

سیستم گردش خون
Circulatory system

سیستم گردش خون

وظایف سیستم گردش خون

(۱) حمل و نقل مواد

انتقال گازهای تنفسی

انتقال مواد غذایی جذب شده از روده به بافتها

انتقال مواد متابولیک دفعی، آب اضافی و یونها به کلیه و یا

سایر اندامهای دفعی

سیستم گردش خون

(۲) تنظیمی

هورمونی: حمل هورمونها از محل ساخت آنها به بافت های مختلف

دما: انتقال به بافت های سطحی

(۳) حفاظت

انعقاد خون: جلوگیری از هدر رفتن خون در خونریزی ها

ایمنی: گلبول های سفید خون بدن را در مقابل عوامل خارجی حفظ می نمایند

سیستم گردش خون

■ مشخصات فیزیکی و شیمیایی خون

(1) ترکیب

(2) مقدار

(3) ویسکوزیته و وزن مخصوص

(4) فشار اسمزی

(5) pH و حفظ ثبات آن *

(6) اسیدوز و آلکالوز جبران شده و جبران نشده

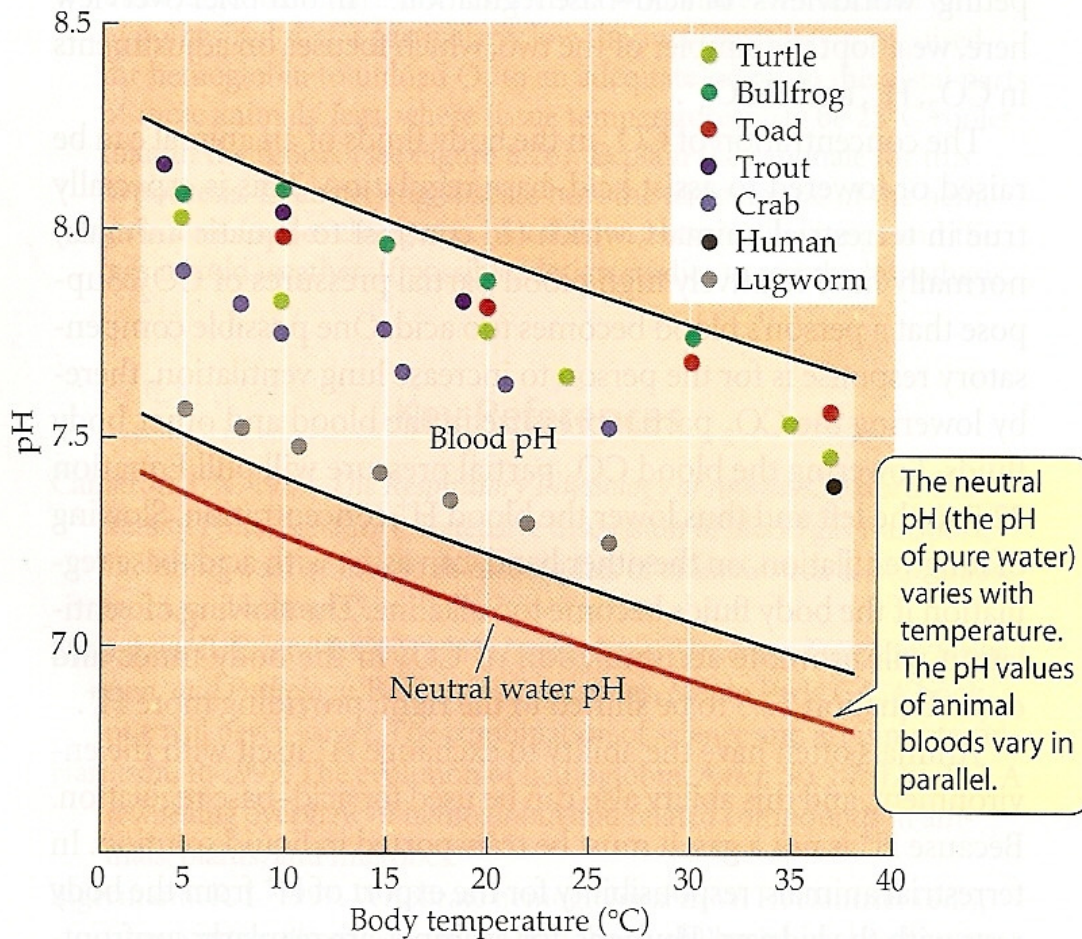
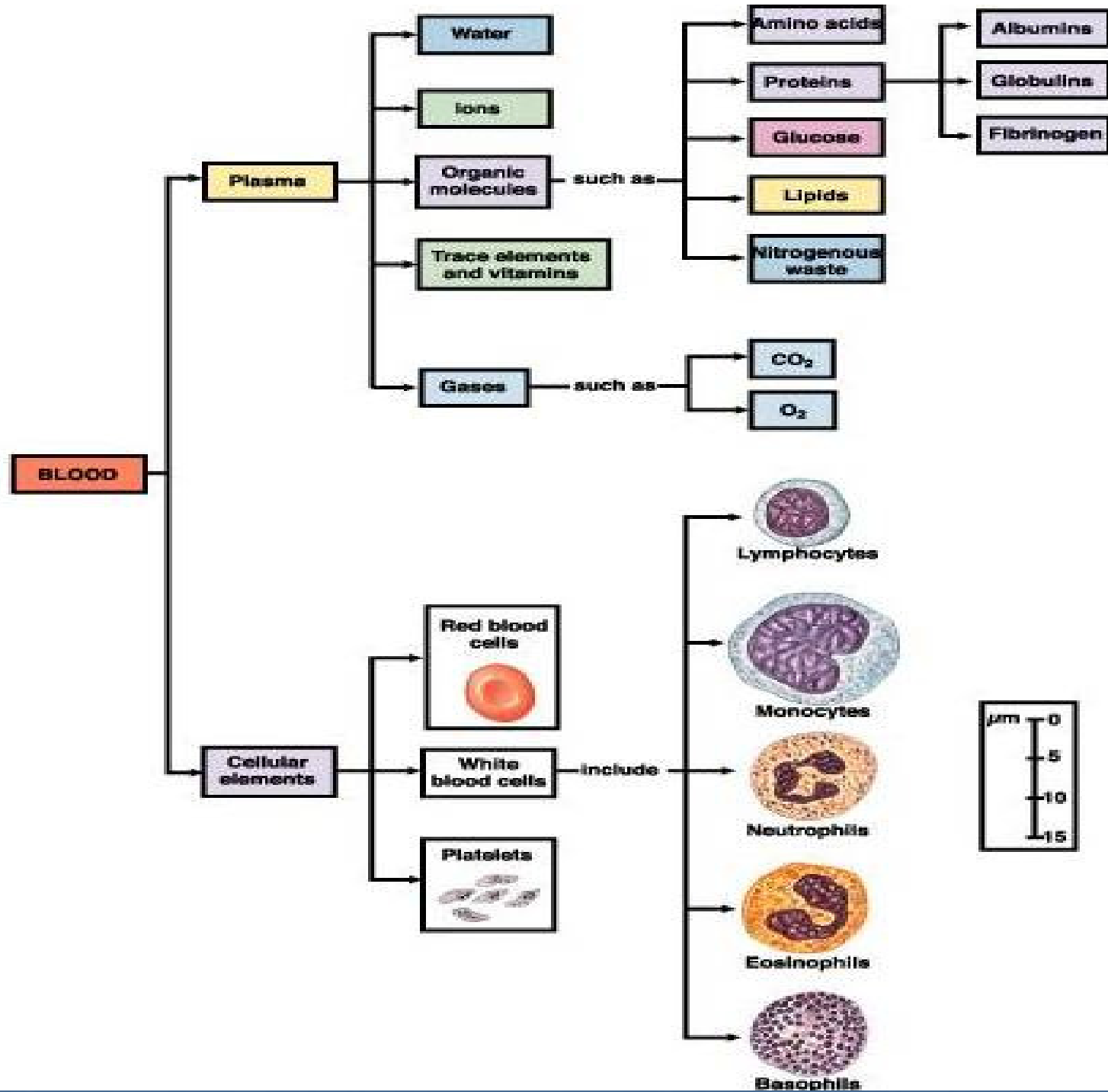


Figure 22.23 Normal blood pH is a temperature-dependent variable As the neutral pH varies with body temperature, blood pH—which is more alkaline than neutral—varies in parallel; thus the blood pH of any particular species tends to remain alkaline to a fixed extent. Data are shown for six poikilothermic species and for humans. Species differ in how alkaline their blood is relative to the neutral pH. (From Dejours 1981.)

سیستم گردش خون

اجزای خون



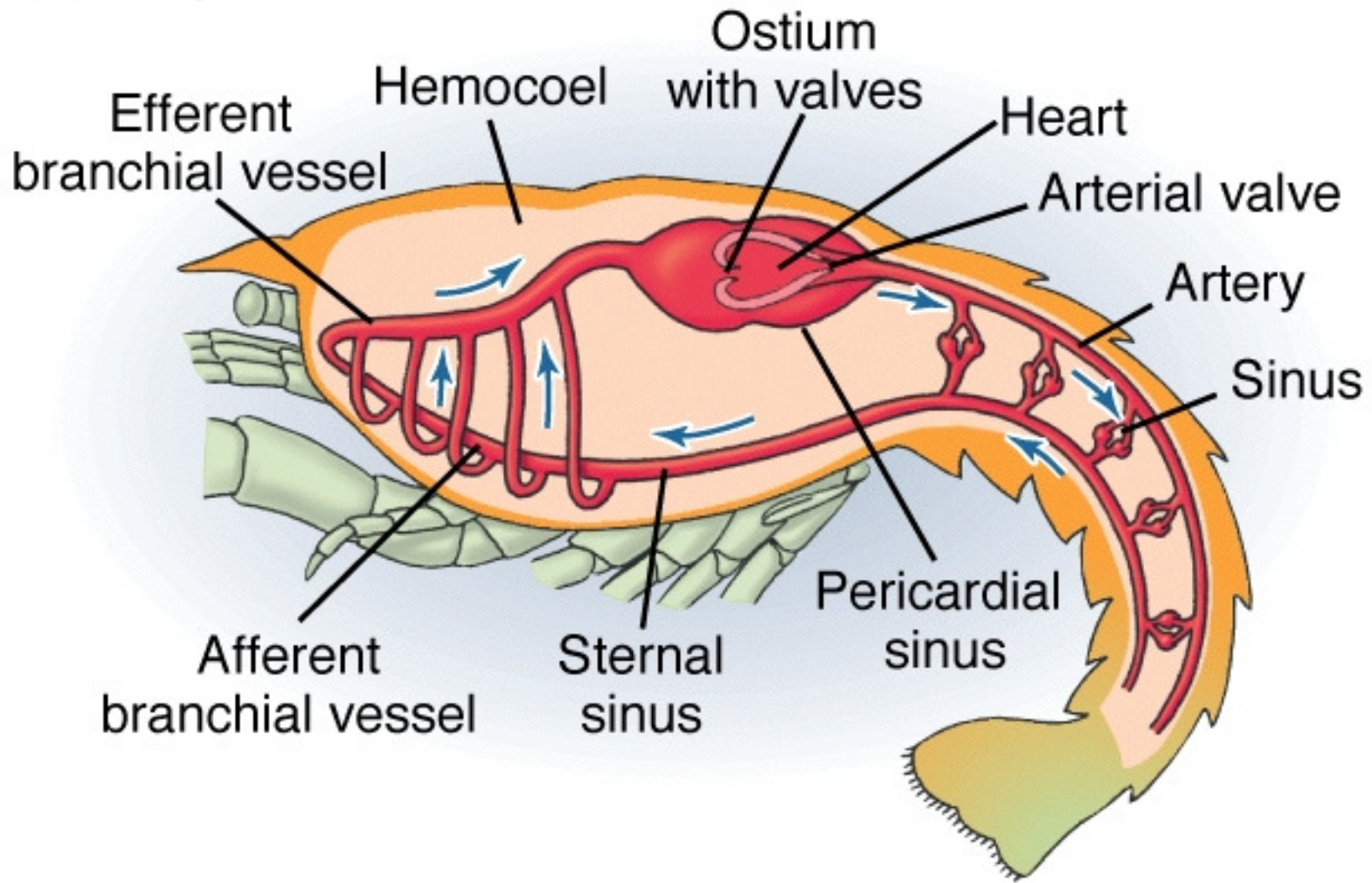
I. General plan

□ Two main types of circulatory systems

1. Open circulatory system

- Present in many invertebrates
- Blood pumped by heart empties into a hemocoel
- Hemolymph bathes tissues directly
- Large volume (20-40% of body volume)
- Low pressure (4.5-9.7 mm Hg)
- Limited ability to alter velocity and distribution of blood flow

(a) Crayfish

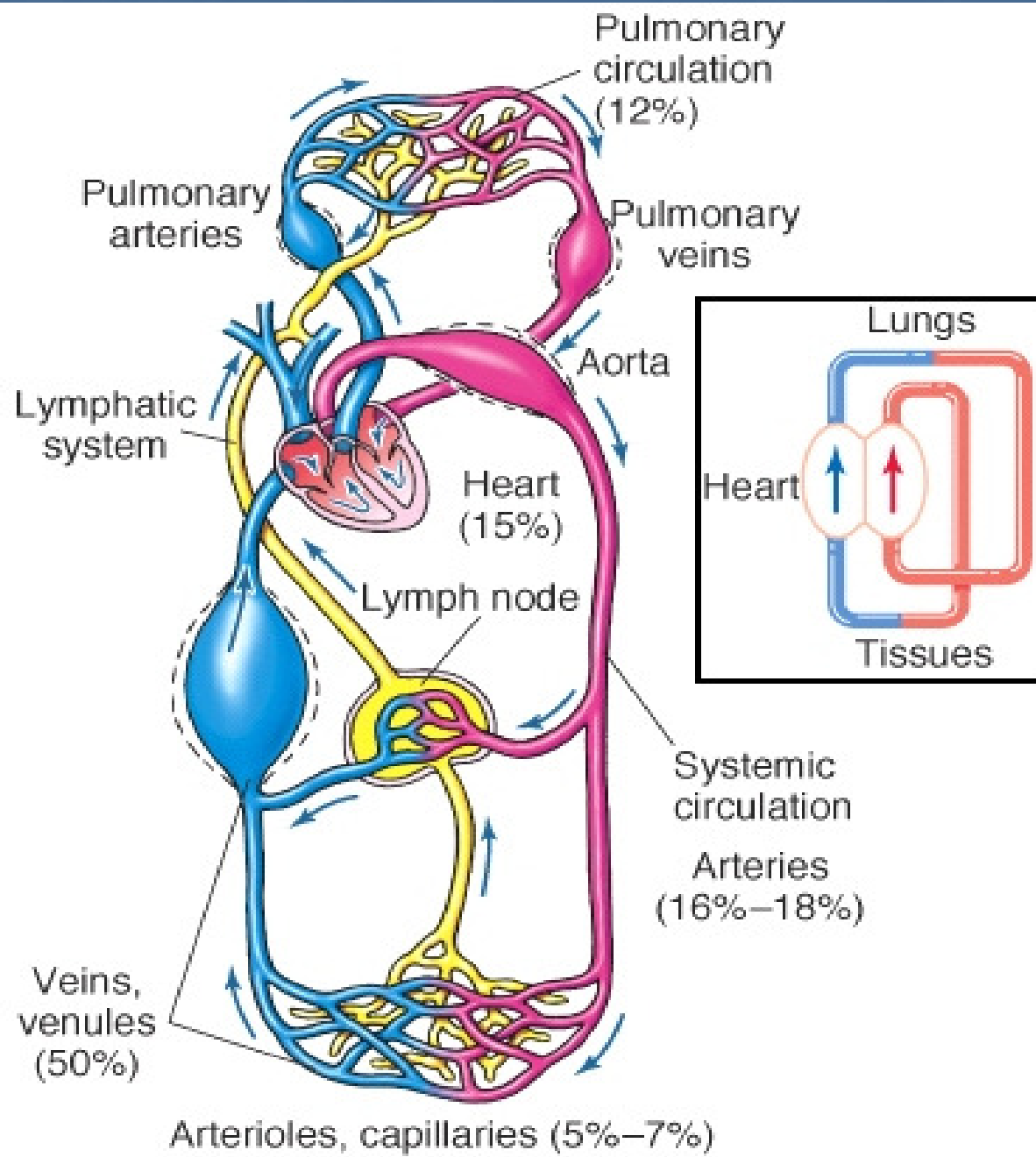


2. Closed circulatory system

- Vertebrates and some invertebrates (e.g. cephalopods)
- Blood flows in a continuous circuit
- Small volume (5-10% of body volume)
- High pressure (can attain pressures of > 100 mm Hg)
- Permits high O₂ uptake
- Allows for ultrafiltration at the kidneys

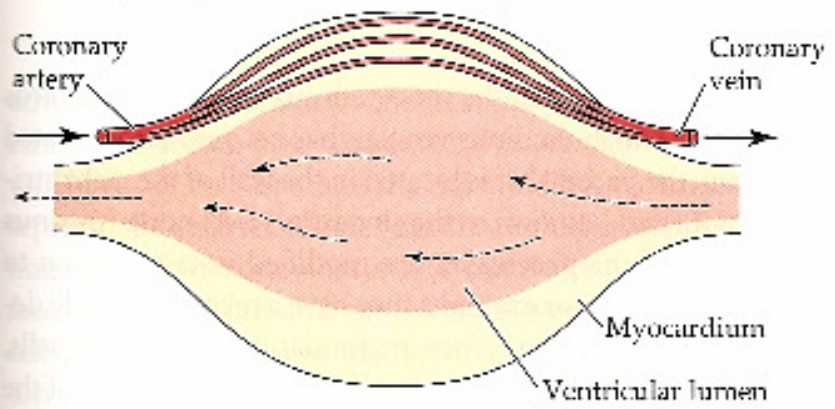
□ Basic components of a closed circulatory system

- A main propulsive organ (heart)- forces blood through the body
- An arterial system- distributes blood and serves as a pressure reservoir
- Capillaries- transfer of materials between blood and tissues
- Venous system- returns blood to the heart and serves as a storage reservoir

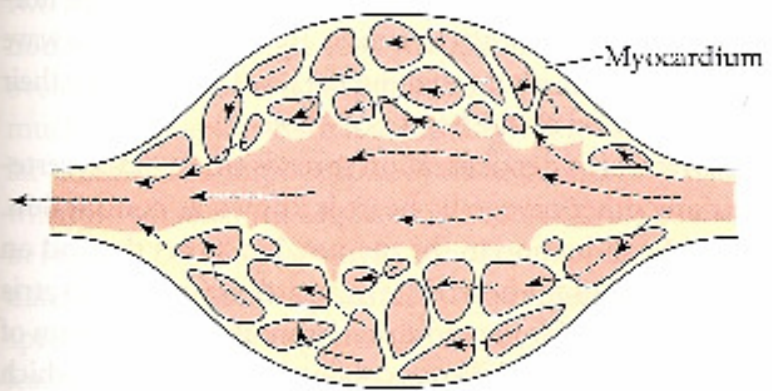


اکسیژن رسانی به میوکارد قلب

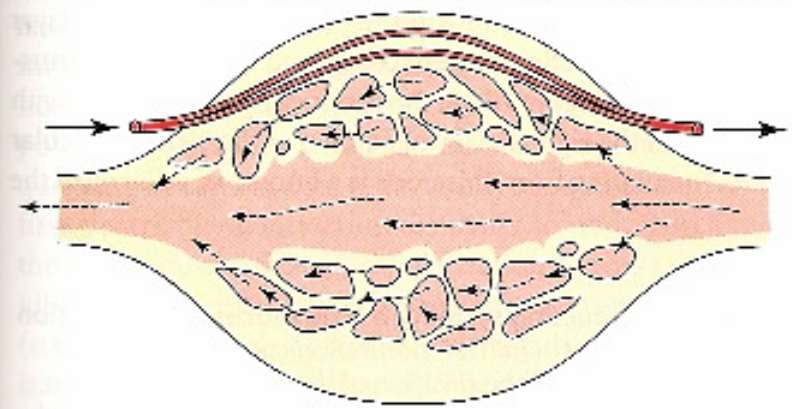
(a) Compact myocardium with coronary arteries and veins



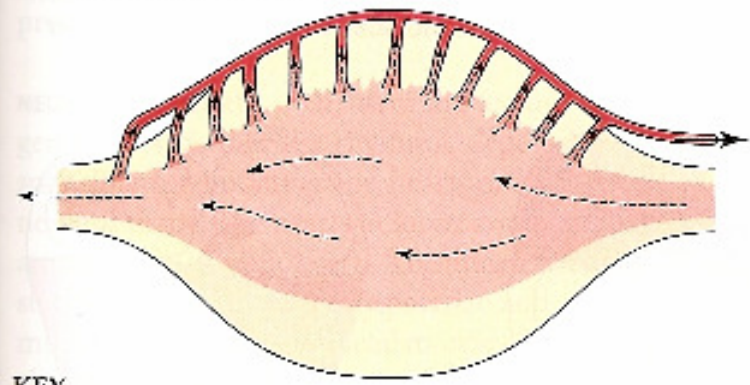
(b) Spongy myocardium with little or no development of coronary vessels



(c) Myocardium composed of outer compact tissue and inner spongy tissue



(d) Myocardium of mixed structure with blood flowing from lumen into coronary veins



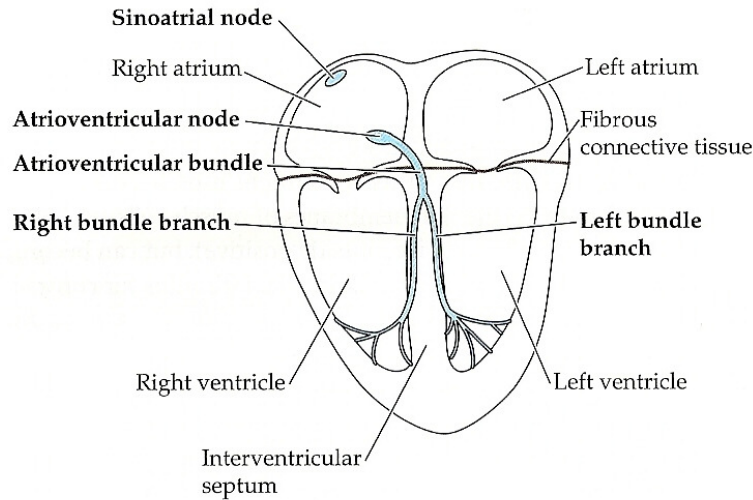
KEY

key structural features of the heart. The myocardium of the two atria

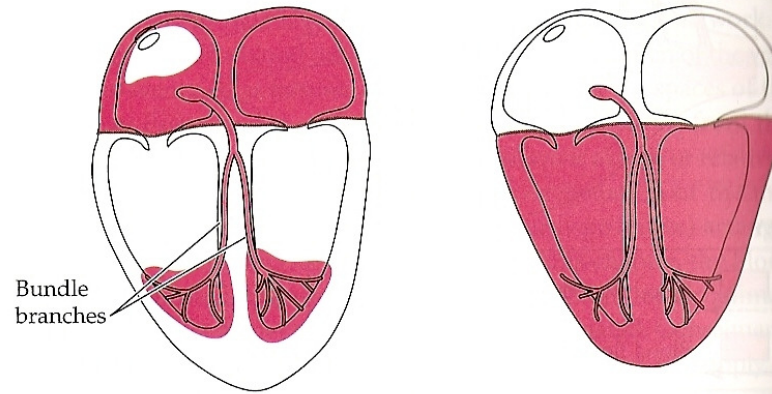
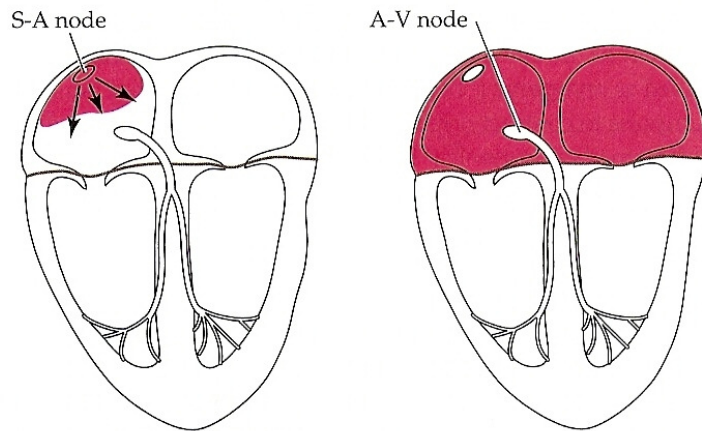
فعالیت الکتریکی قلب

ضربان میوزنیک

(a) The conducting system and sinoatrial node



(b) The initiation and spread of depolarization during a heartbeat



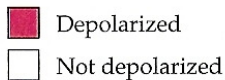
1 Depolarization begins in the S-A node and spreads outward through atrial muscle.

2 Although depolarization spreads rapidly throughout the atrial muscle, its spread into the A-V node is delayed. The depolarized atria start to contract.

3 Once the A-V node becomes depolarized, the depolarization spreads very rapidly into the ventricles along the conducting system. Atrial muscle starts to repolarize.

4 The nearly simultaneous depolarization of cells throughout the ventricular myocardium leads to forceful ventricular contraction.

KEY



(A-V) node. Emanating from this node is a bundle of cells called the

Figure 23.4 The conducting system and the process of conduction in the mammalian heart (a) The morphological arrangement of the conducting system and the position of the sinoatrial node. The branches of the right and left bundle branches are in fact more elaborate than shown; traveling along the inner surfaces of the ventricles and across the ventricular cavities, they run to much of the inner wall of each ventricle. (b) The initiation and conduction of depolarization during a heartbeat. (a after Scher and Spach 1979; b after Rushmer 1976.)

فعالیت الکتریکی قلب ضربان نروژنیک

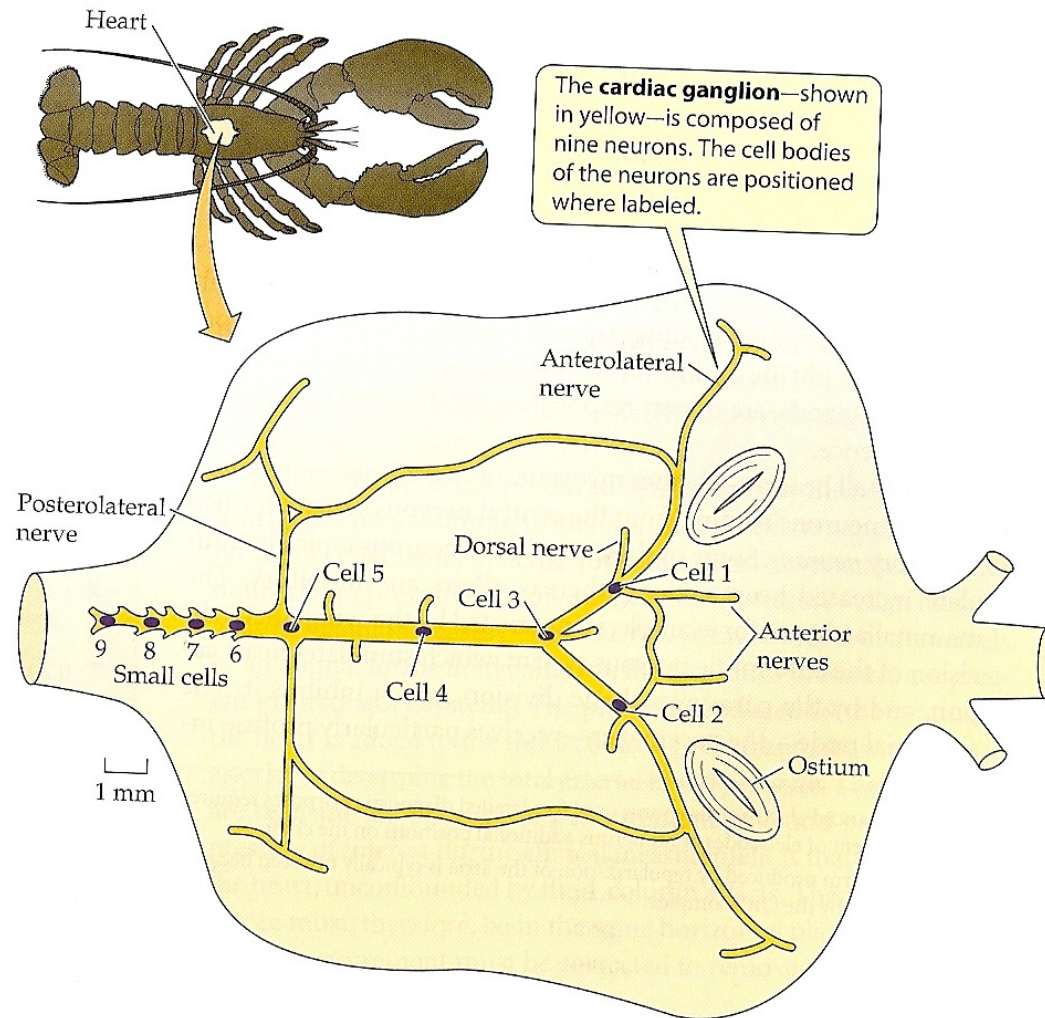
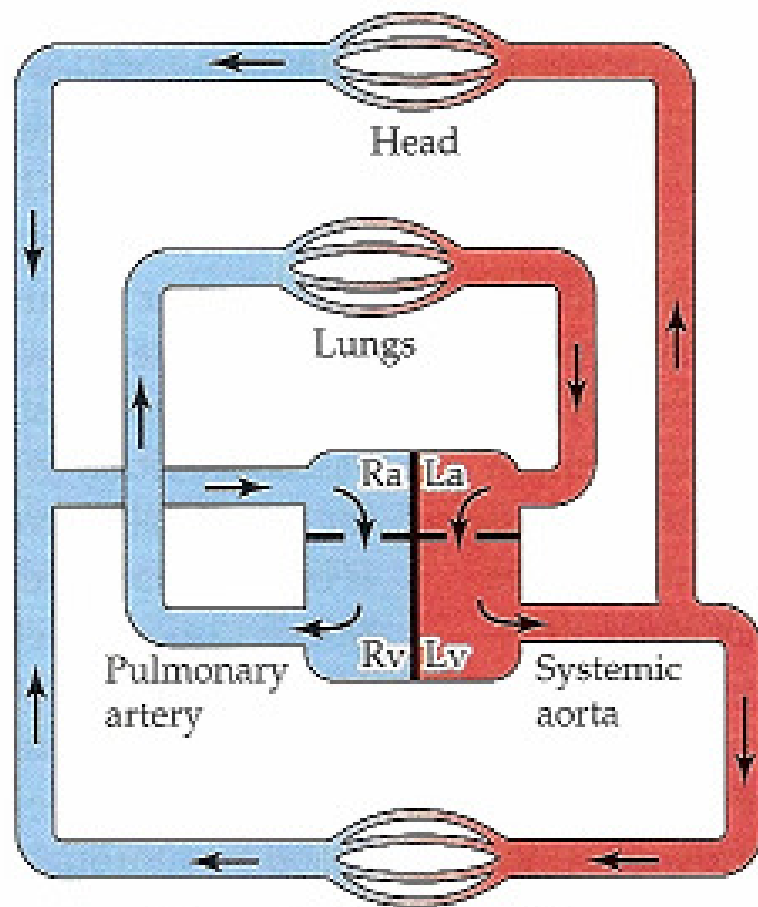


Figure 23.5 The neurogenic heart of a lobster and the cardiac ganglion that initiates and controls its contractions A dorsal view of the heart of the American lobster (*Homarus americanus*), showing the cardiac ganglion, which is positioned on the inside dorsal surface. The cell bodies of the nine neurons that compose the ganglion are marked in black. Neuronal processes go out from each cell body and together form the structure of the ganglion. The posterior four neurons (numbers 6–9) are small, whereas the anterior five are large. Neurons that carry impulses to heart muscle cells exit the ganglion through the various nerves. Regulatory neurons from the central nervous system enter the ganglion in the dorsal nerve. The function of the ostia (slitlike openings through the heart wall) is to allow blood to enter the heart.

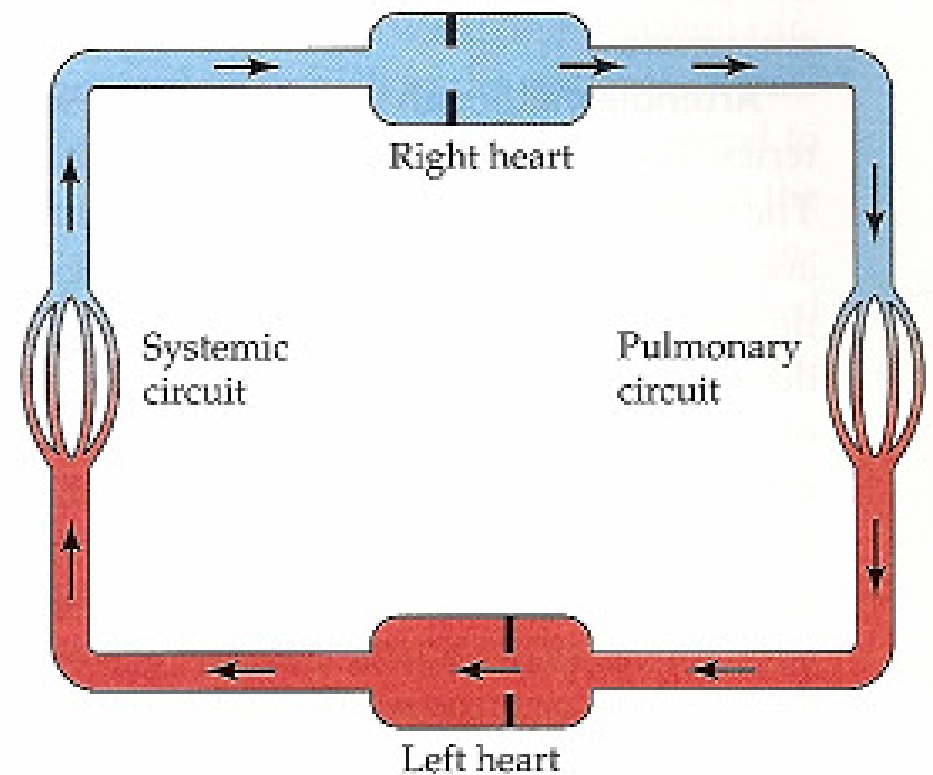
گردش خون در پستانداران و پرندگان

(a) The circulatory plan



Systemic circulation of thorax and abdomen, body wall, limbs

(b) A schematic of the circulatory plan emphasizing that the systemic and pulmonary circuits are connected in series



(b) A teleost heart

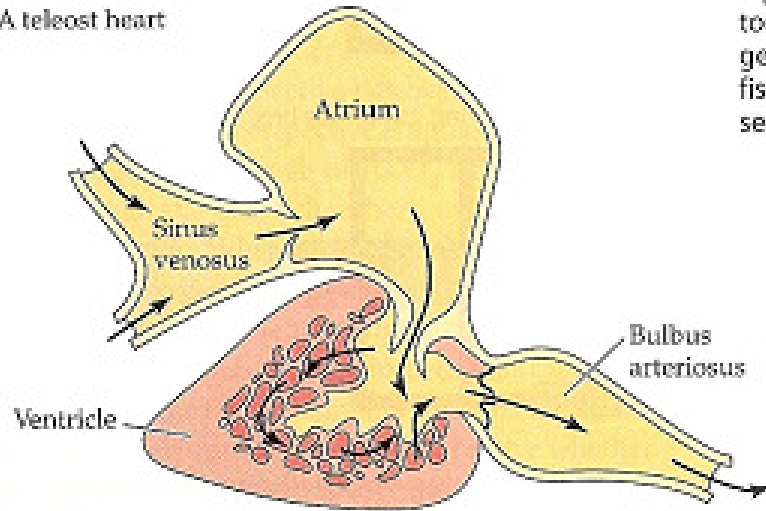
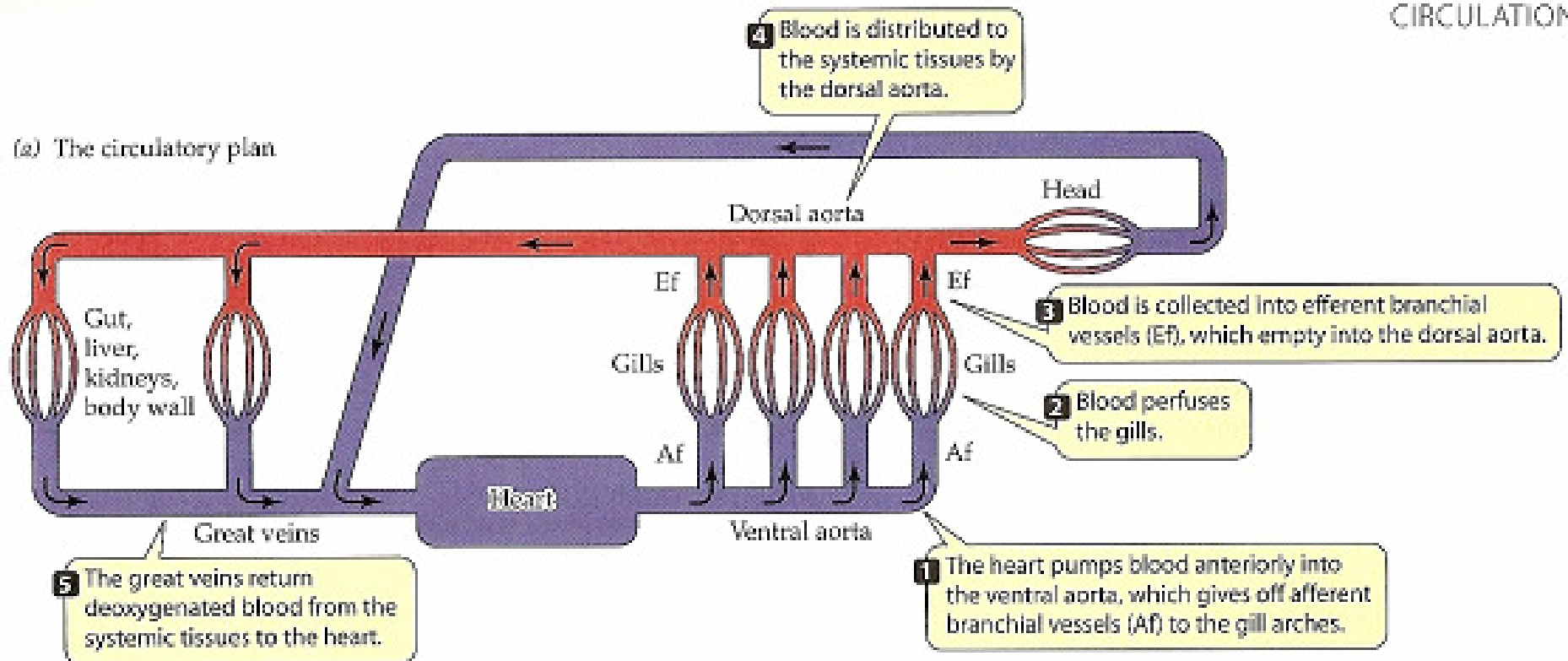


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گردش خون در ماهیان

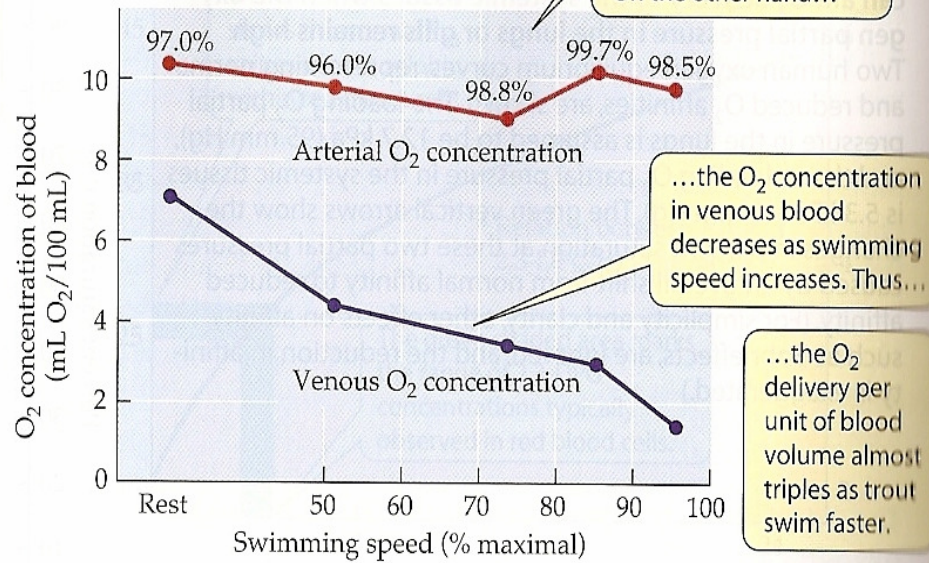
CIRCULATION

(a) The circulatory plan

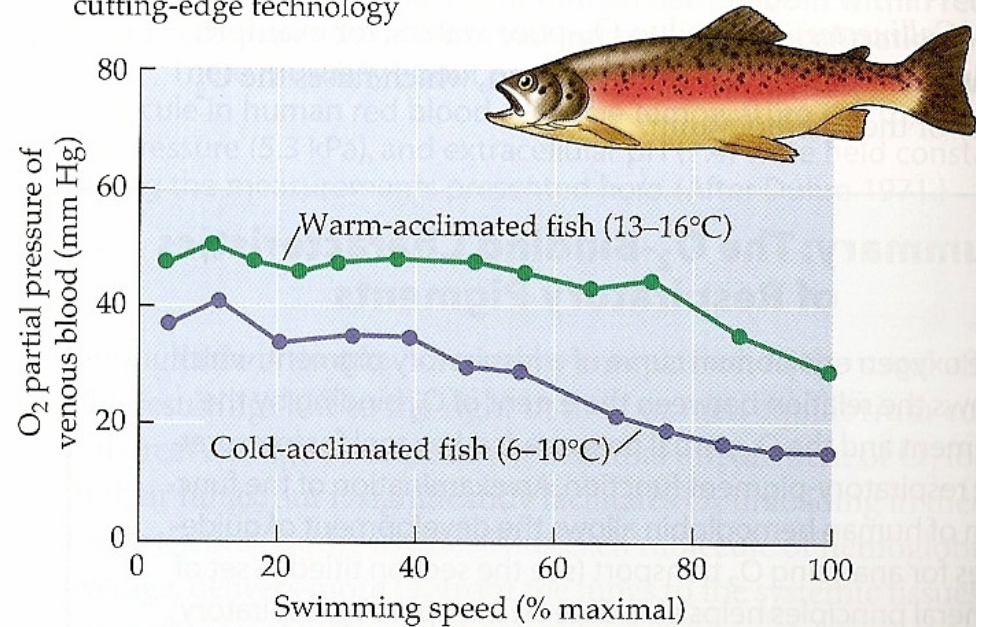


چگونگی افزایش کارایی گردش خون و تنفس در ماهیان

(a) Arterial and venous O₂ concentrations

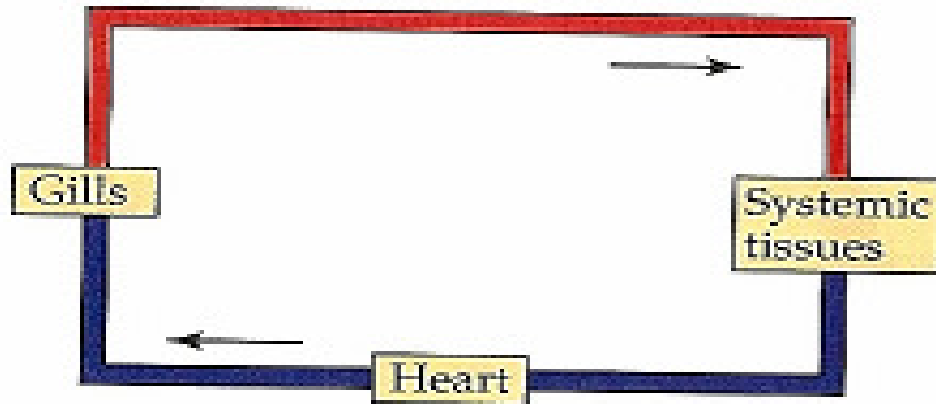


(b) Venous O₂ partial pressure monitored remotely with cutting-edge technology

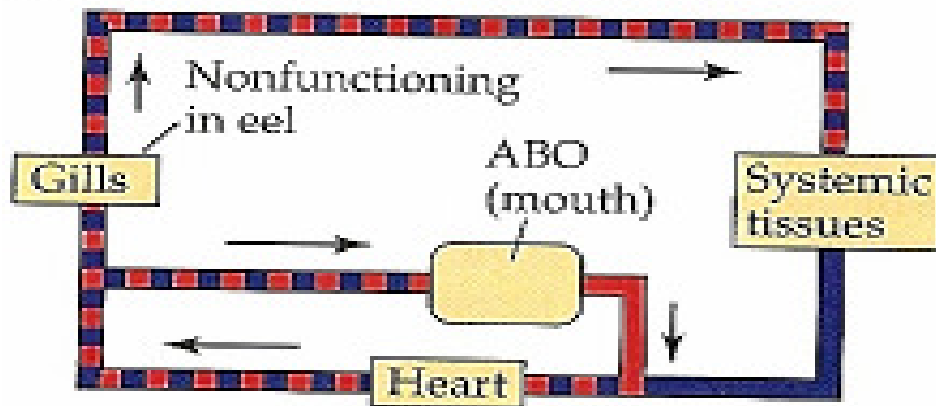


گردش خون در اندامهای تنفس هوایی ماهیان

(a) Circulatory plan of ordinary fish

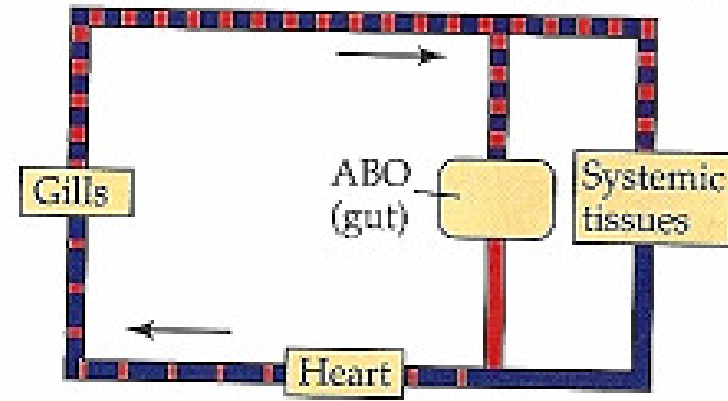


(b) Circulatory plan in electric eel



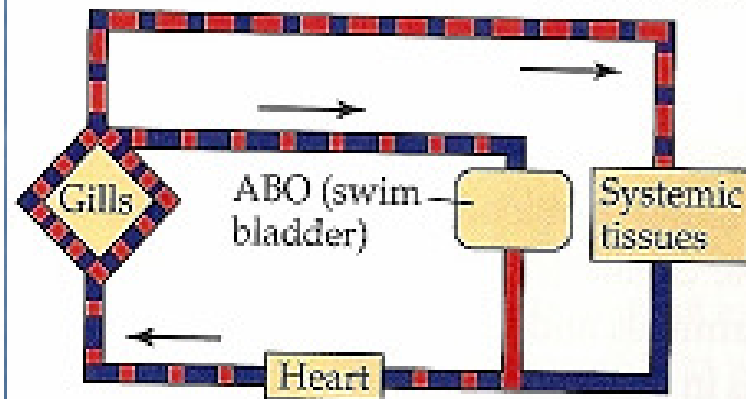
Electrophorus electricus

(c) Circulatory plan in fish using gut for air breathing



Plecostomus گربه ماهی

(d) Circulatory plan in fish using swim bladder for air breathing



Bowfin *Amia*

تنفس در ماهیان دودمی (*Protopterus* (dipnoi))

