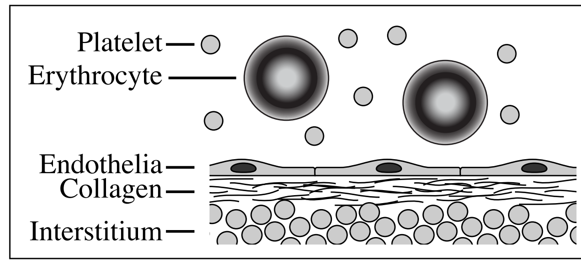
Transport of iron within the blood is accompanied by a protein called Transferrin. Transferrin will carry the iron to organs such as the liver or spleen or to the red bone marrow for incorporation into hemoglobin. Once the transferrin-iron complex reaches its destination, the iron must then be complexed with ferritin at the new cell site.



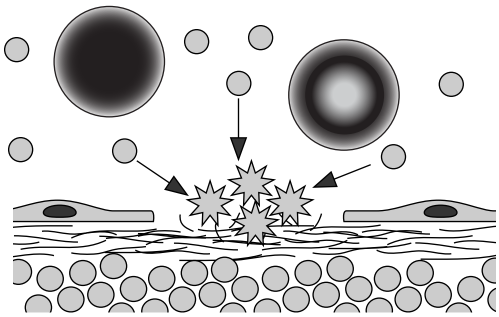
Introduction to Lymphocytes

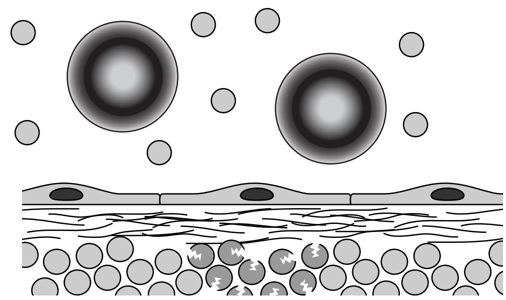


Hemostasis



Platelet Plug - Exposed collagen due to endothelia damage allows for platelet adhesion, enlargement, and aggregation. Platelets soon release serotonin and clotting factors.





Platelet-released clotting factors initiate a complex cascade of reactions culminating in Factor X activation and the, therefore, the "common pathway".

Intrinsic Pathway

Synergist operation of both pathways results in both a quick and prolonged response that will efficiently stop blood flow in almost all cases.

Extrinsic Pathway

Damaged tissues release "tissue factor," which bypasses several reactions of the Intrinsic pathway prompting quick activation of the common pathway.

Common Pathway leads to polymerization of Fibrinogen into fibrin fibers. These fibrin fibers will be cross-linked to form a secure adhesive mesh that can effectively stop bleeding.

Factor X → Prothrombinase

Prothrombin → Thrombin

Fibrinogen → Fibrin