



心血管系统导论

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内 容

- 一、心血管系统的组成和生理功能**
- 二、心血管疾病种类和发病机制**
- 三、心血管疾病预防和急救常识**

心血管疾病是人类第一杀手

GBD 2013 Mortality and Causes of Death Collaborators. Lancet. 2015; 385(9963): 117–171

	All ages deaths (thousands)		
	1990	2013	Median % change
Cardiovascular diseases	12 279.6 (11 776.6 to 12 764.1)	17 297.5 (16 520.2 to 18 071.9)	40.8 (36.17 to 46.36)
Rheumatic heart disease	373.5 (302.5 to 464.6)	275.1 (222.6 to 353.9)	-26.5 (-33.64 to -17.20)
Ischaemic heart disease	5 737.5 (5 254.9 to 6 148.6)	8 139.9 (7 322.9 to 8 758.5)	41.7 (35.96 to 48.44)
Cerebrovascular disease	4 584.8 (4 162.1 to 4 968.1)	6 446.9 (5 963.0 to 7 155.2)	40.2 (34.43 to 49.56)
Ischaemic stroke	2 182.9 (1 923.3 to 2 430.9)	3 272.9 (2 812.7 to 3 592.6)	50.2 (41.02 to 59.27)
Neoplasms	5 659.7 (5 440.4 to 5 826.6)	8 235.7 (7 941.4 to 8 538.9)	45.6 (39.82 to 51.55)
Oesophageal cancer	313.1 (275.0 to 351.5)	440.2 (389.2 to 516.8)	39.9 (26.42 to 56.36)
Stomach cancer	763.4 (725.6 to 803.2)	841.0 (791.6 to 894.1)	10.1 (3.94 to 17.43)

Heart Attack



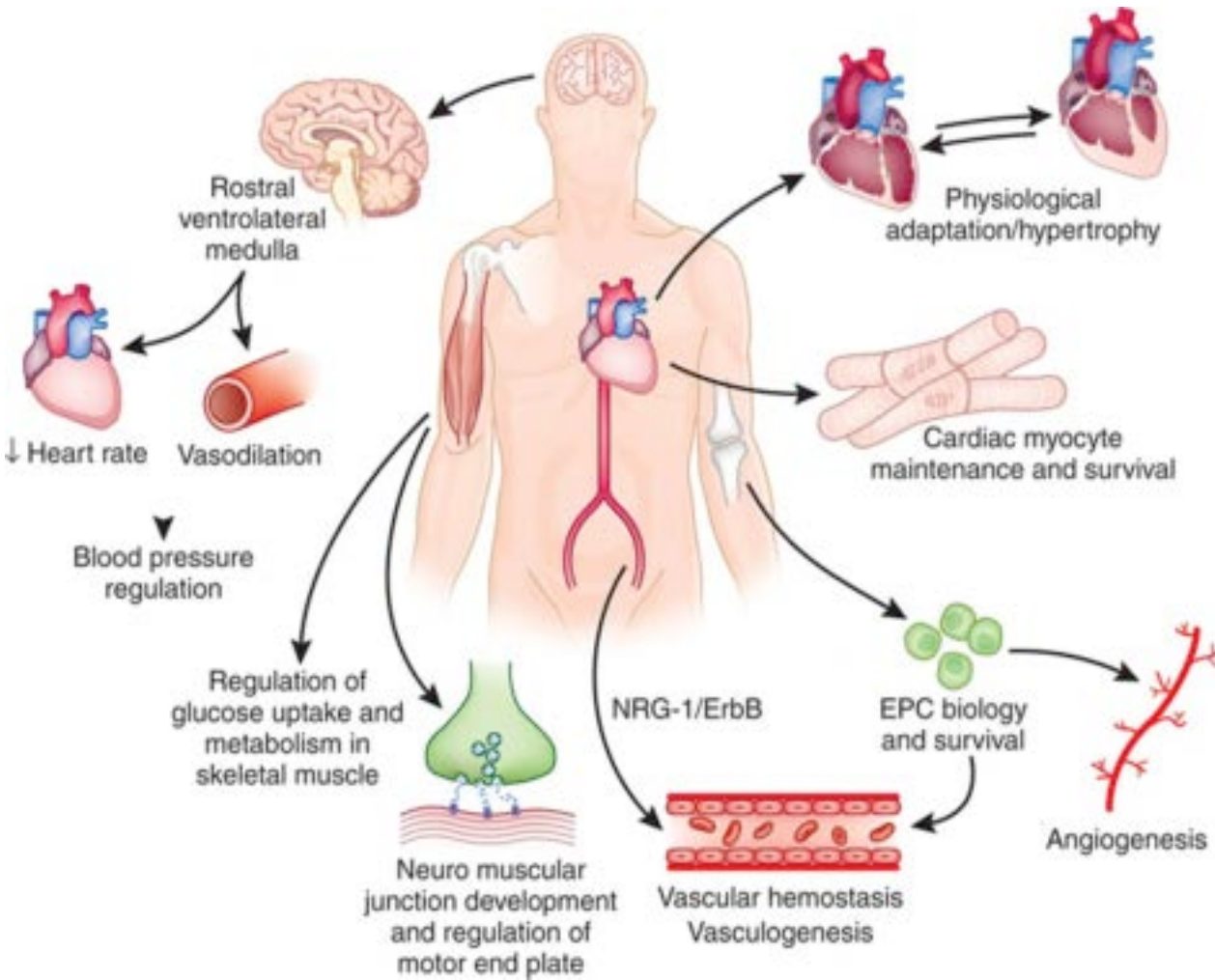
Stroke



我国心血管病现患人数2.9亿，其中脑卒中1300万，冠心病1100万，心力衰竭450万，肺原性心脏病500万，风湿性心脏病250万，先天性心脏病200万，高血压2.7亿。

《中国心血管病报告2016》

心血管疾病复杂性需要多学科协同研究



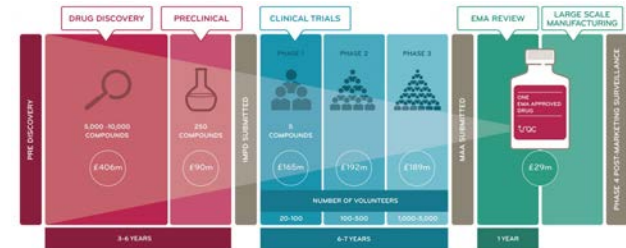
生物医学基础研究



生物医学工程

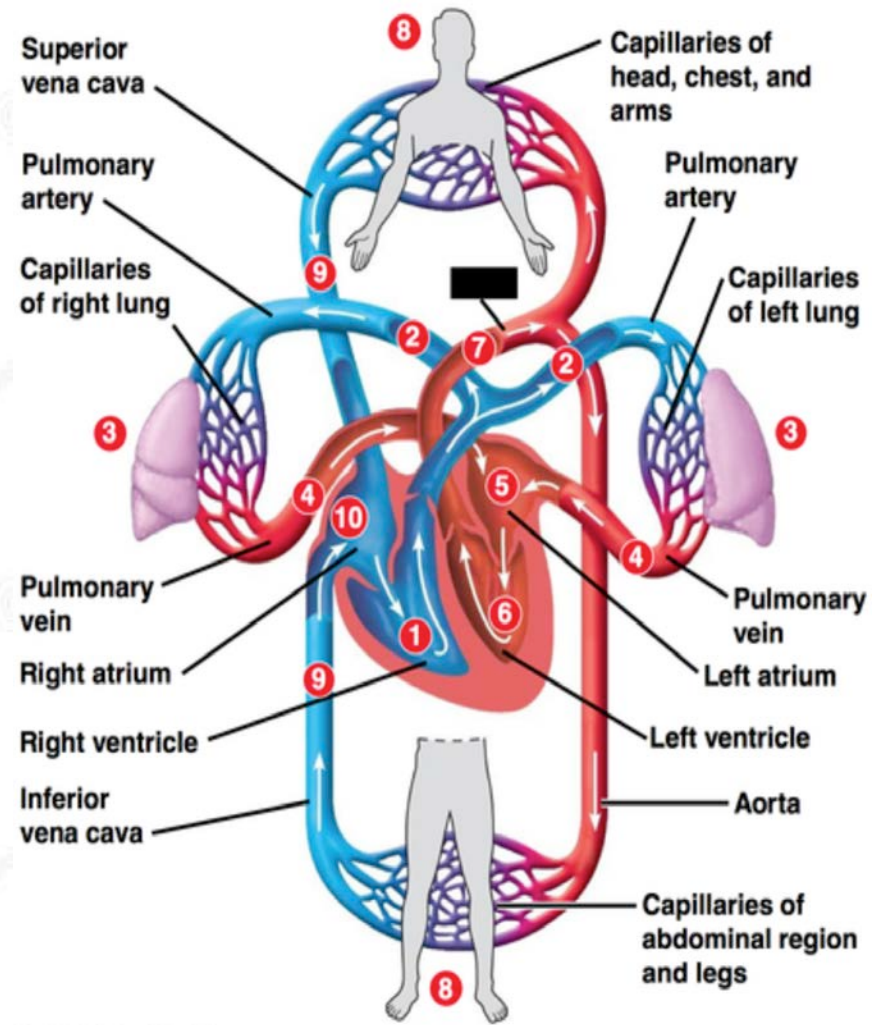
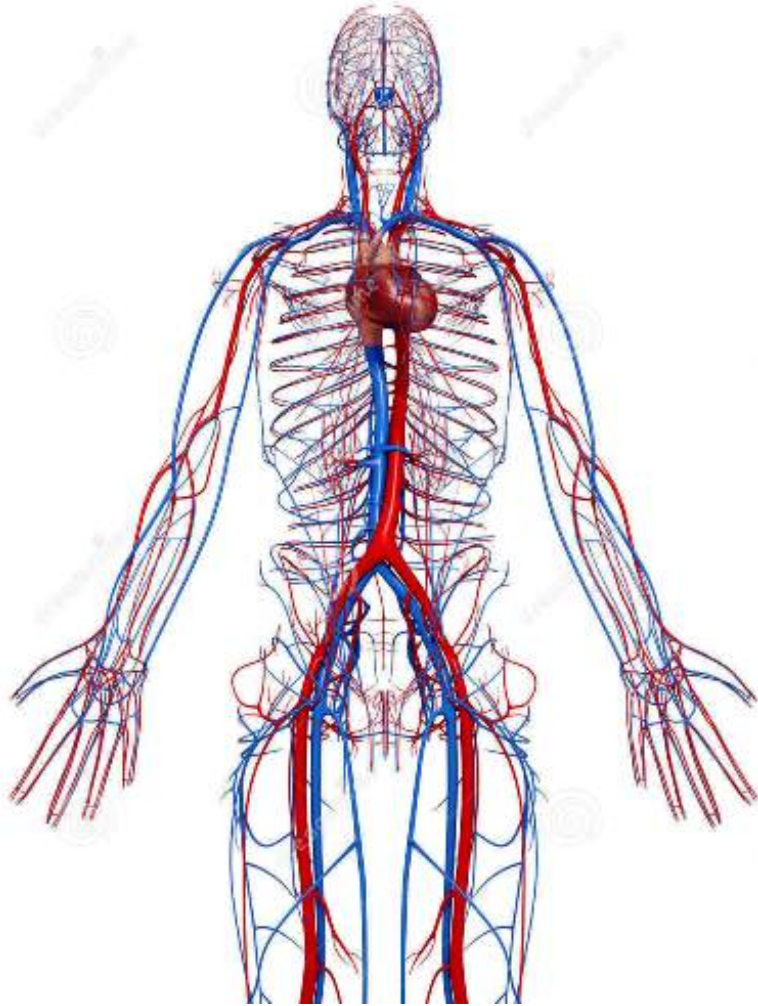


药物研发

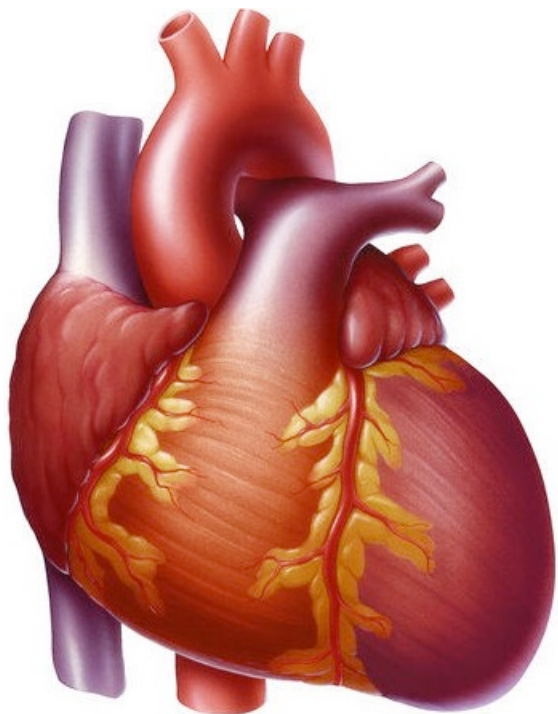


一、心血管系统组成和生理功能

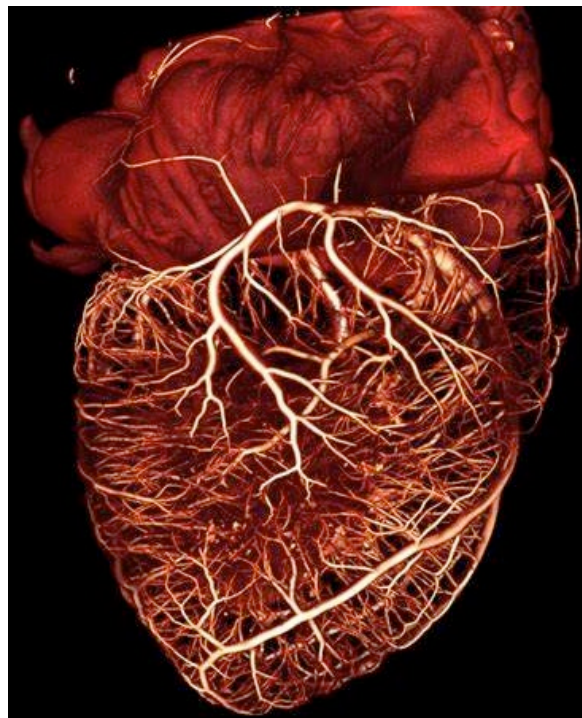
心血管系统组成



心脏和血管的基本知识

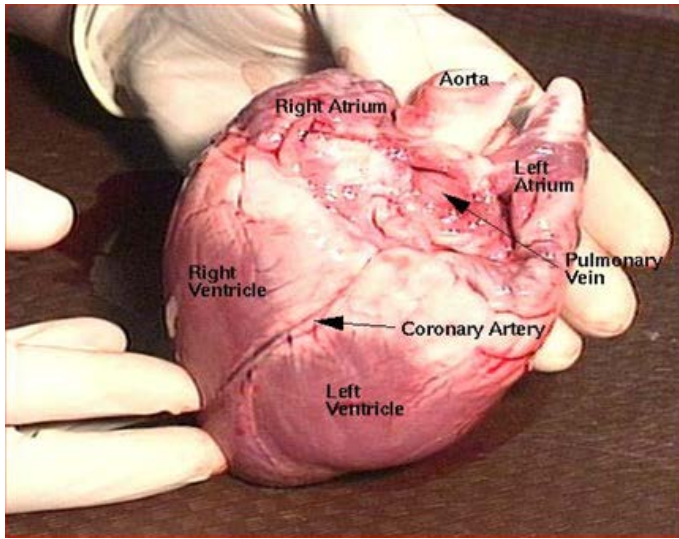


拳头大小/重量约260克
100000次/天
30亿次/一生
8000公斤血液/24小时
需氧量是其他组织10倍
心肌代谢旺盛能量储备少

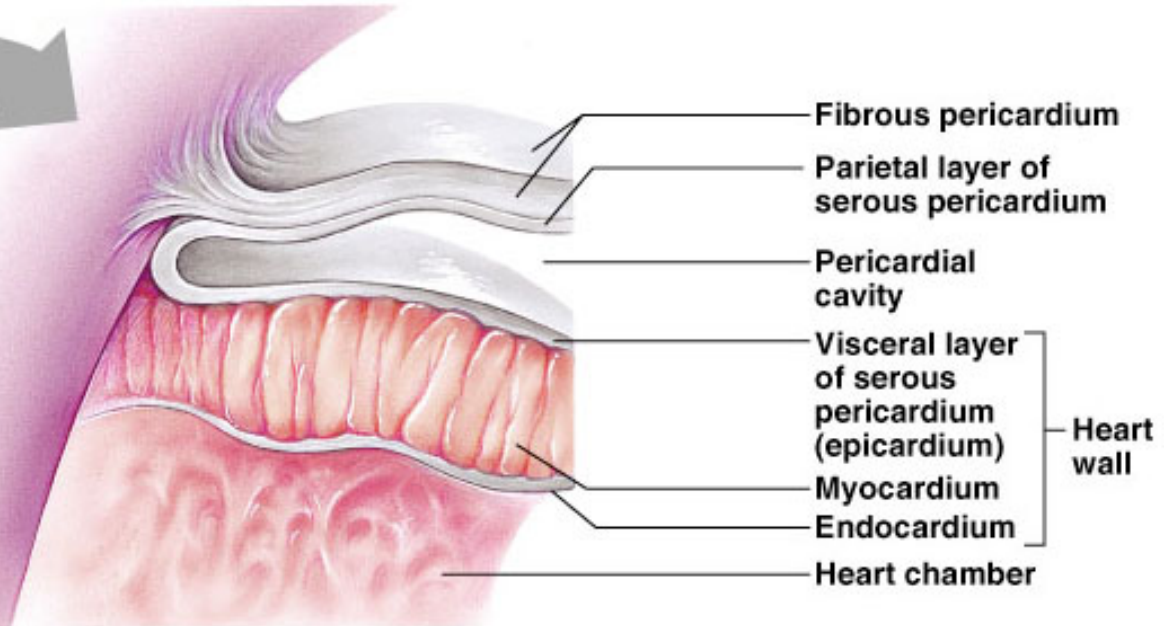
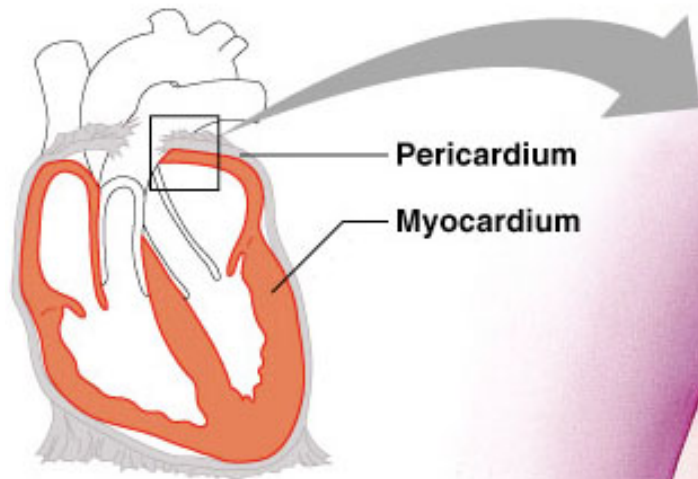


人体血管网9700公里

1、心脏外形

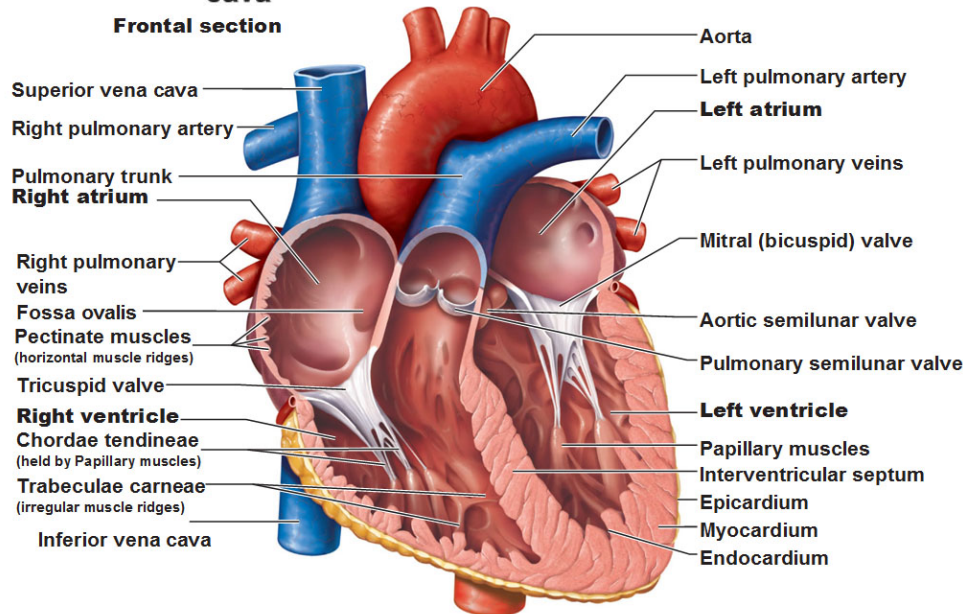
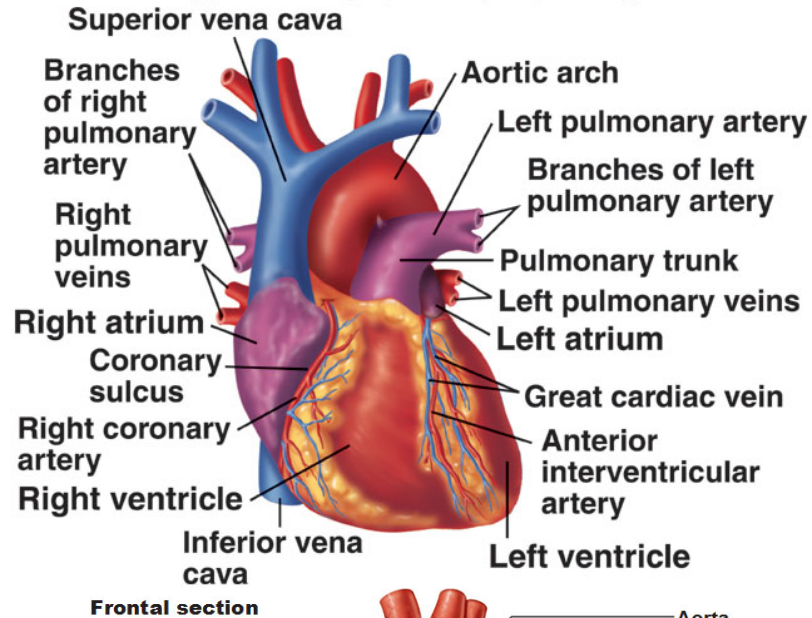


- **Epicardium** – visceral layer of the serous pericardium
- **Myocardium** – cardiac muscle layer forming the bulk of the heart
- **Fibrous skeleton** of the heart – crisscrossing, interlacing layer of connective tissue
- **Endocardium** – endothelial layer of the inner myocardial surface

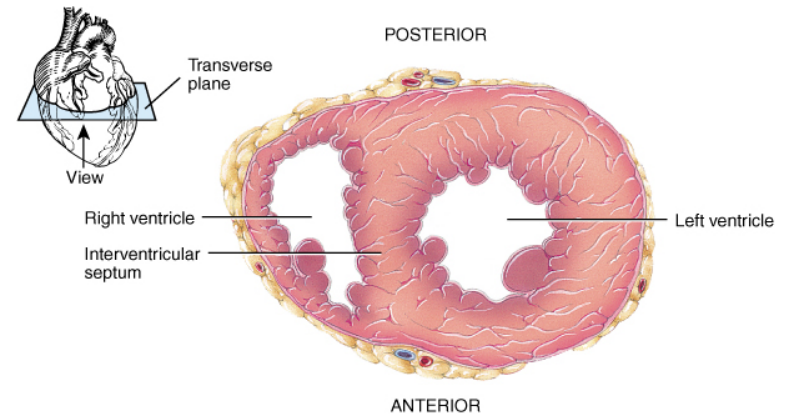
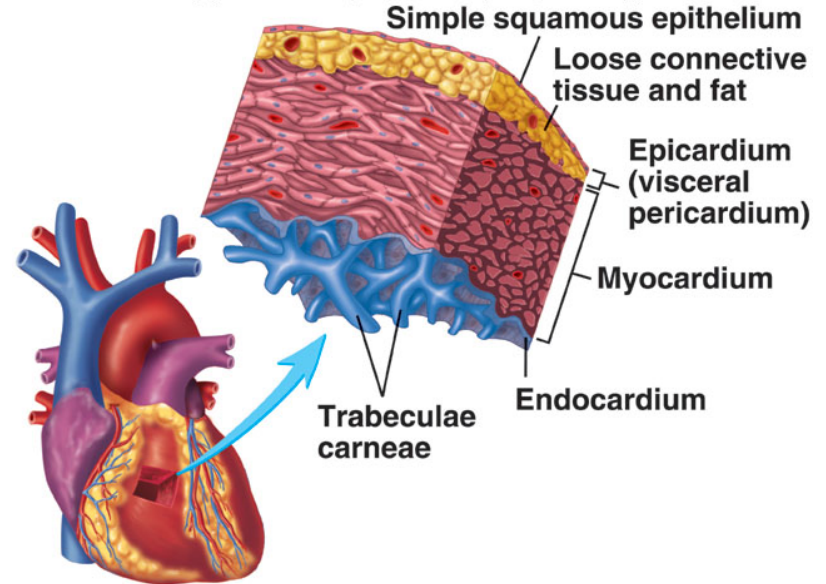


2、心脏的基本结构和特点

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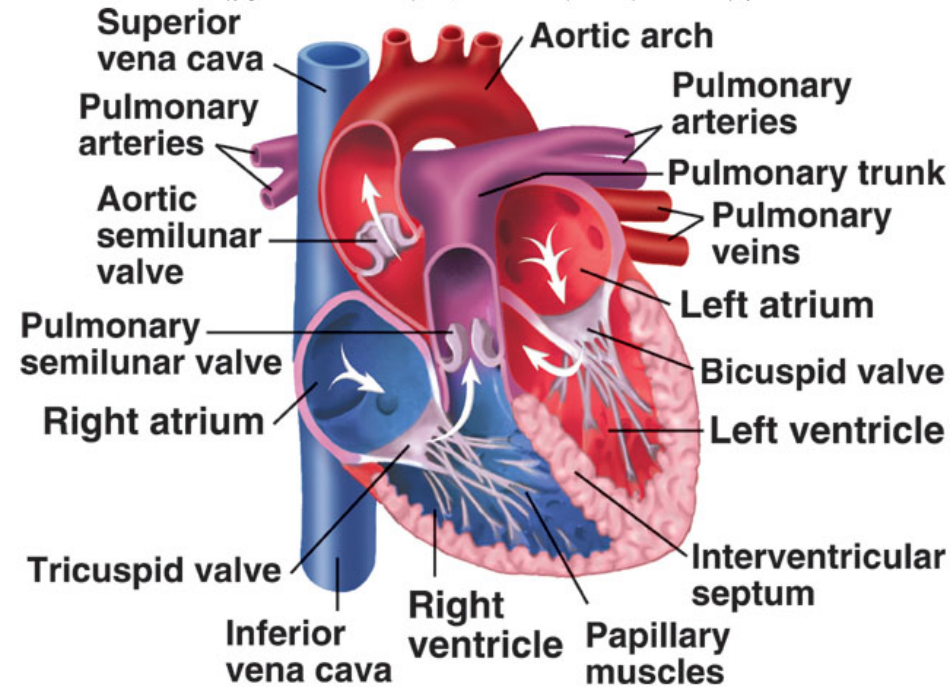


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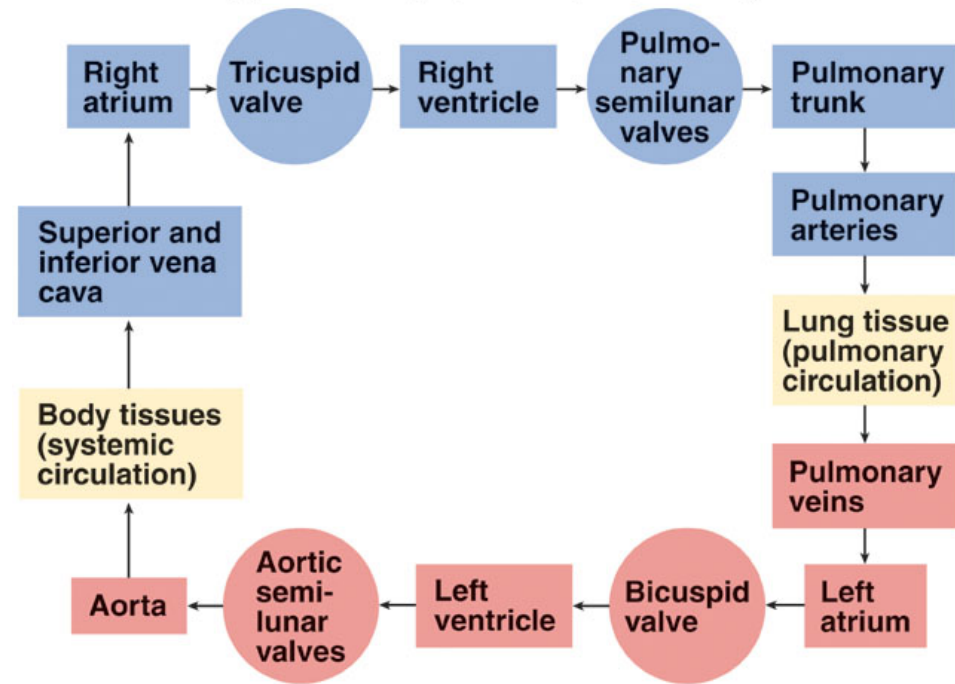


3、心脏的基本结构和特点

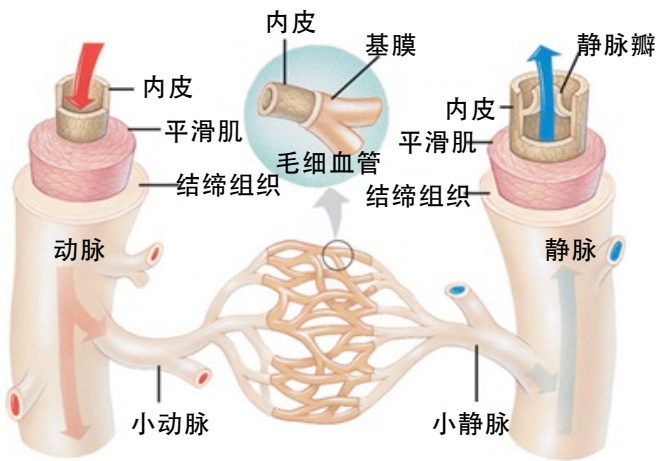
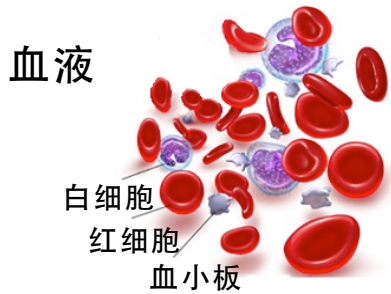
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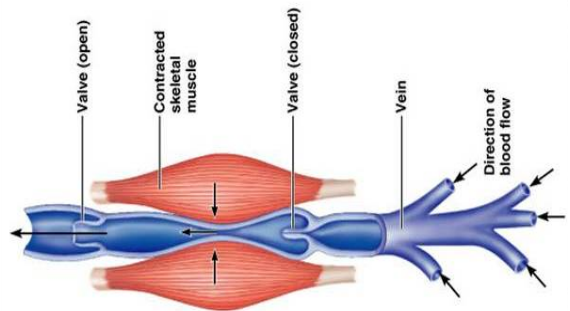
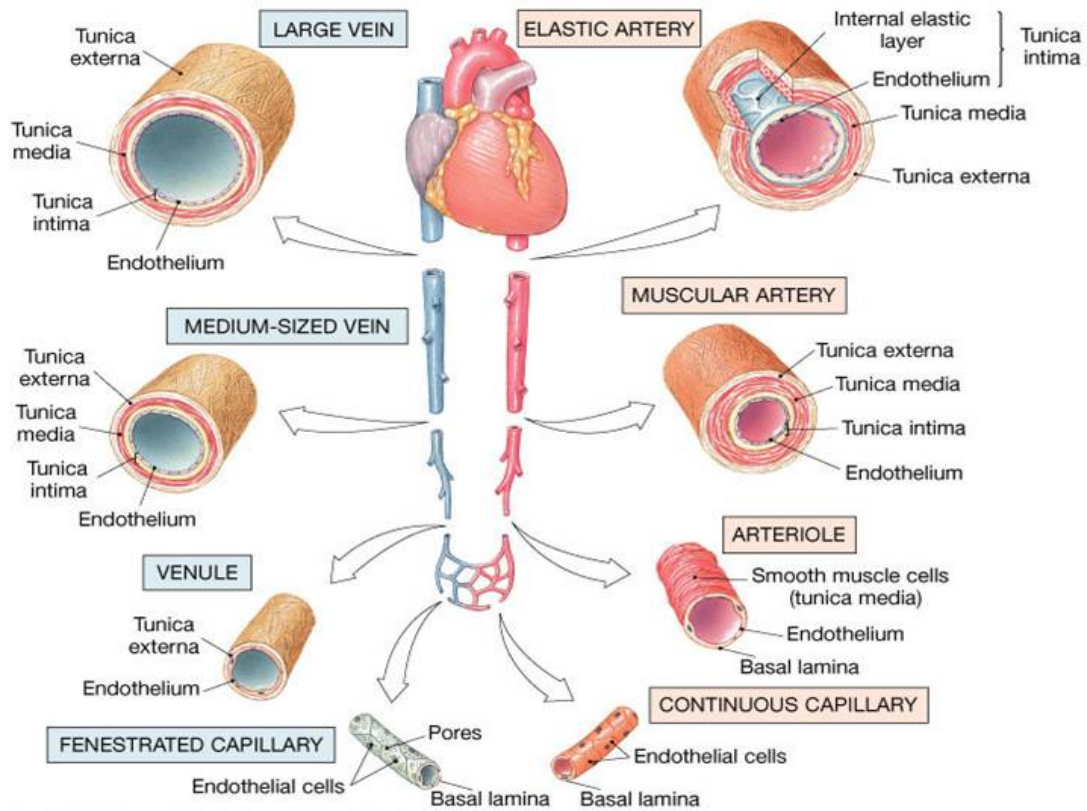
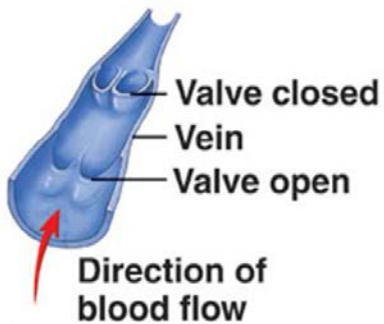
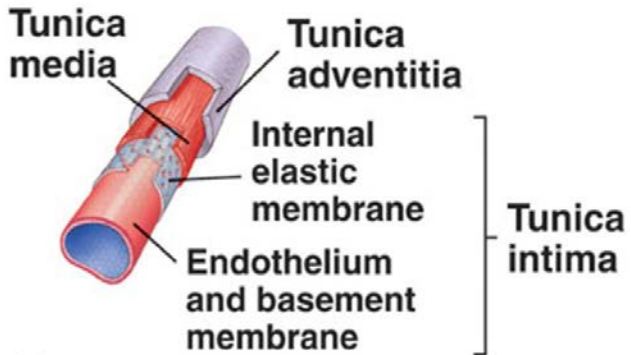
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4、血管系统构成



血管

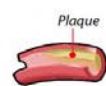
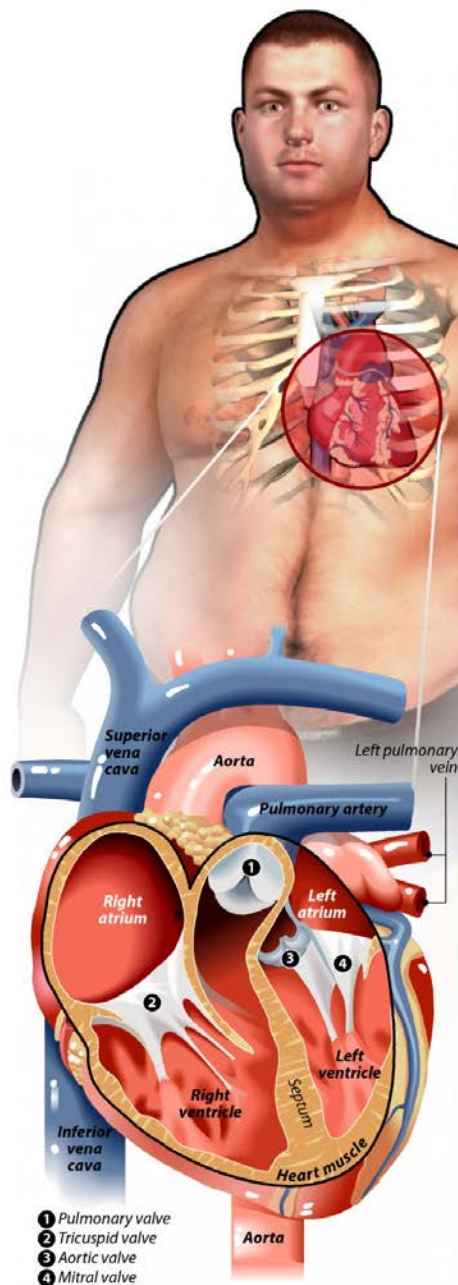
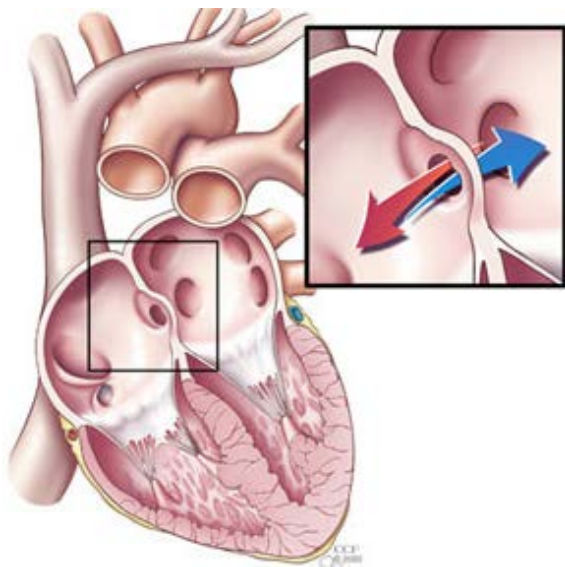


二、心血管疾病种类、发病机制及治疗

心血管疾病主要种类



小儿先天性心脏病



Coronary heart disease
Blocked or clogged arteries limit blood flow to the heart and starving it of oxygen and nutrients.



Arrhythmia
The heart beats irregularly.



Heart failure
The heart can't pump as powerfully as it needs to in order to supply the body with oxygen and nutrients, causing the heart muscles to overwork and weaken.



Heart valve disease
One of more of the hearts' valves — which control blood flow into and out of the heart — doesn't work.



Cardiomyopathy
An enlarged or abnormally stiff or thick heart, causing the heart to pump weaker than normal and sometimes leading to heart failure or arrhythmia.



Pericarditis
An inflammation of one or more layers of the pericardium, a thin membrane that lines the heart.



Aorta disease
A portion of the aortic wall weakens and balloons out, forming an aneurysm.



Vascular disease
Heart disease is often related to diseases of the circulatory system, including arteries, veins and lymph vessels, or blood disorders.

冠心病

心律失常

心衰

瓣膜病

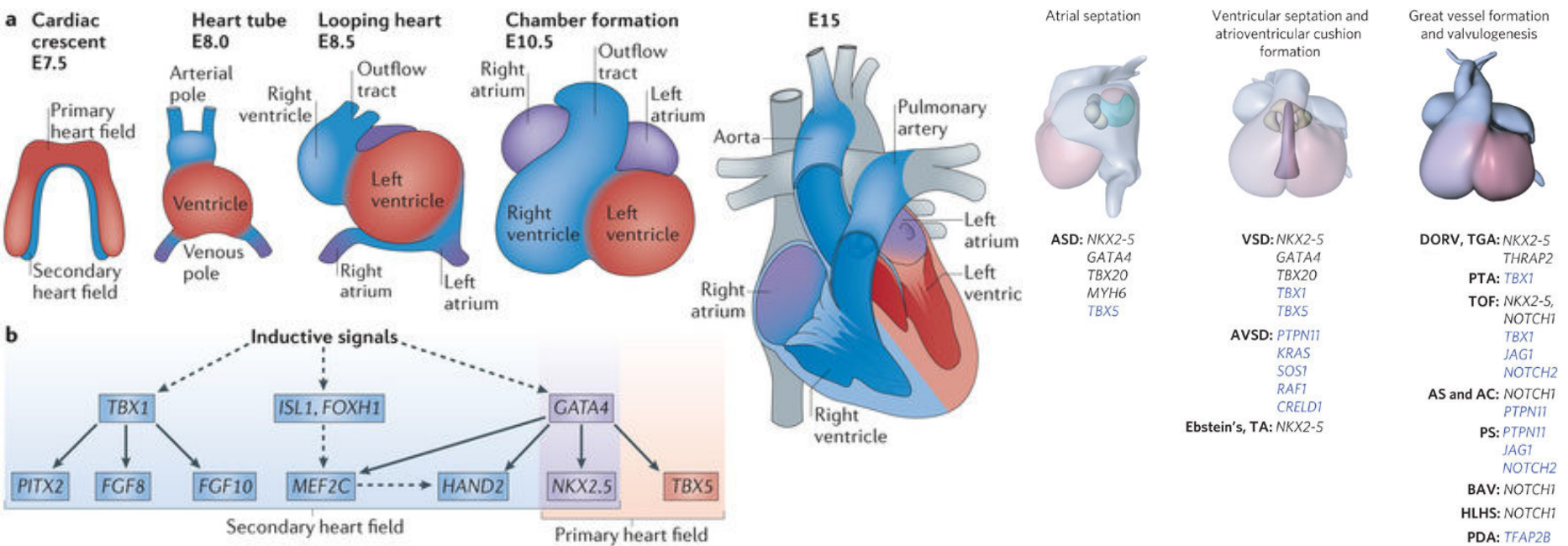
心肌病

心包炎

主动脉病

血管病

1、心脏发育的分子调控及先天性心脏病

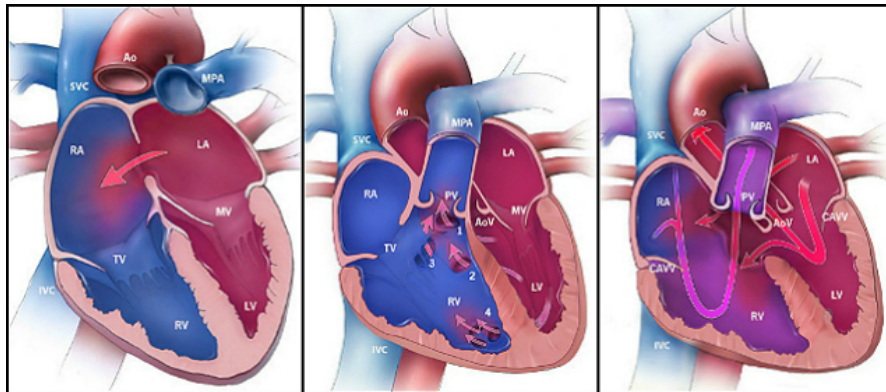


Nature Reviews | Molecular Cell Biology

房间隔缺损

室间隔缺损

法洛四联症



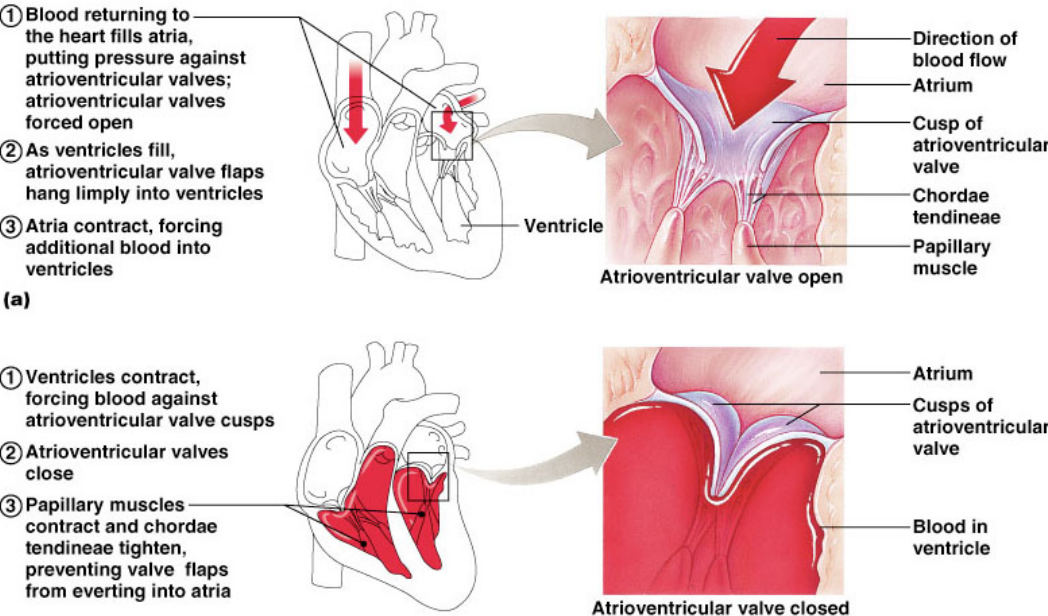
Children with Tetralogy of Fallot exhibit bluish skin during episodes of crying or feeding.



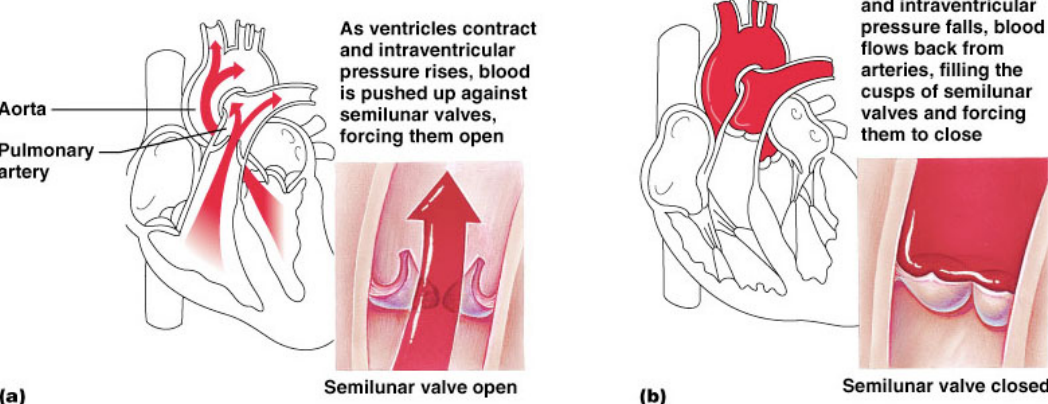
重症者有25%~35%在1岁内死亡，50%病人死于3岁内，70%~75%死于10岁内，90%病人会夭折。由于慢性缺氧引起红细胞增多症，继发性心肌肥大和心力衰竭

2、心瓣膜功能及瓣膜病

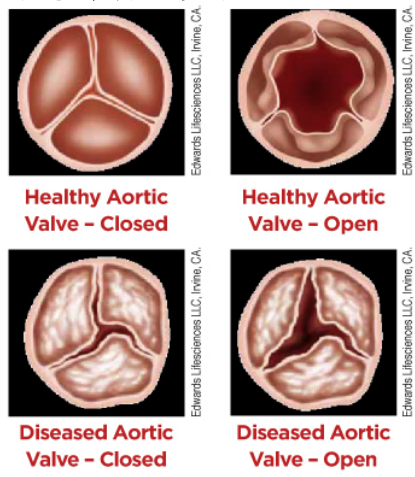
房室瓣



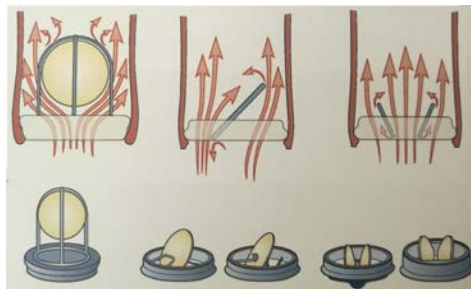
半月瓣



瓣膜病变

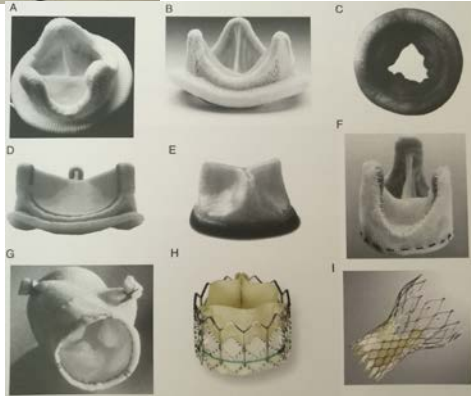


人工心脏瓣膜

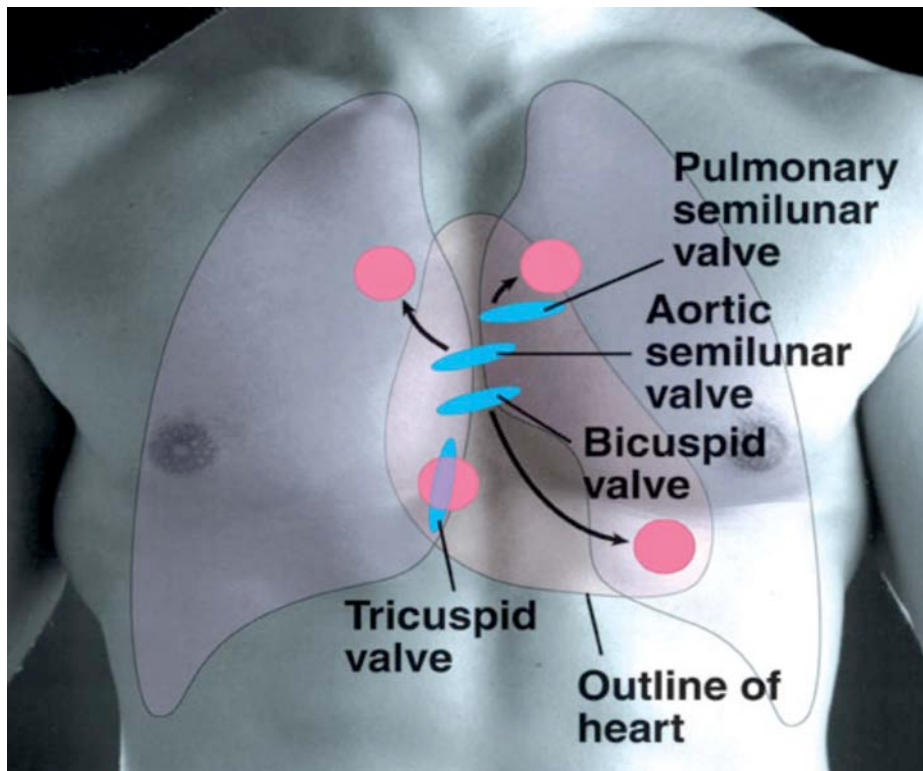


生物瓣

机械瓣



心瓣膜位置与心声听诊



听诊器：心脏收缩和瓣膜关闭的声音（心声）

心声有二：第一声较低而长，是心室开始收缩、房室瓣关闭和大动脉接受血液而涨大时的声音；第二声较高而短，是心室收缩完毕，开始舒张，大动脉的半月瓣关闭时的声音。

瓣膜闭锁不全：大动脉半月瓣在心室舒张时不能完全关闭，血液“漏”回左心室，出现“丝丝”的声音，即杂音。房室瓣如有损伤而闭锁不全时，同样也会出现杂音。

雷内克医生

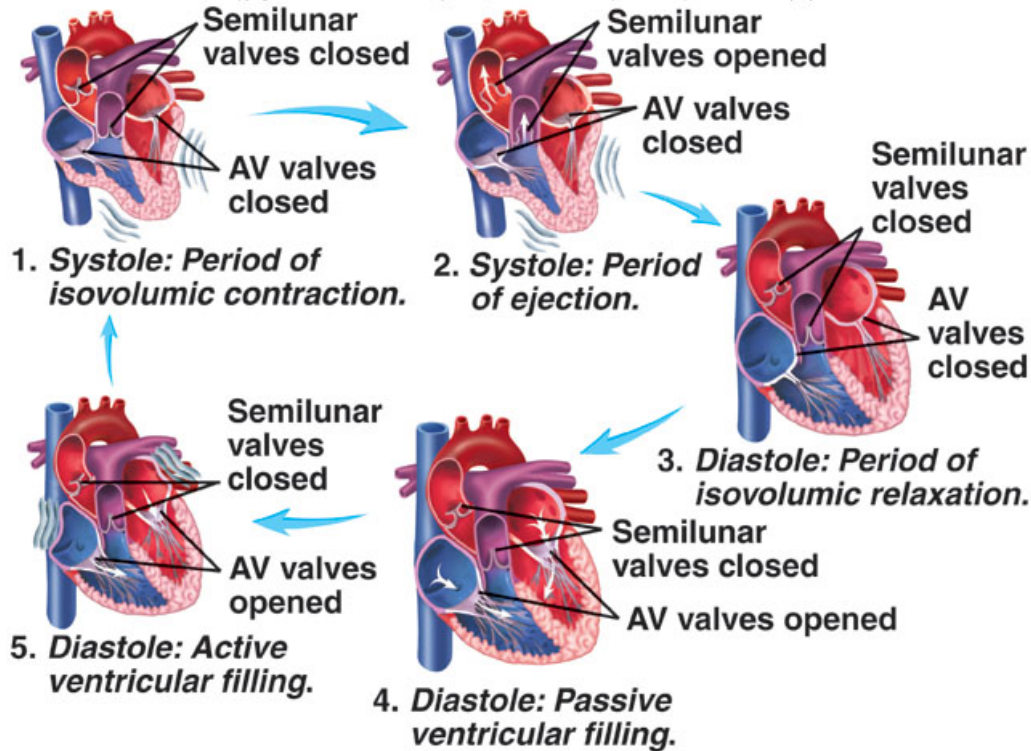


René Laennec

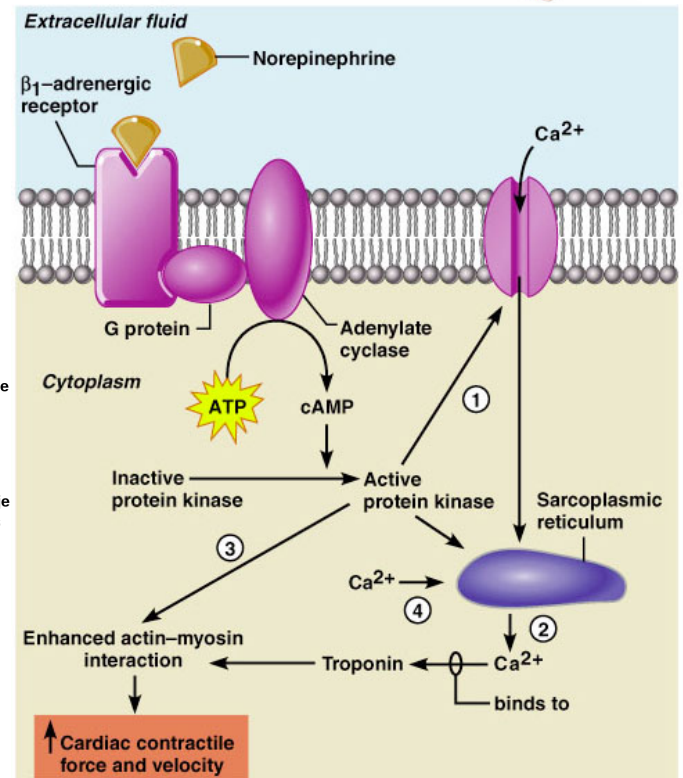
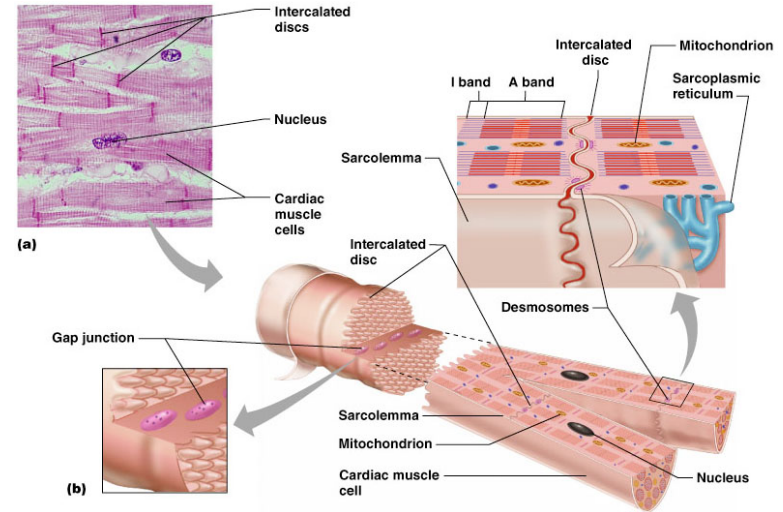
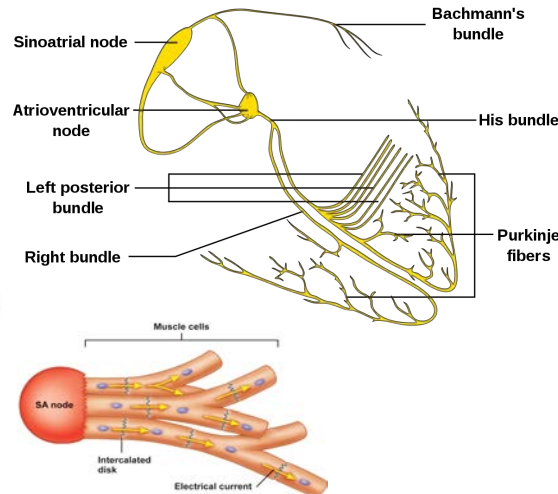
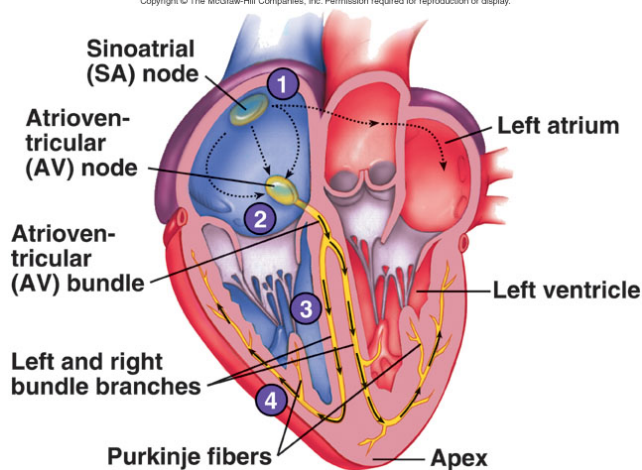


3、心脏节律性-窦性心律

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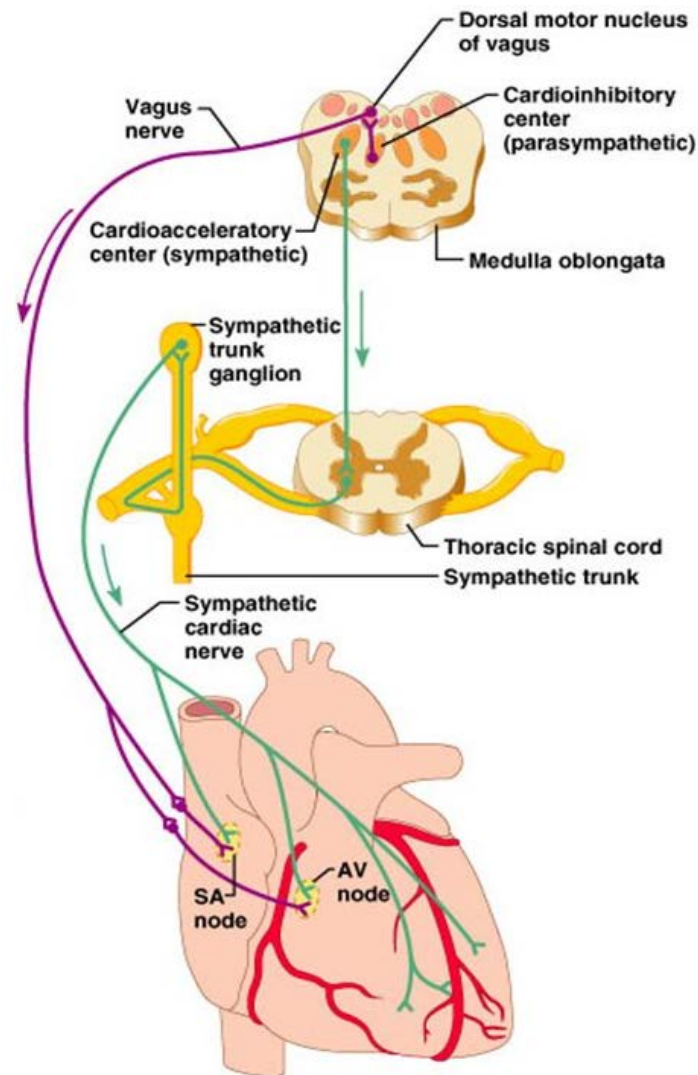
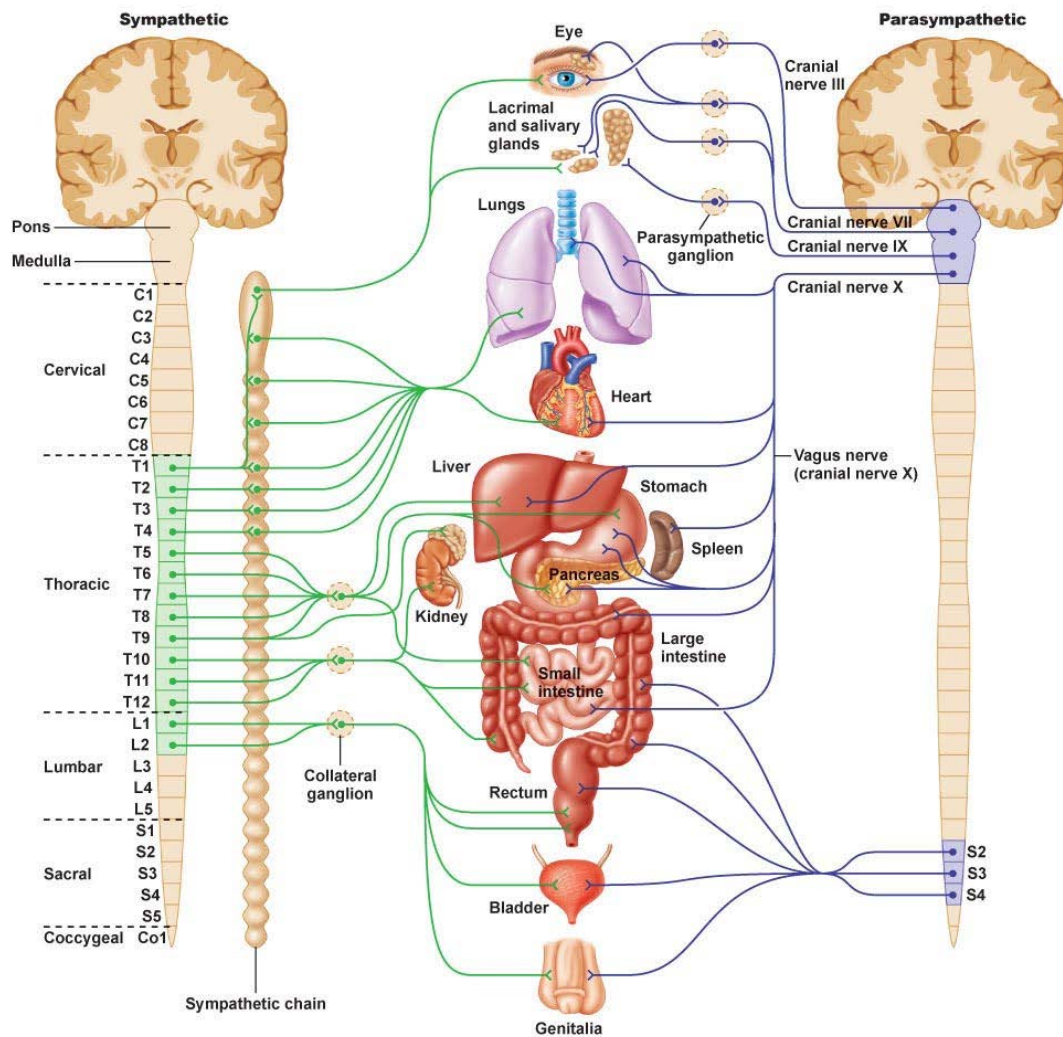


植物神经调节心律

植物性神经系统

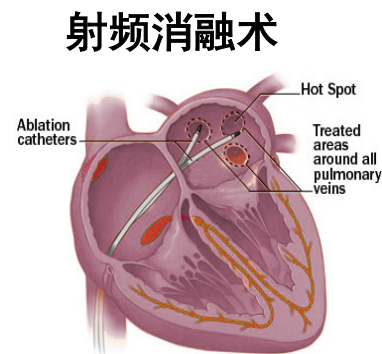
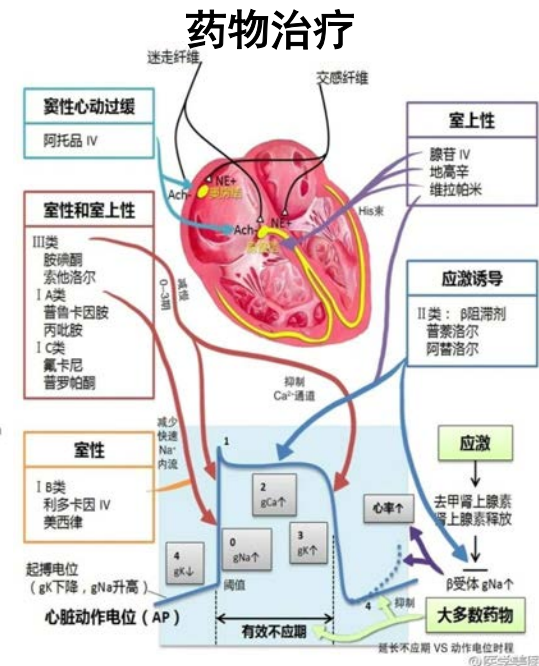
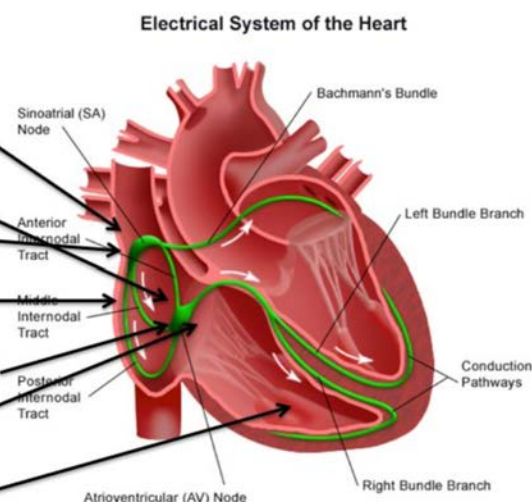
交感神经系统

副交感神经系统

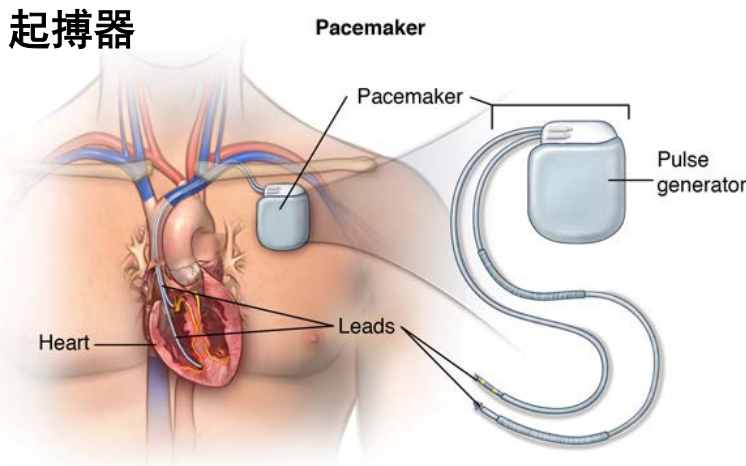


心律失常类型和治疗

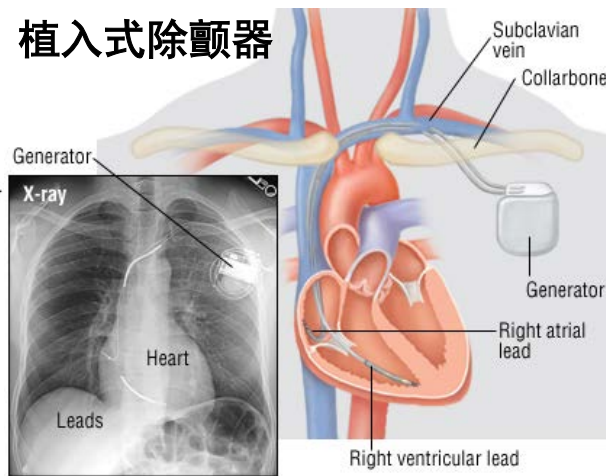
- SLOW**
 - Sinus bradycardia
 - Heart block
- FAST**
 - Sinus tachycardia
 - Atrial tachycardia
 - Supraventricular tachycardia
 - Junctional tachycardia
 - Ventricular tachycardia



起搏器



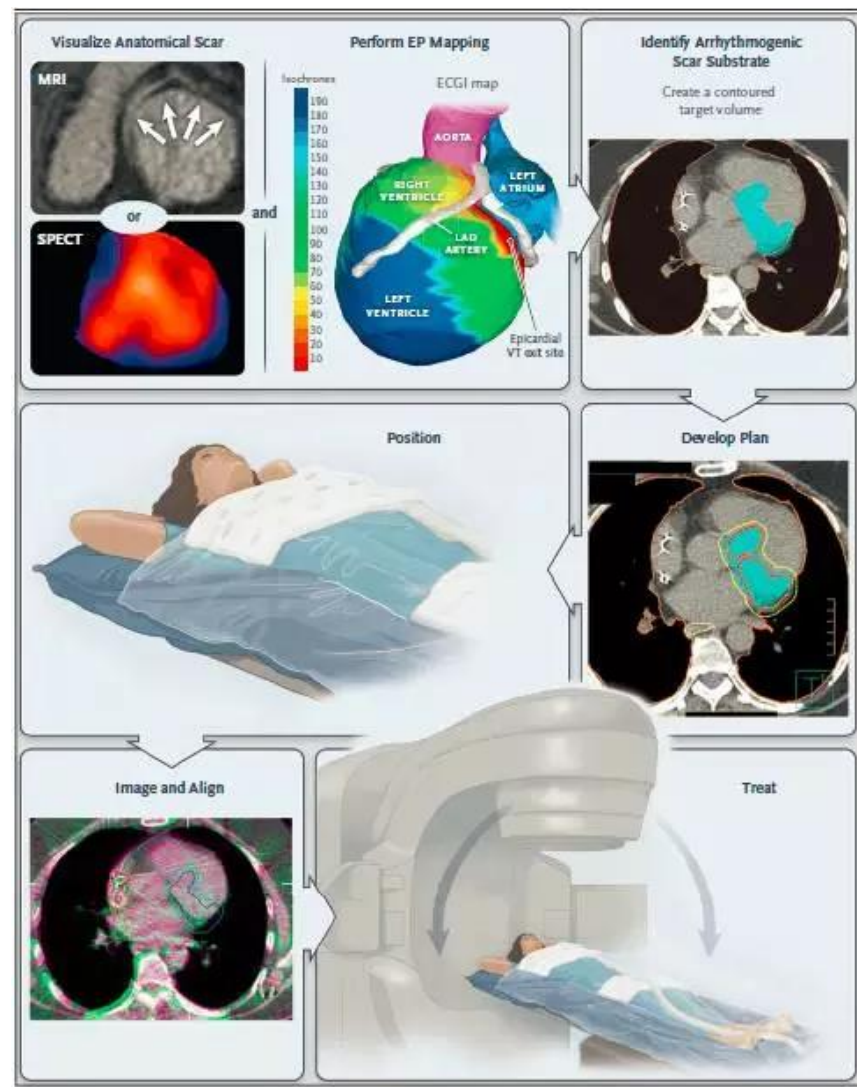
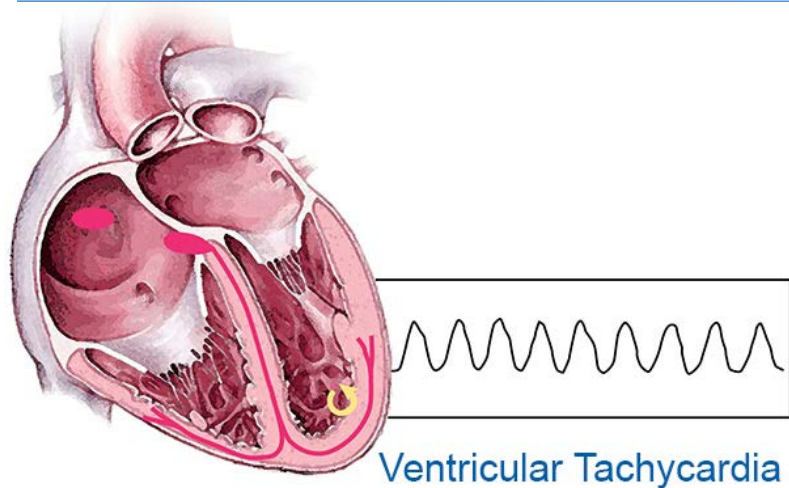
植入式除颤器



除颤器

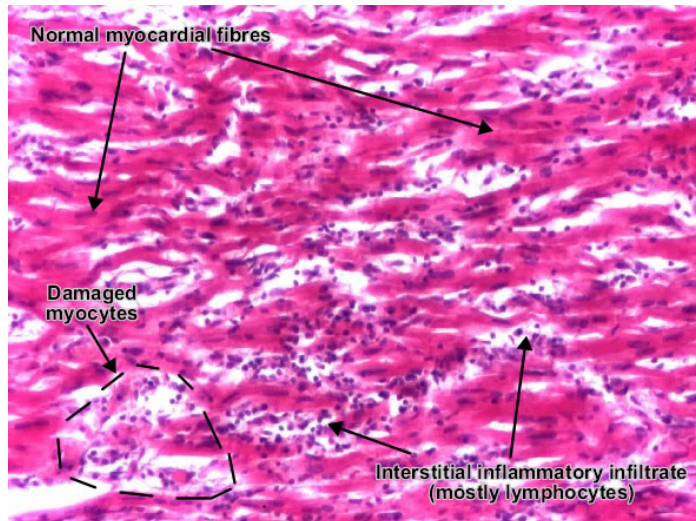
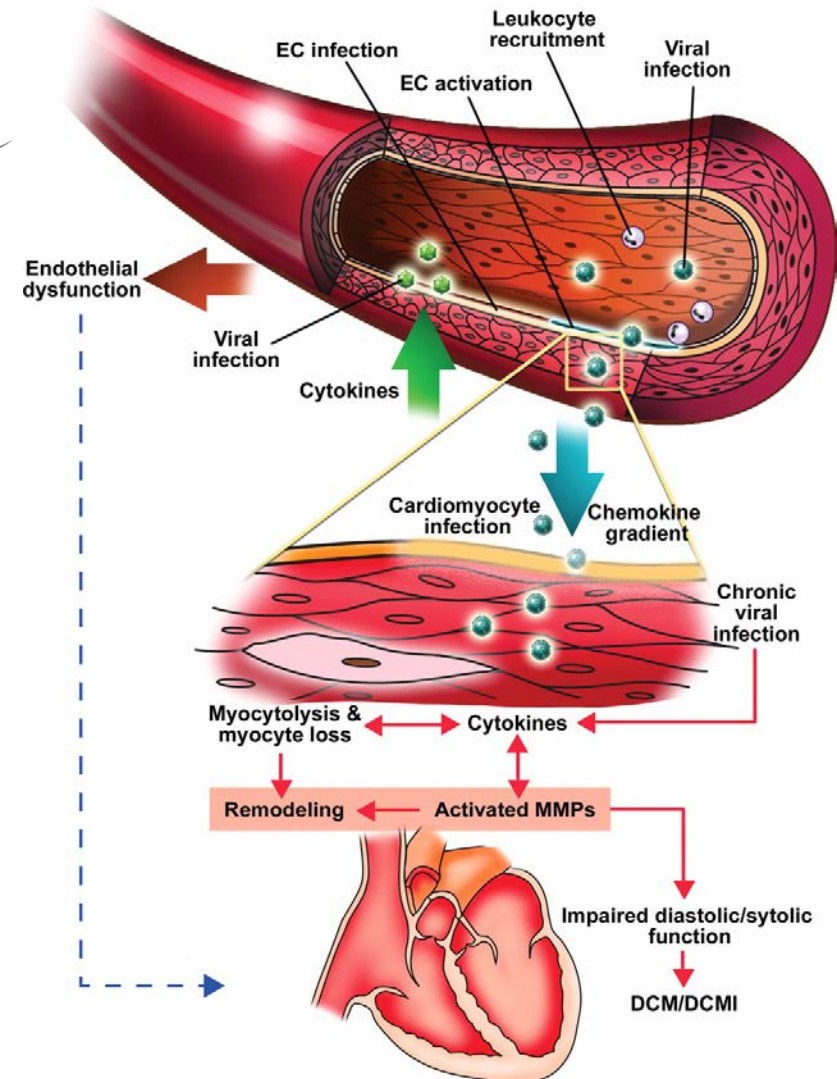
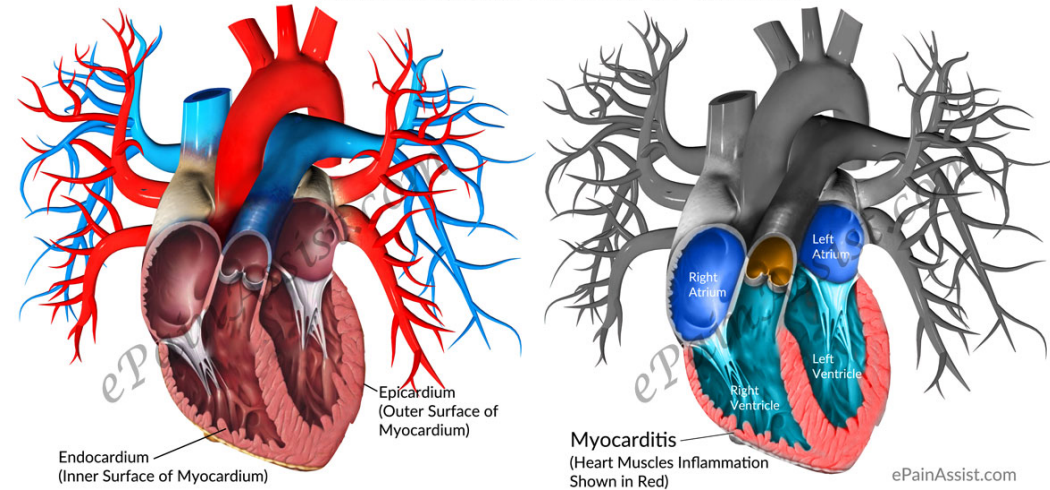


室性心动过速治疗新技术-立体定向消融放射治疗 (SBRT)

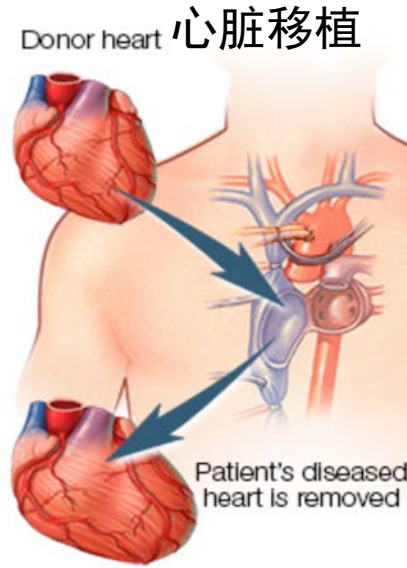
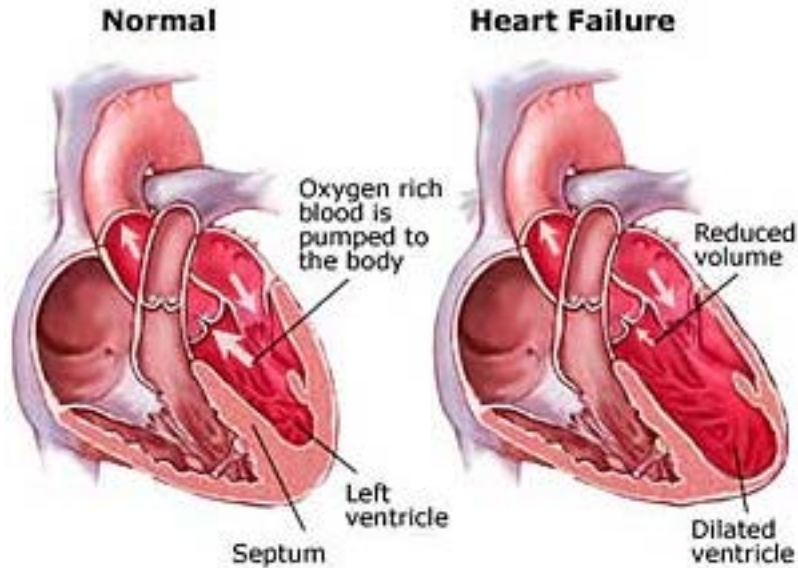


4、心肌炎

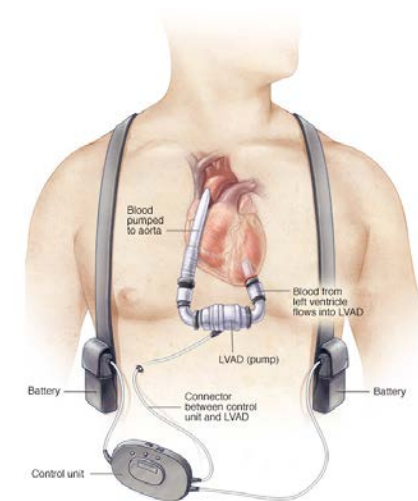
Inflammation of Heart Muscles



5、心力衰竭（心衰）与人工心脏



左心室辅助装置



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Dilated pupils, a sympathetic nervous system response

Skin pale, gray, or cyanotic

Dyspnea, SOB, early symptom from pulmonary congestion

Orthopnea, cannot breathe unless sitting up

Crackles, wheeze are adventitious breath sounds

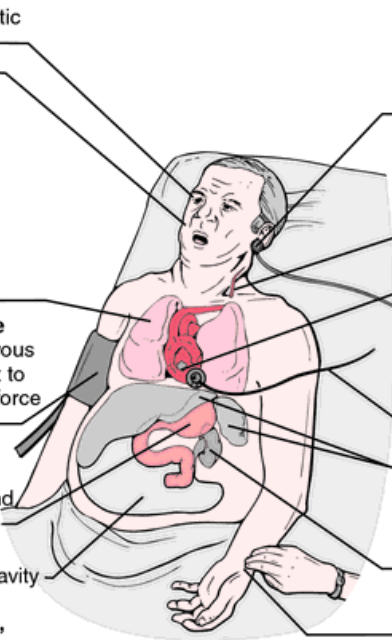
Cough, frothy pink or white sputum

Decreased blood pressure stimulates sympathetic nervous system, which acts on heart to increase rate and increase force of contraction

Nausea and vomiting as peristalsis slows and bile and fluids back up into stomach

Ascites, fluid in peritoneal cavity

Dependent, pitting edema, in sacrum, legs



Anxiety, gasping from pulmonary congestion

Falling O₂ saturation

Confusion, unconsciousness from decreased O₂ to brain

Jugular vein distention from venous congestion

Infarct, may be cause of decreased cardiac output

Fatigue, weakness from decreased cardiac output

S₃ gallop, tachycardia

Enlarged spleen and liver from venous congestion. This causes pressure on breathing

Decreased urine output

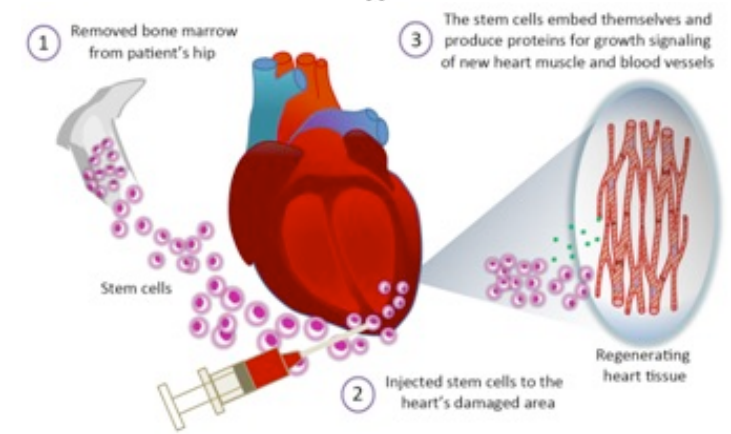
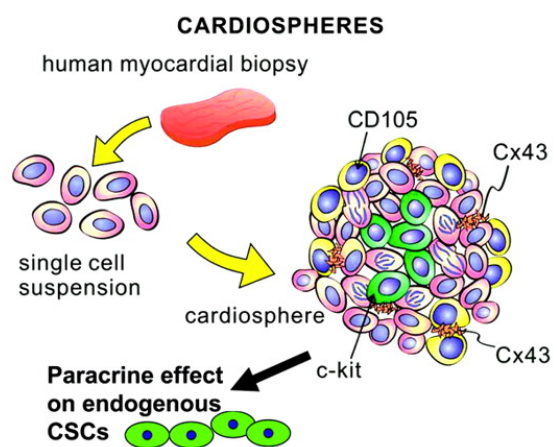
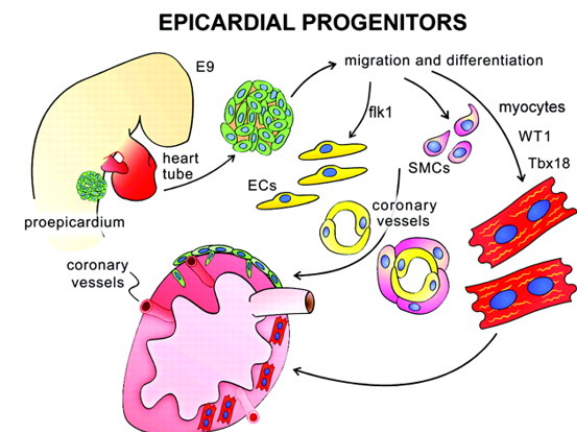
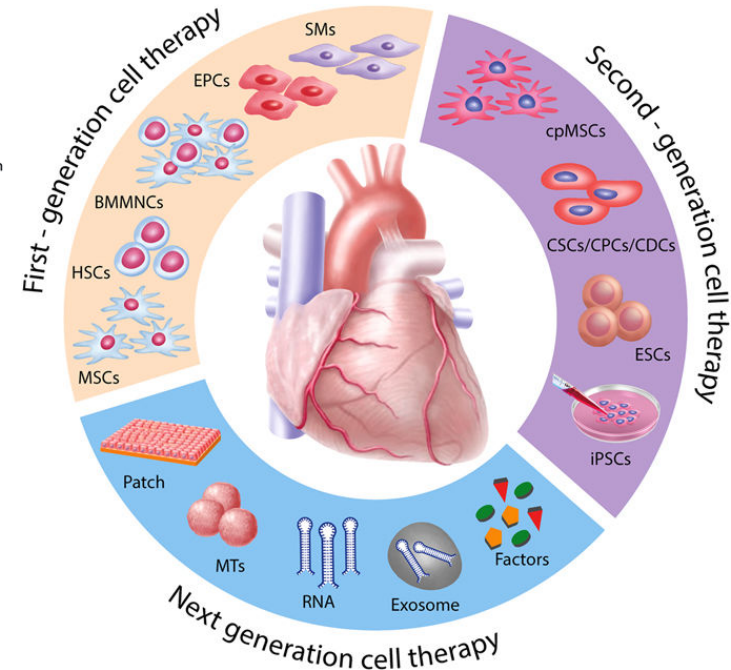
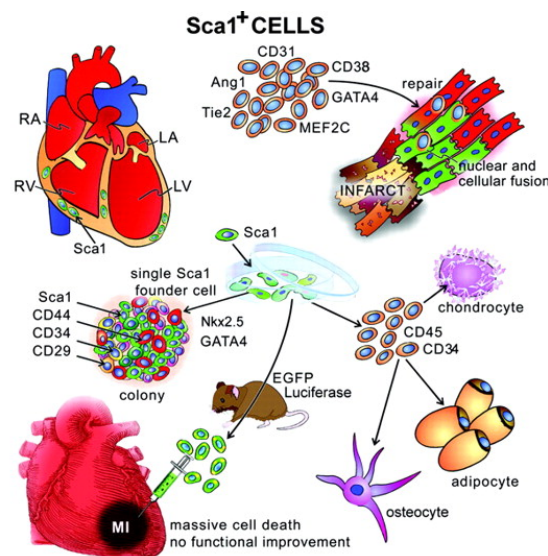
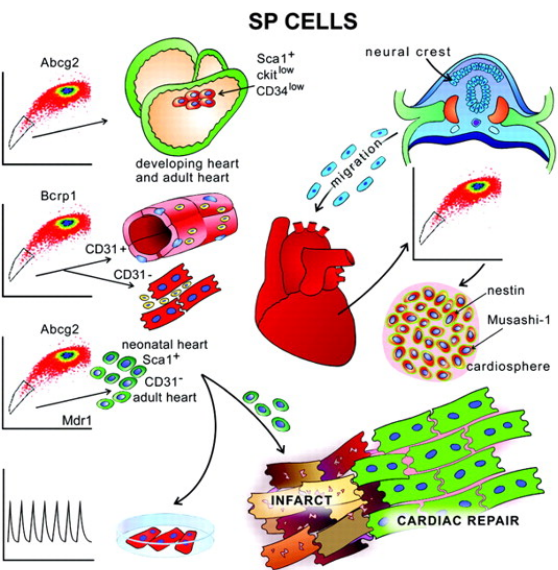
Weak pulse

Cool, moist skin

人工心脏

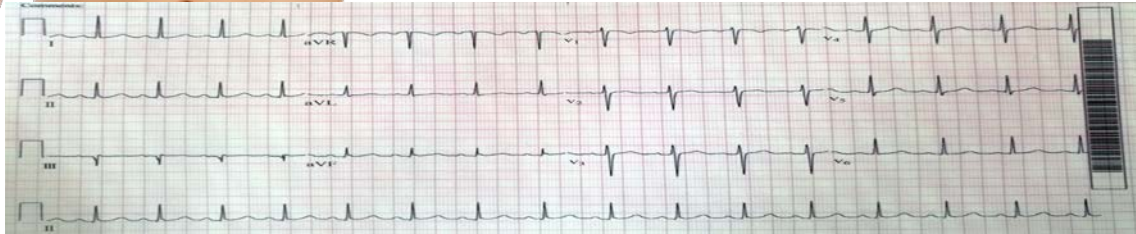
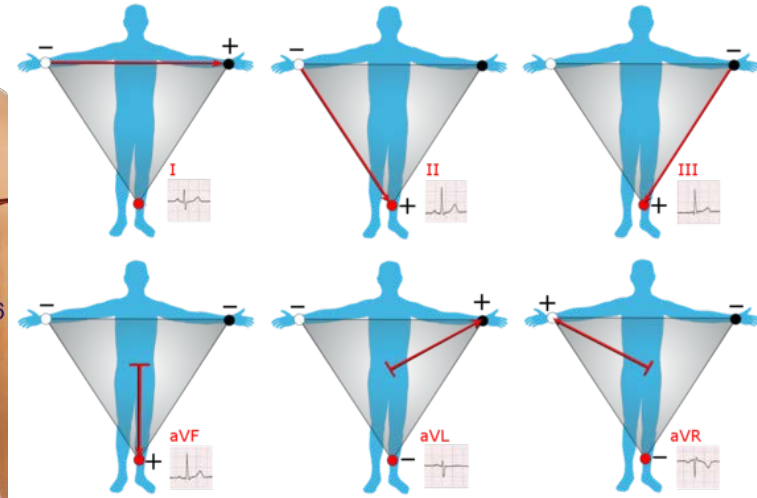
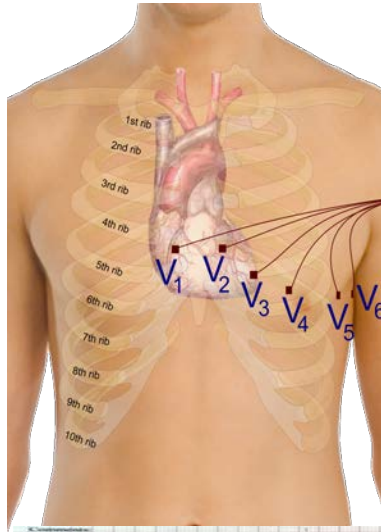
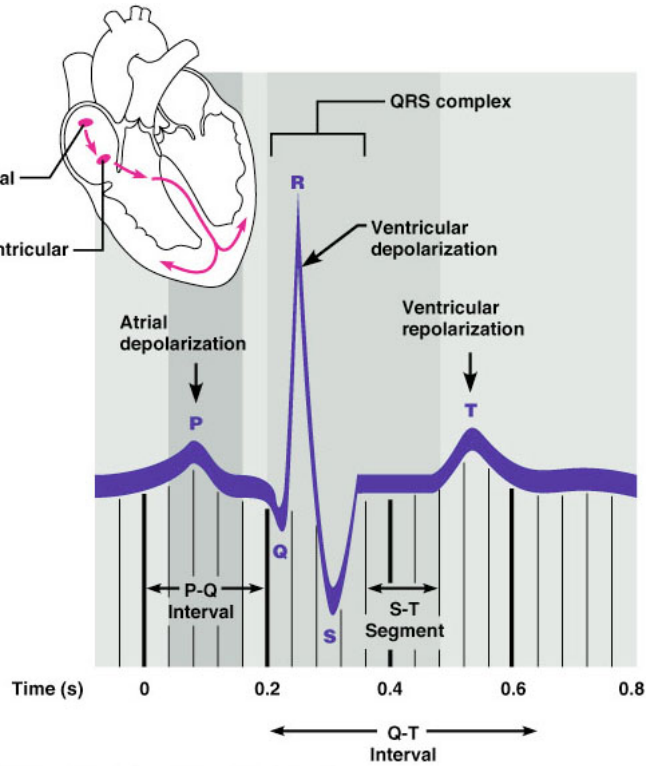


Cardiac progenitor cell classes

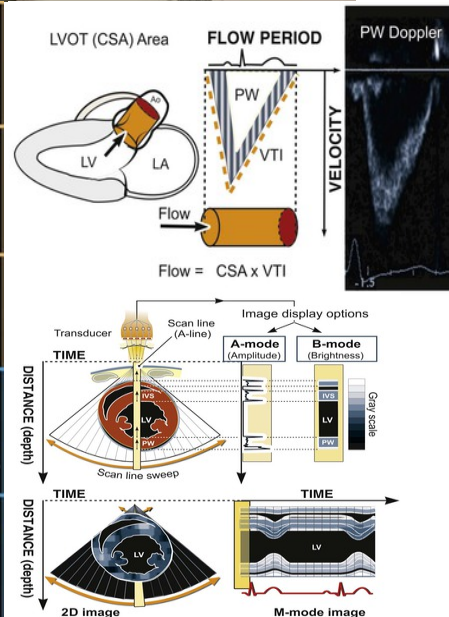
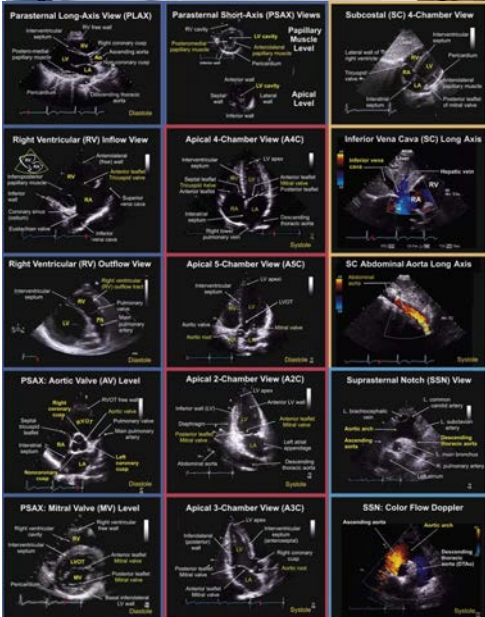


Circulation. 2009;120:2515-2518

7、心脏功能检测-心电图



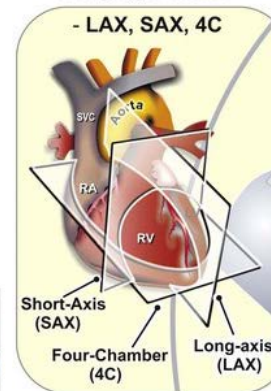
8、心脏功能检测-心超



1 Transducer Position or "Window"

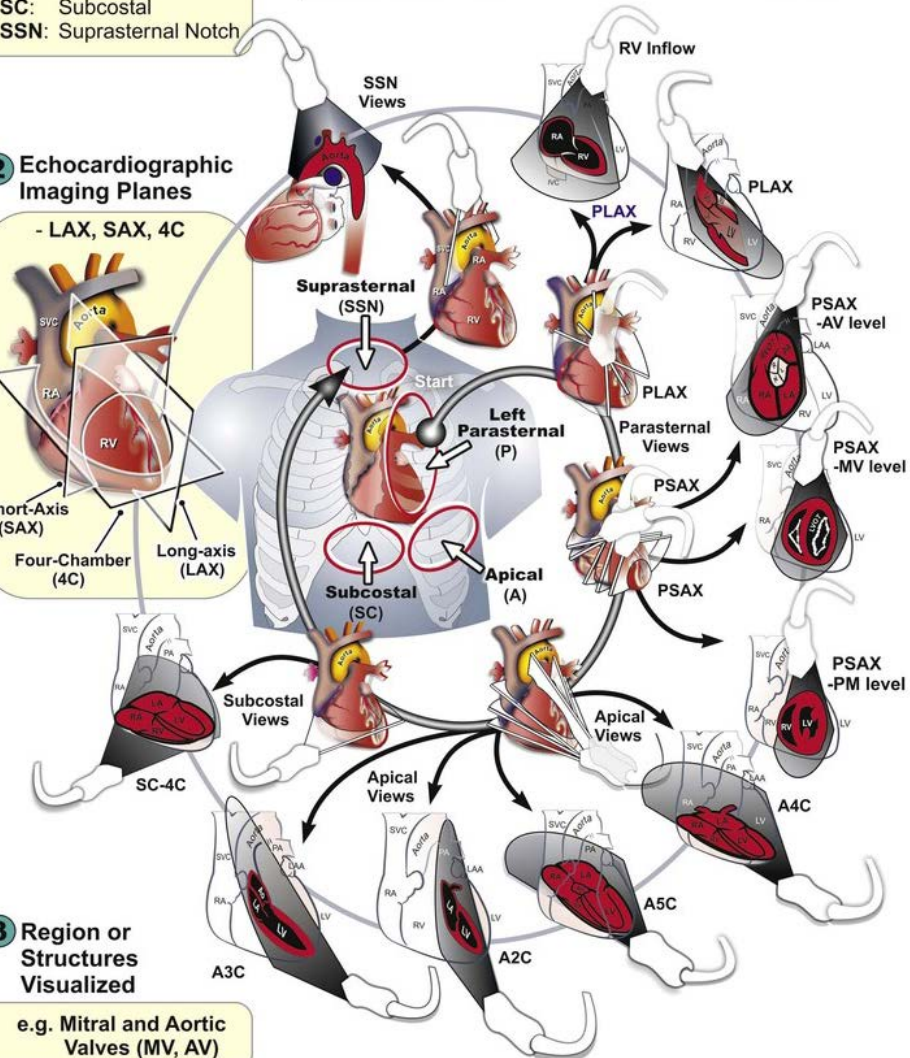
P: Parasternal
A: Apical
SC: Subcostal
SSN: Suprasternal Notch

2 Echocardiographic Imaging Planes



3 Region or Structures Visualized

e.g. Mitral and Aortic Valves (MV, AV)

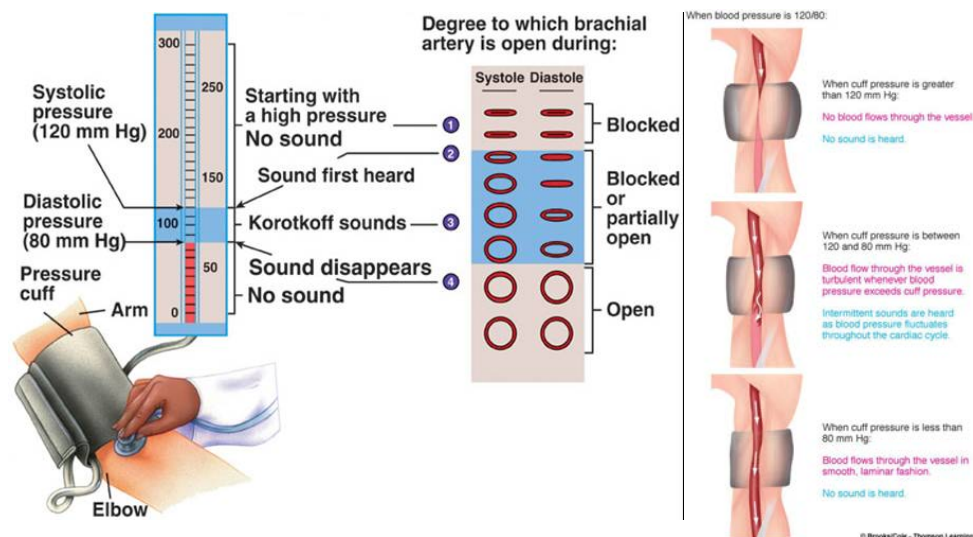


9、高血压

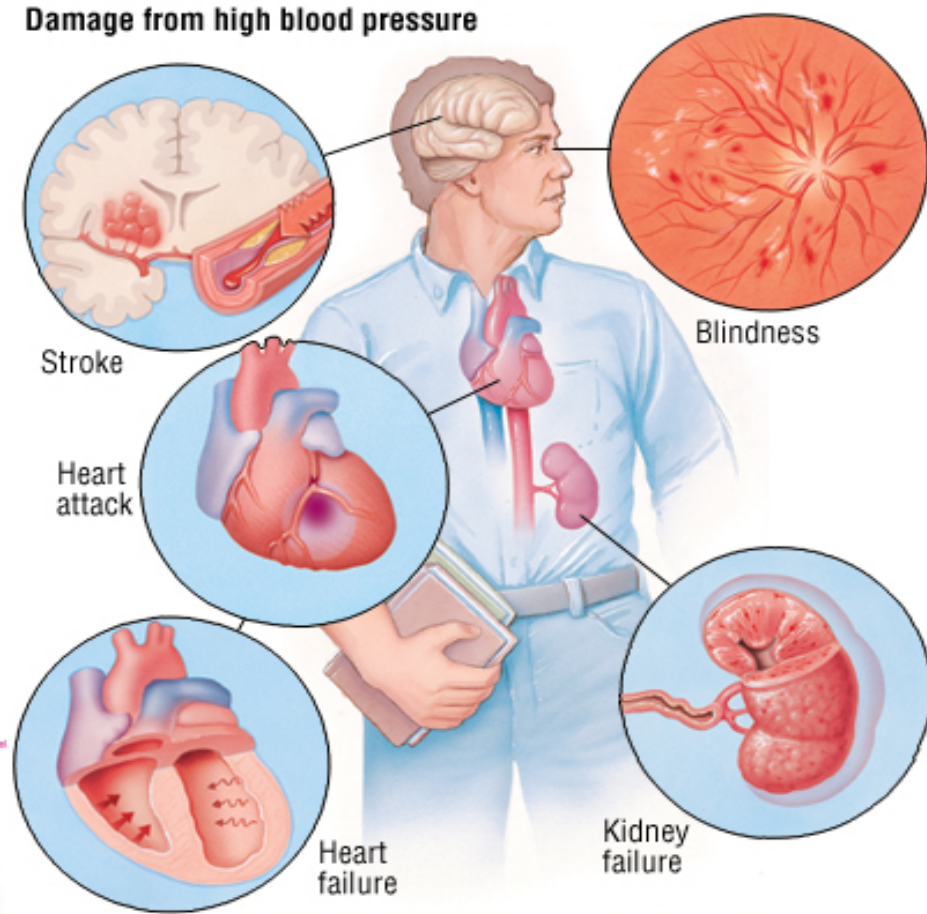


美国心脏协会（AHA）2017年11月发布高血压新标准：130/80mmHg

之前标准： 中国和美国都是140/90mmHg

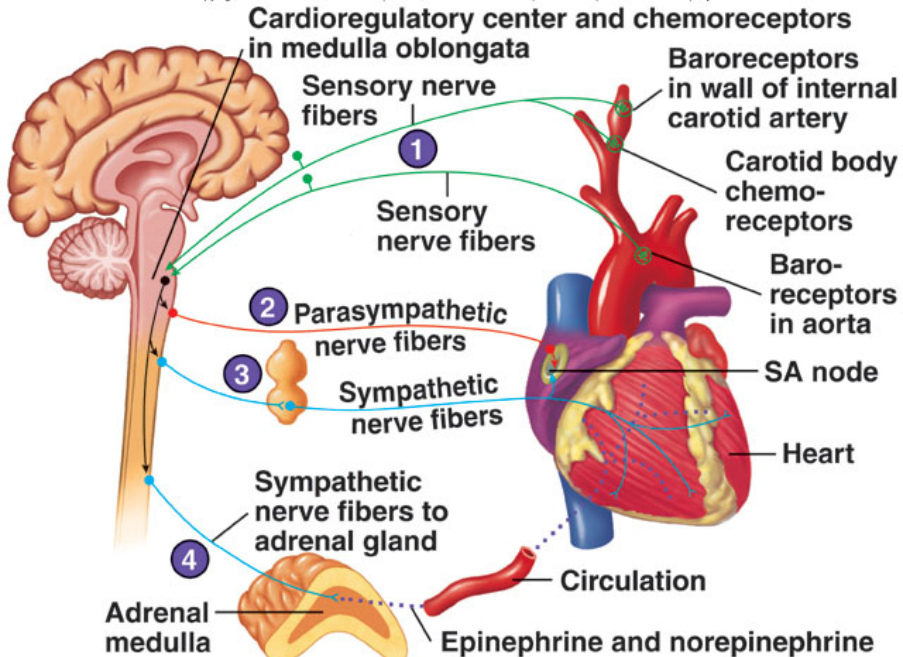


Damage from high blood pressure

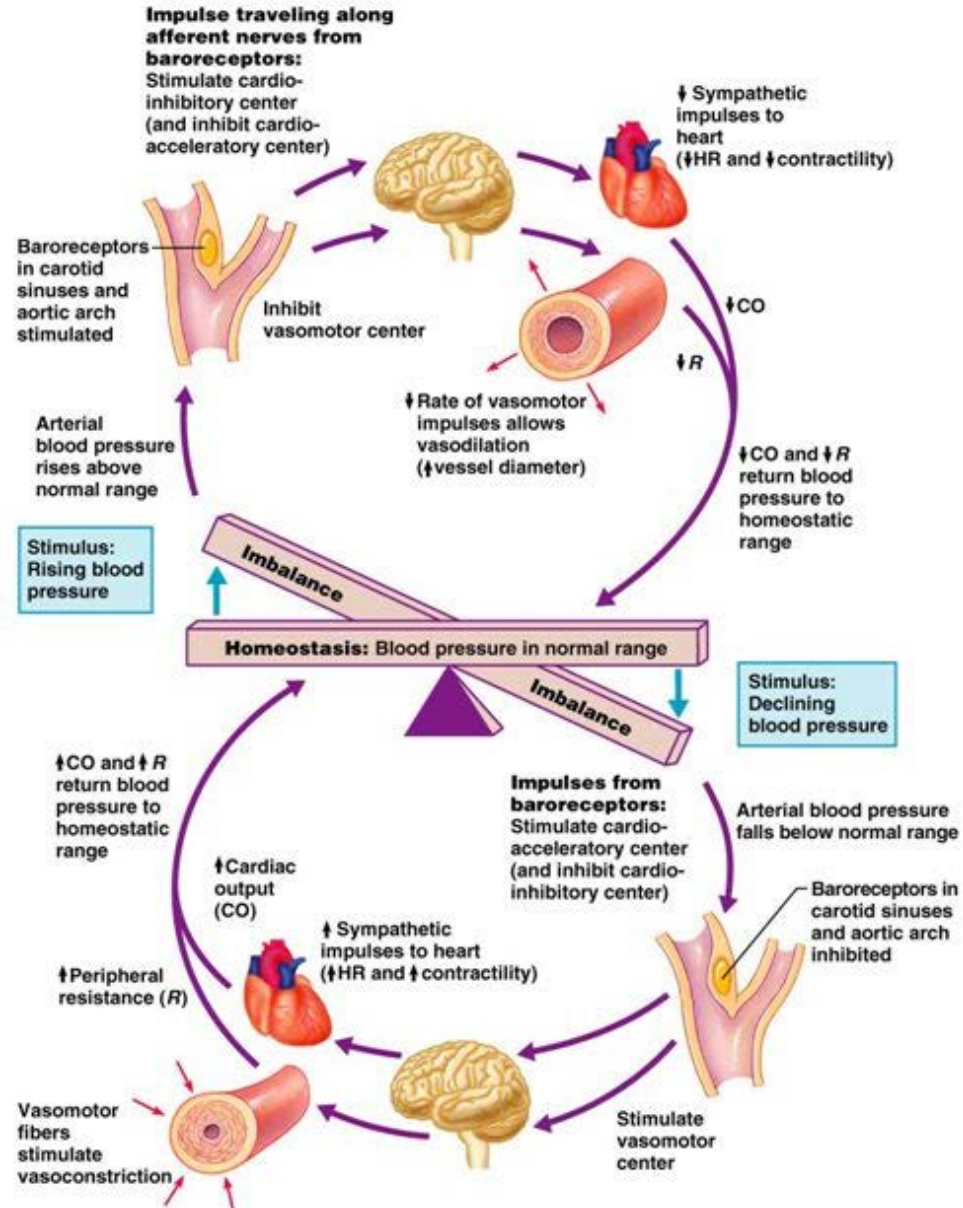
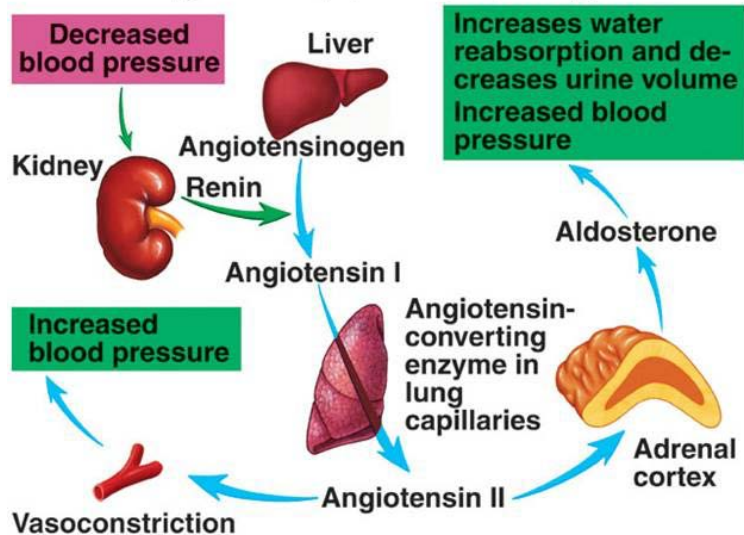


压力感受器和化学感应器反射与血压稳态维持

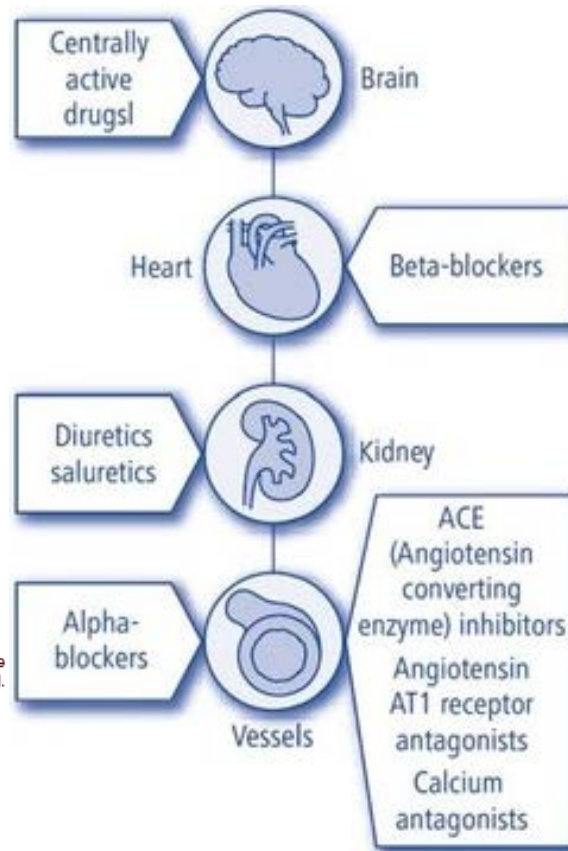
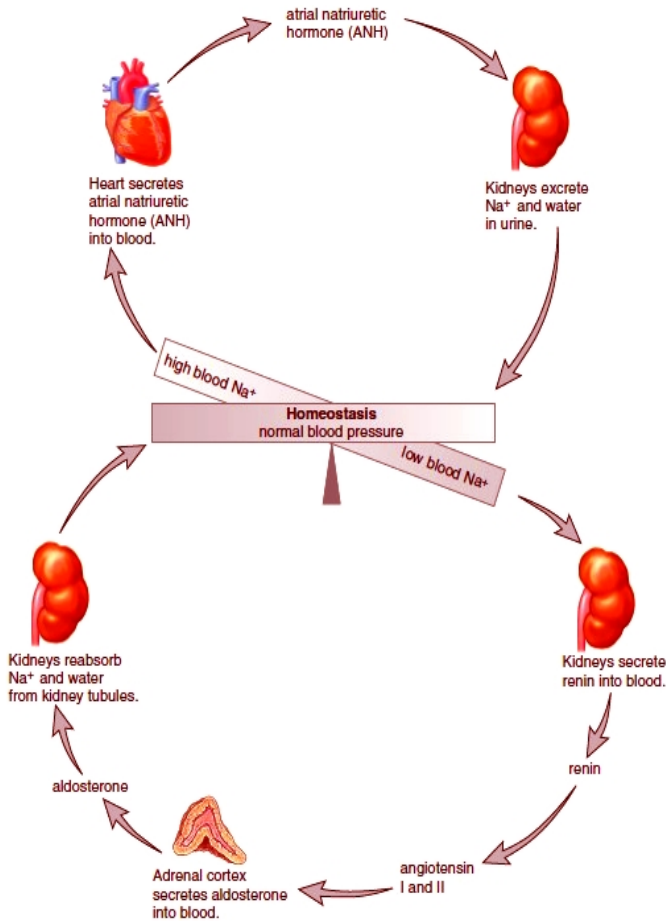
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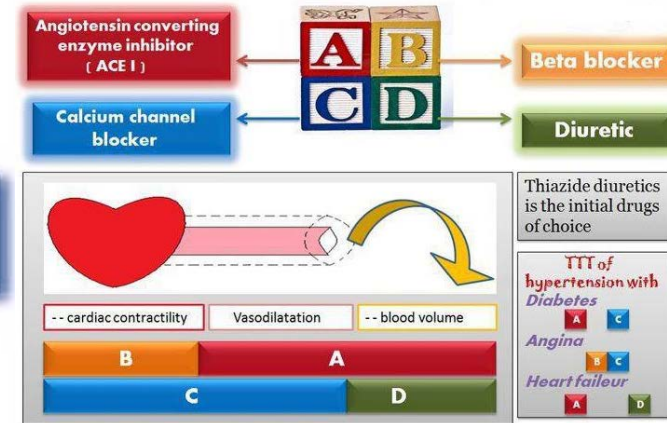
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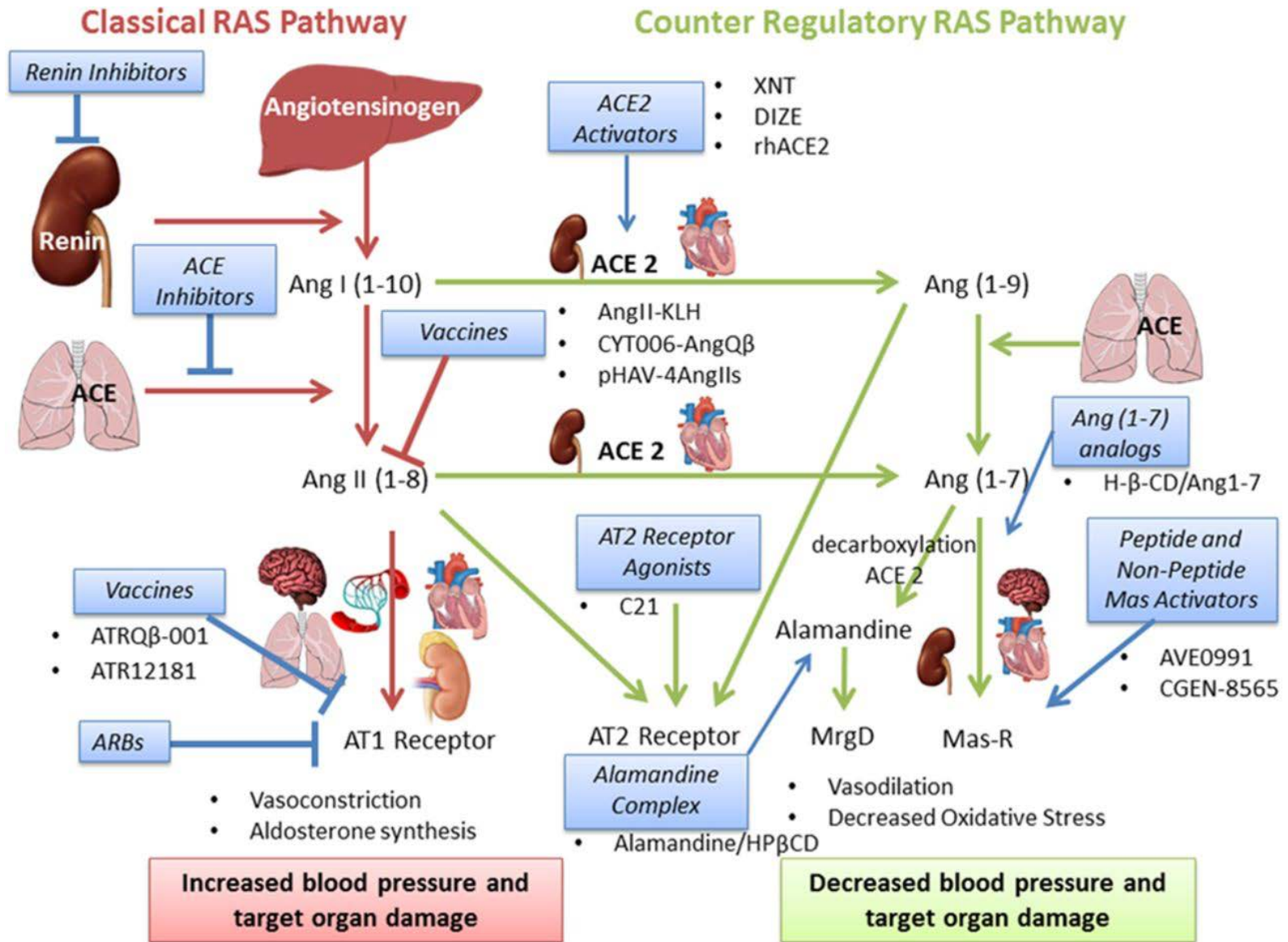
高血压药物治疗



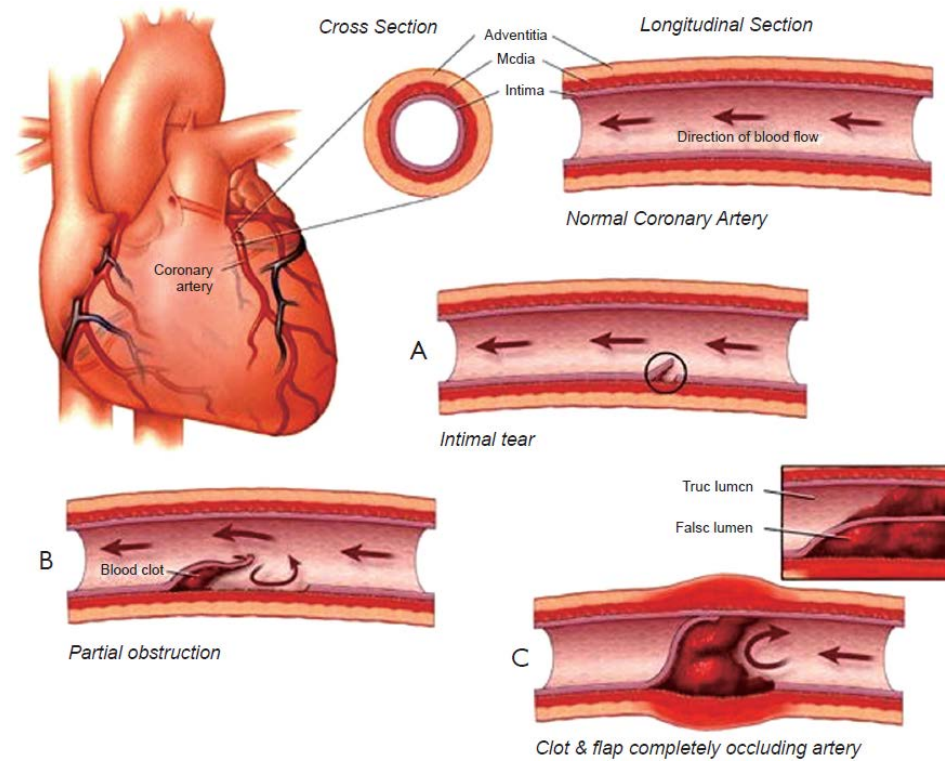
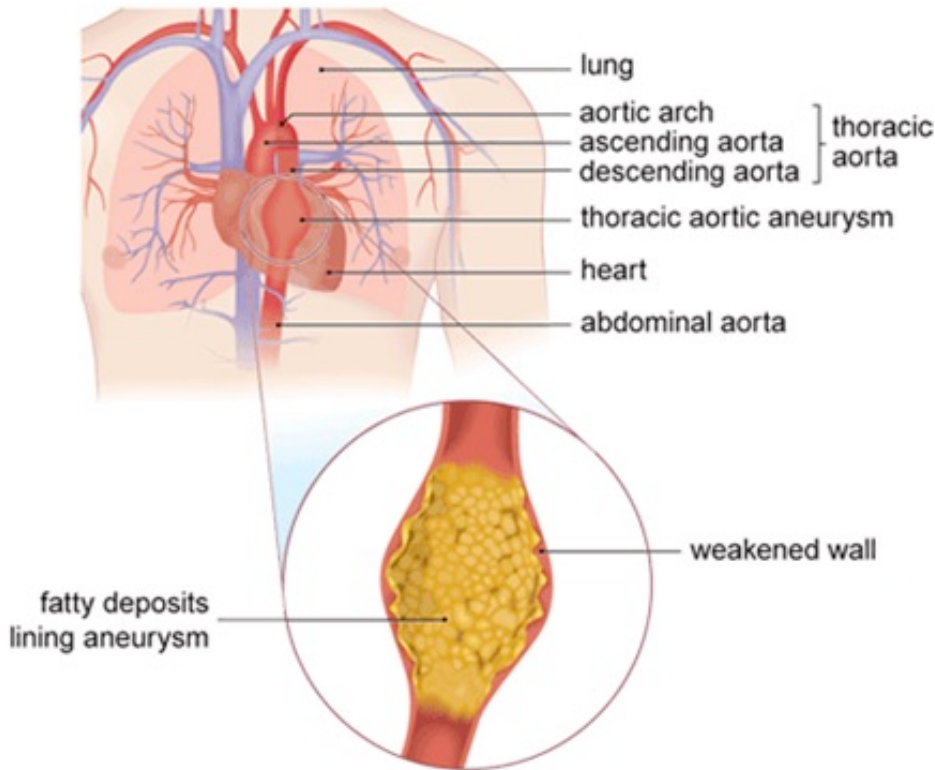
Treatment of hypertension



高血压药物研发靶标（肾素-血管紧张素系统（RAS））



10、动脉瘤和动脉夹层



11、深静脉血栓

DEEP VEIN THROMBOSIS is the formation of a blood clot (also known as thrombosis) in a deep vein. DVT predominantly occurs in the legs but also can occur in the pelvic area or arms. It can lead to partial or complete blockage of circulation which will cause serious medical problems.

WARNING SIGNS OF DVT
You should contact your doctor if you experience the following:

- Pain
- Warmth
- Tenderness
- Redness
- Swelling

ACROSS THE COUNTRY
Nearly **2 million** Americans are affected by DVT each year.

Up to **600,000** people are hospitalized due to DVT each year.

STAY ACTIVE
Immobility increases the chances of developing a blood clot. If you're sitting for an extended period of time - like on an airplane or at work - get up, stretch your legs and walk around. These foot exercises can also help create blood flow.

COMPLICATIONS
In the most serious cases of DVT, a part of the clot can break away and travel through the bloodstream to the lungs. This can cause a **PULMONARY EMBOLISM (PE)** and is potentially life threatening.

WARNING SIGNS OF PE
If a blood clot has travelled to your lungs, you may experience:

- Shortness of breath
- Rapid breathing
- Chest pain
- Rapid heart rate
- Light headedness

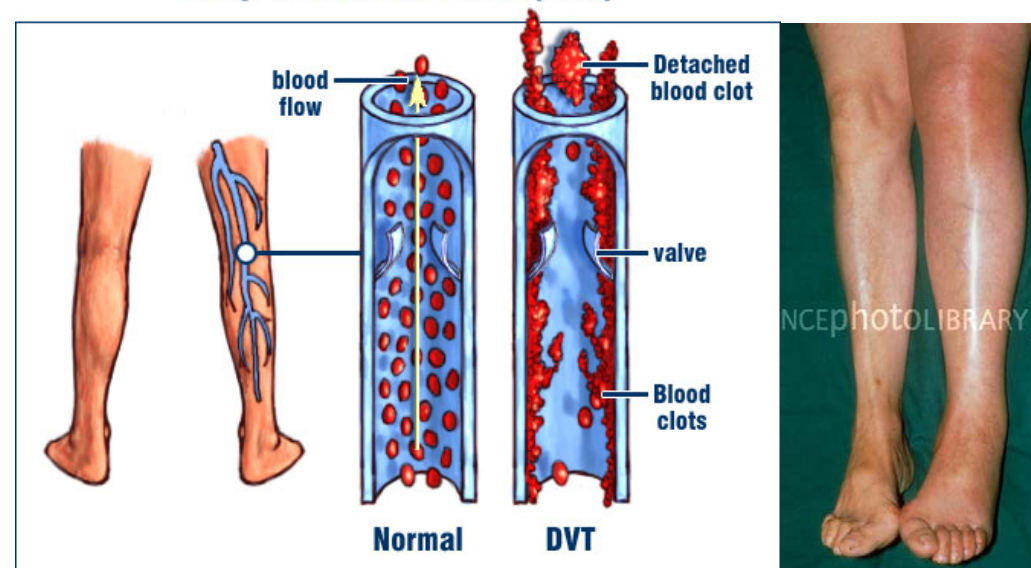
CAUSES OF DVT
The formation of a blood clot can happen to anyone at any age or health. Sometimes there are no warning signs or symptoms. You should be aware of the circumstances that can trigger a blood clot.

Pregnancy
Pregnant women are **5 times** more likely to develop a DVT than non-pregnant women. Women taking oral contraceptives or hormone replacement can be at increased risk of DVT, as well.

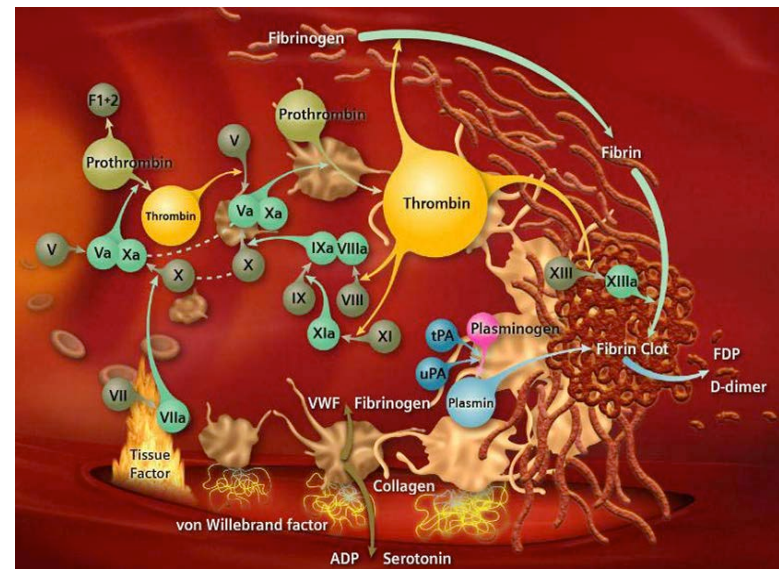
Extended Bed Rest
You should move around as soon as possible after having been confined to a bed, such as after surgery, illness or injury.

Health Factors
You have control over a number of health factors that can increase your risk of DVT, such as obesity, smoking, taking birth control pills and dehydration.

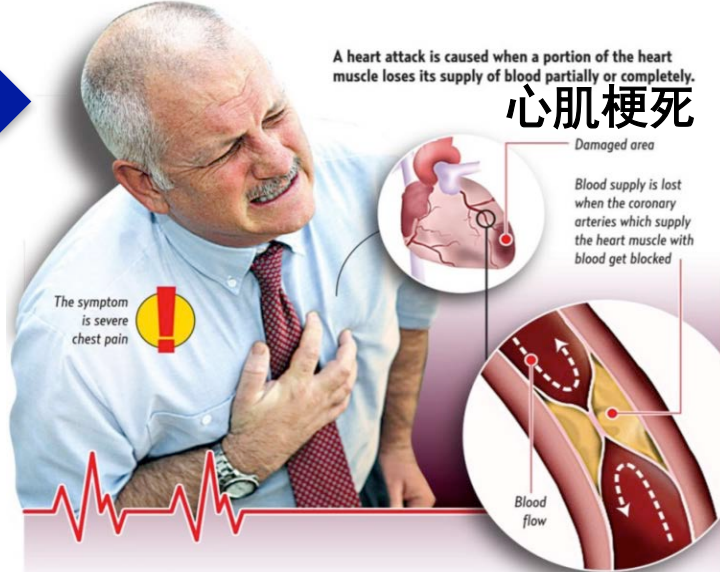
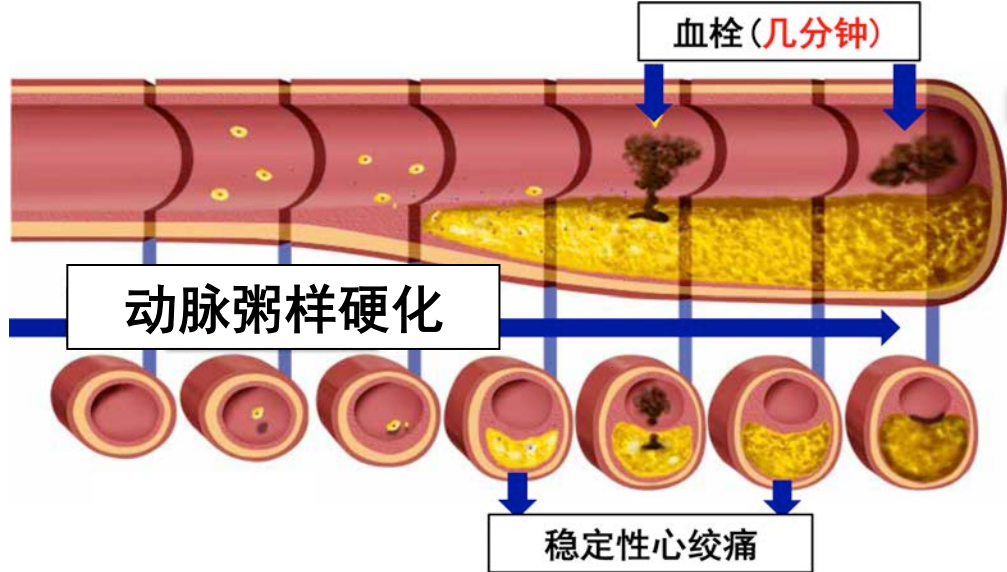
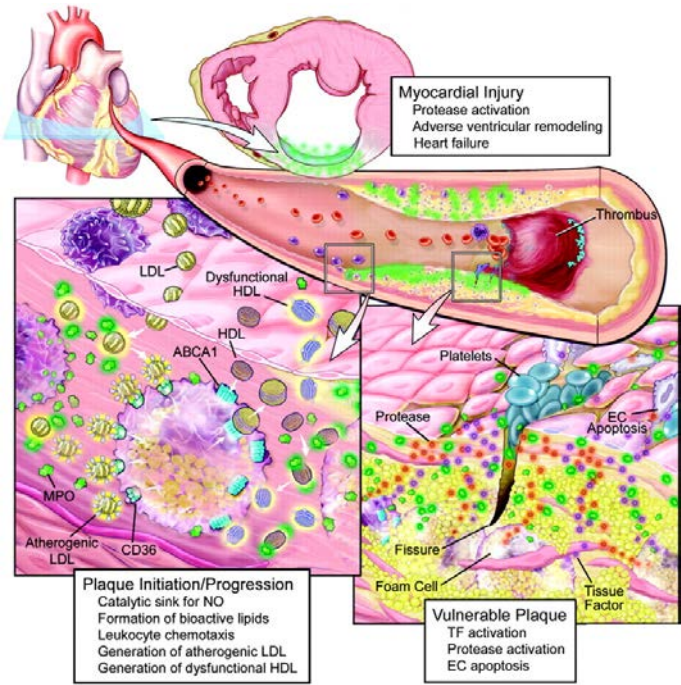
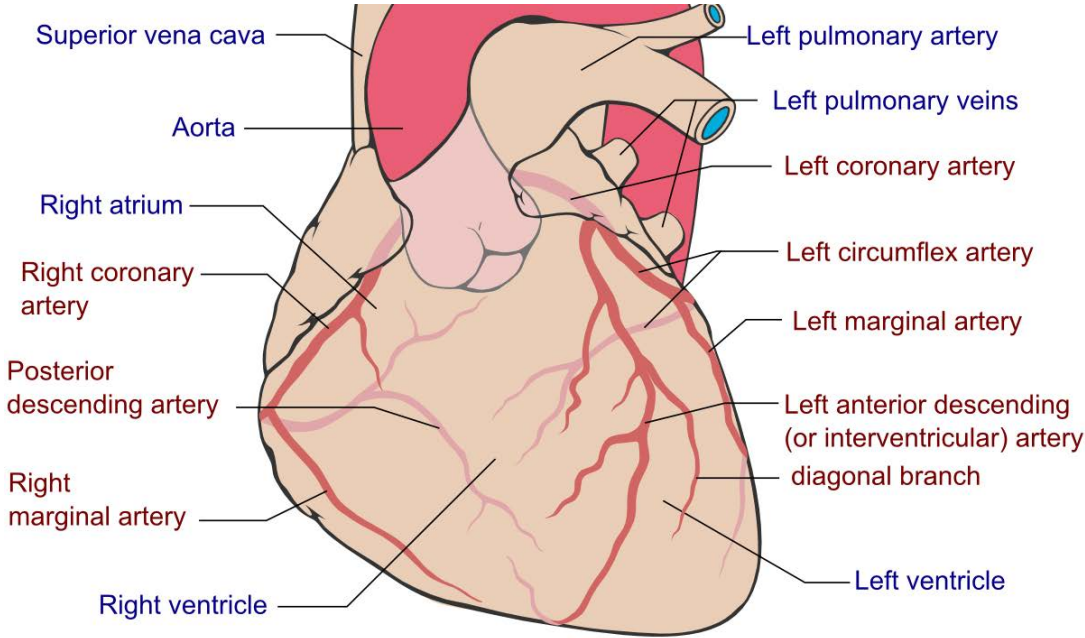
Deep Vein Thrombosis (DVT)



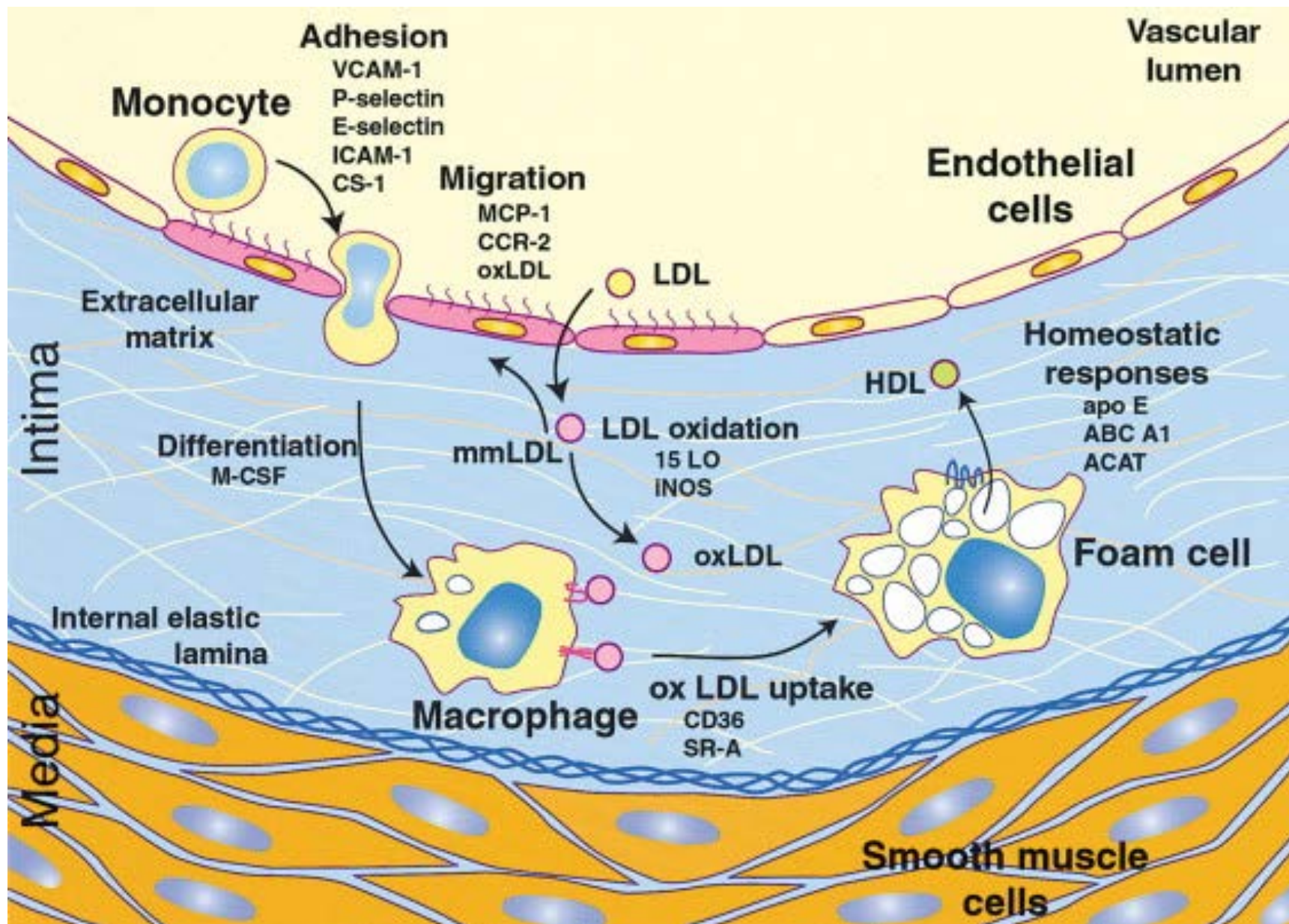
凝血系统激活



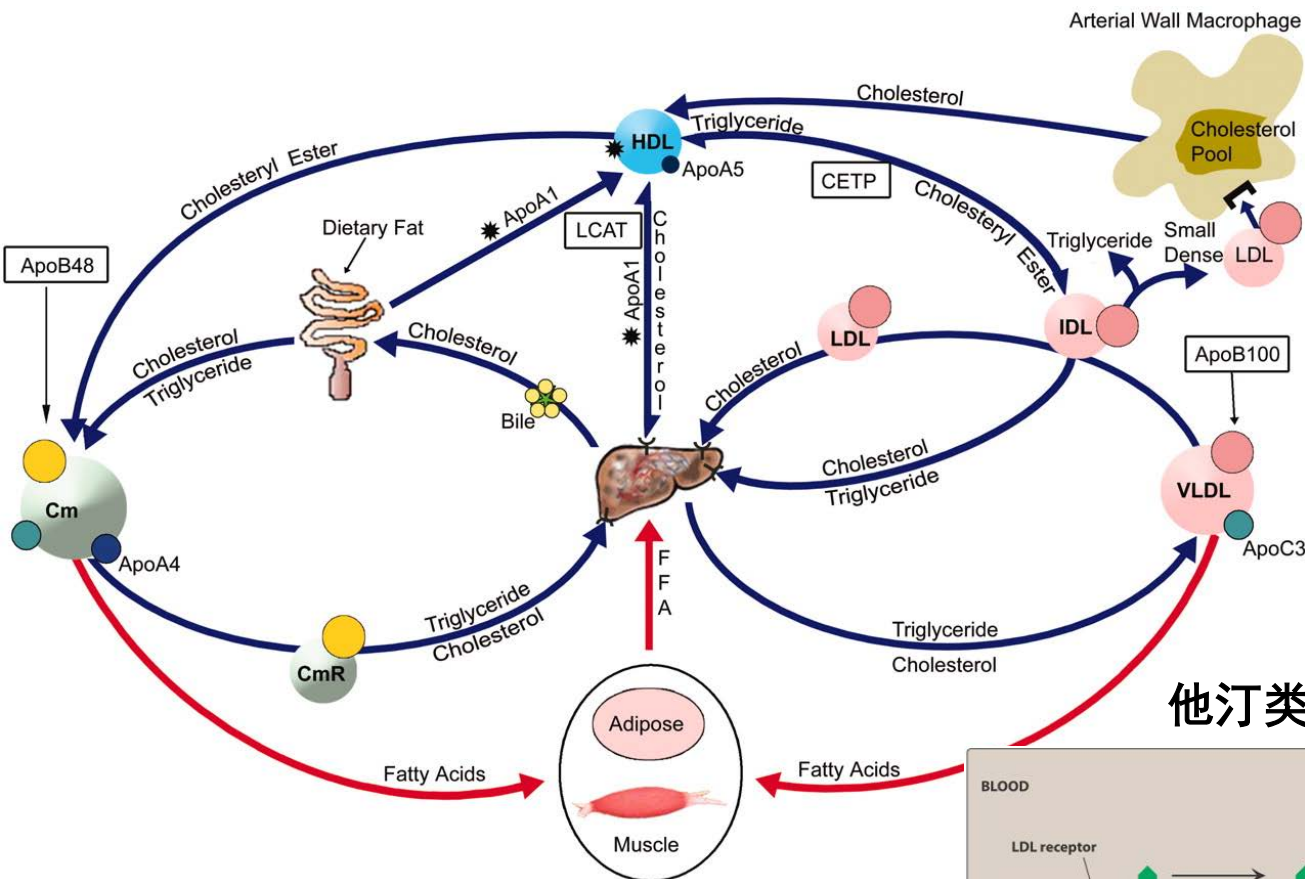
12、冠脉循环和冠心病



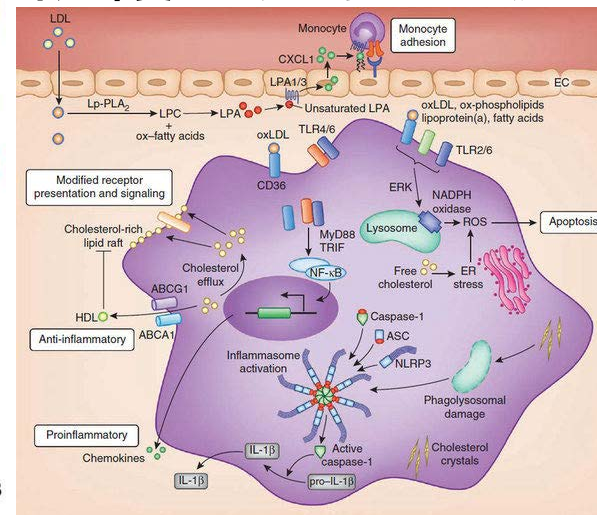
动脉粥样硬化发生



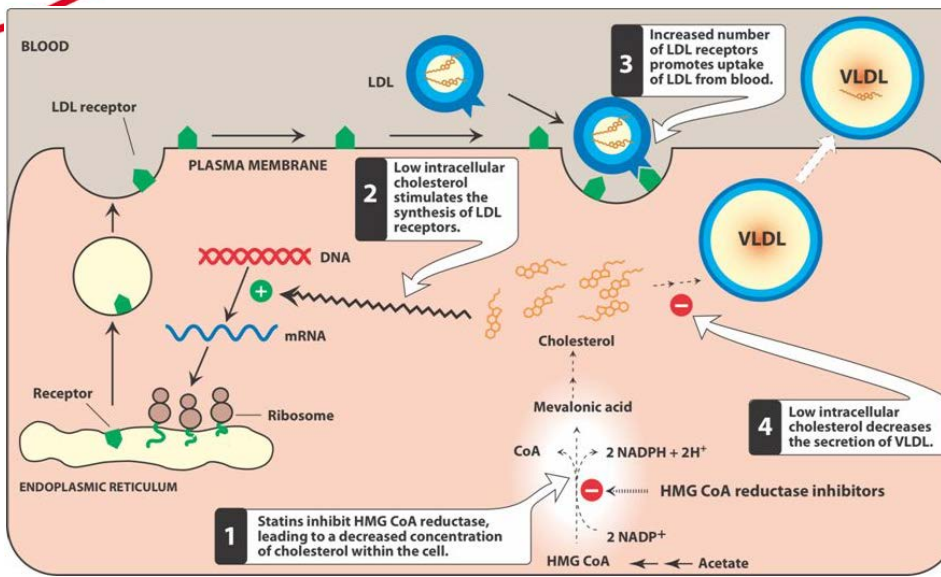
高脂血症与动脉粥样硬化



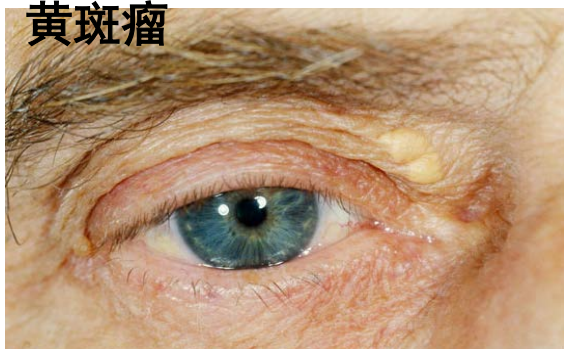
低密度脂蛋白与巨噬细胞



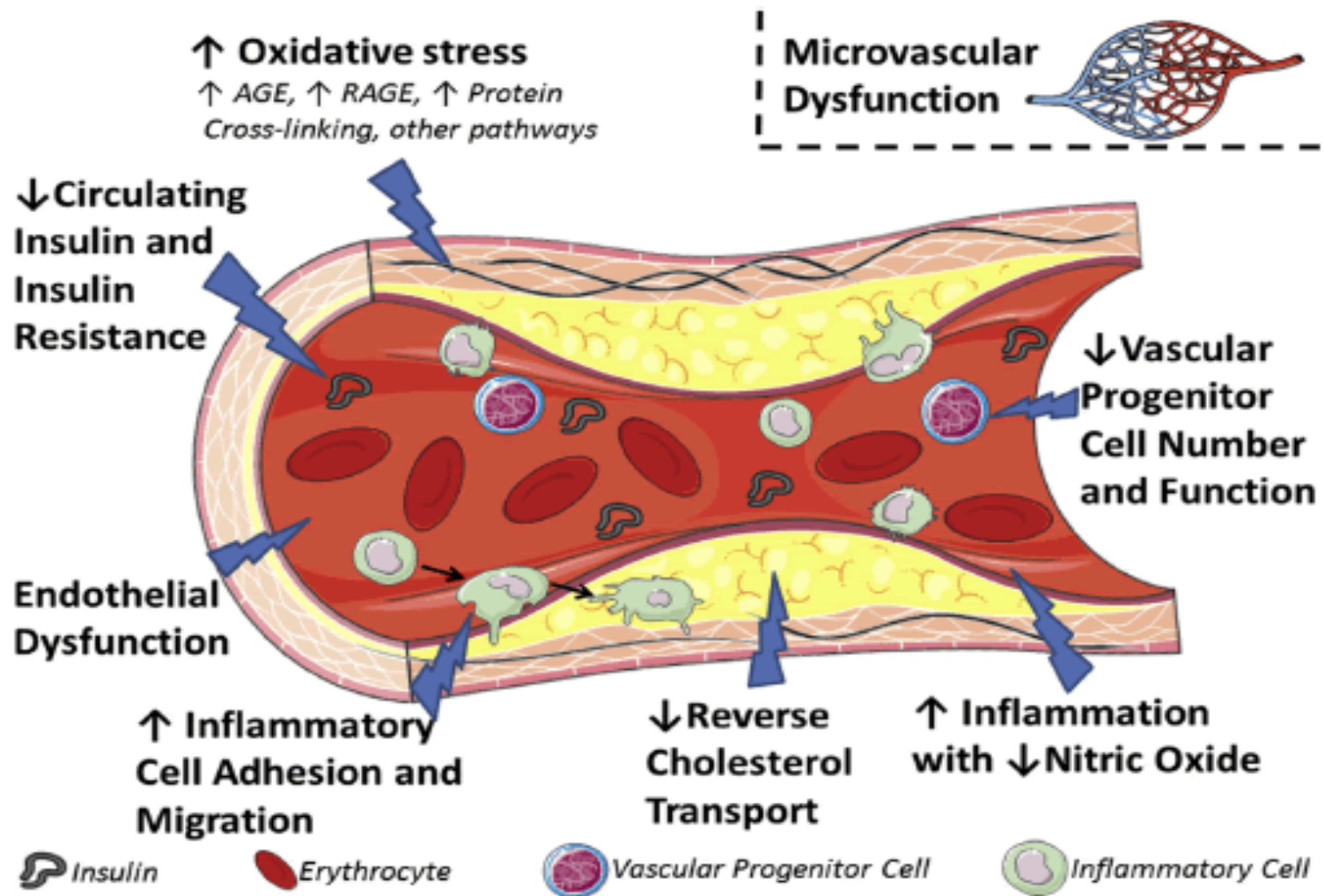
他汀类药物作用机制



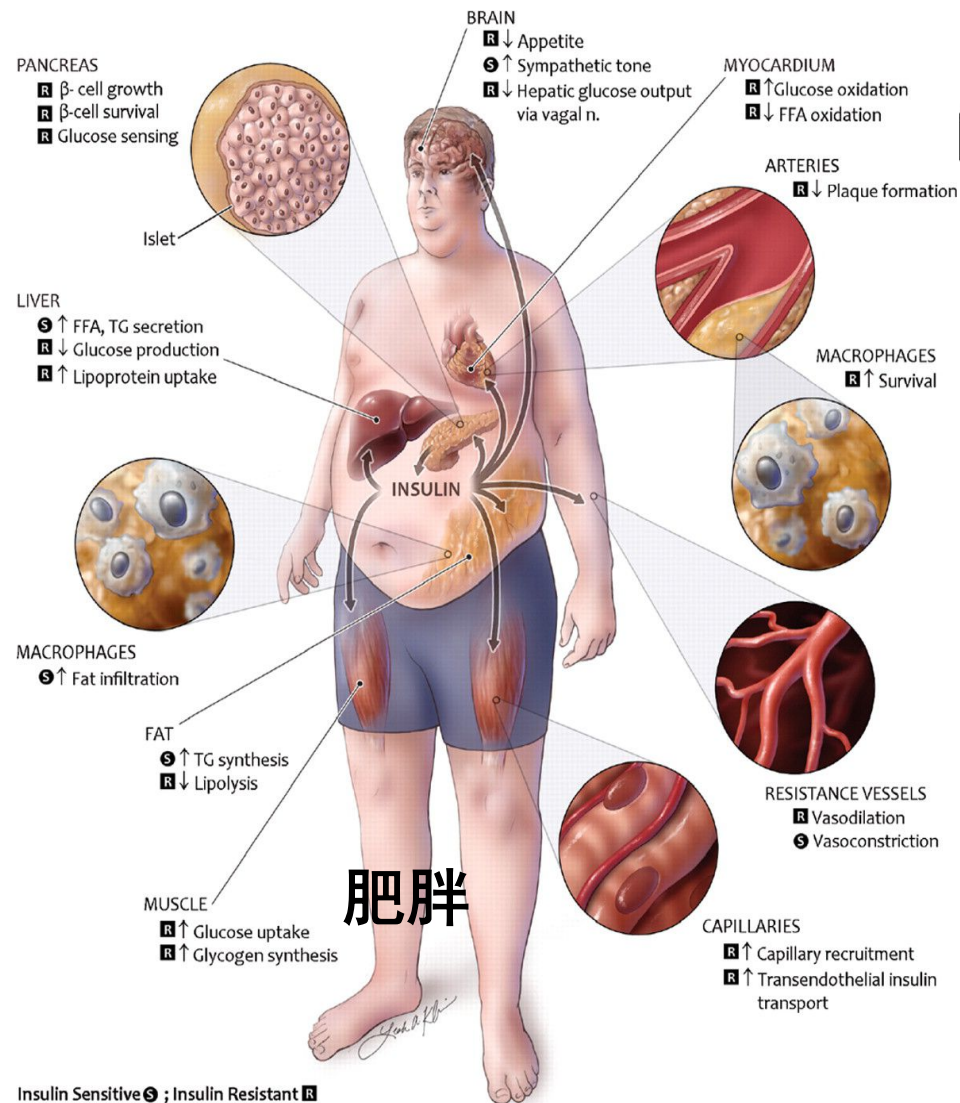
黄斑瘤



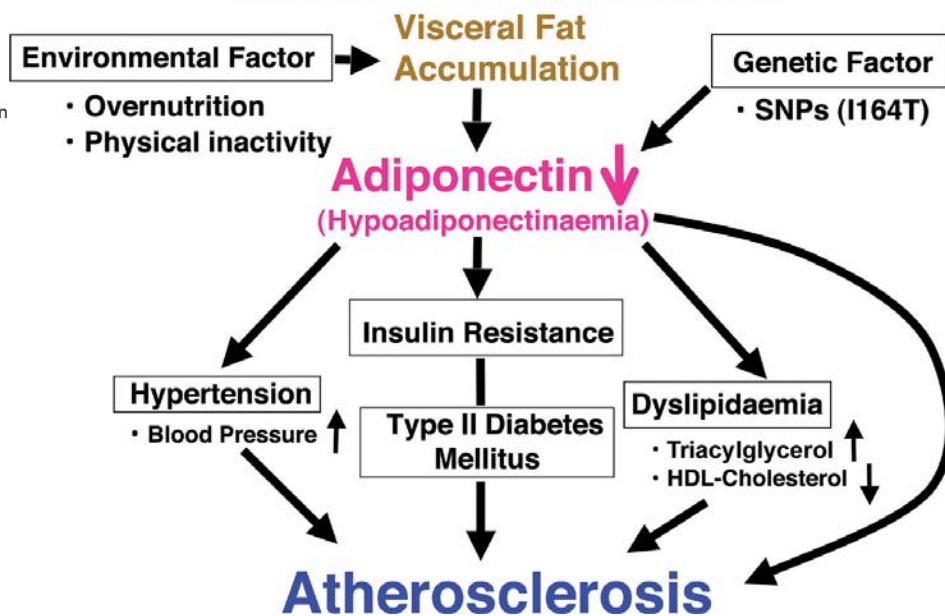
糖尿病与动脉粥样硬化



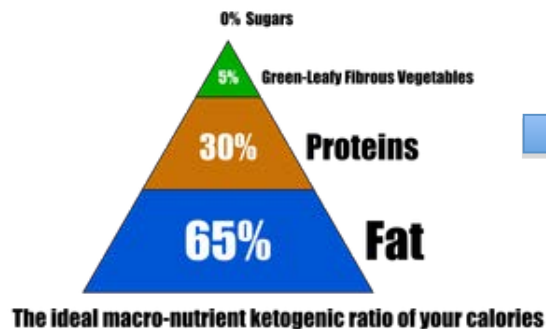
代谢综合征与动脉粥样硬化



Metabolic Syndrome

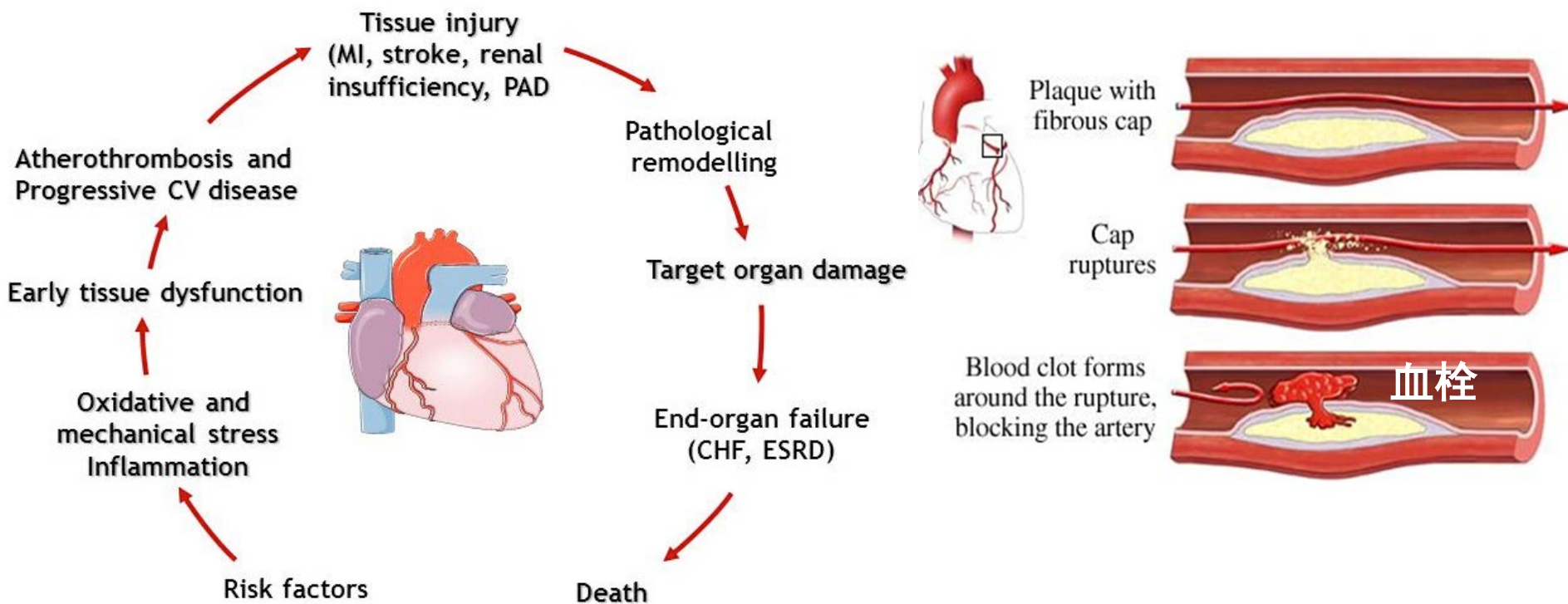


Keto Food Pyramid



减肥?

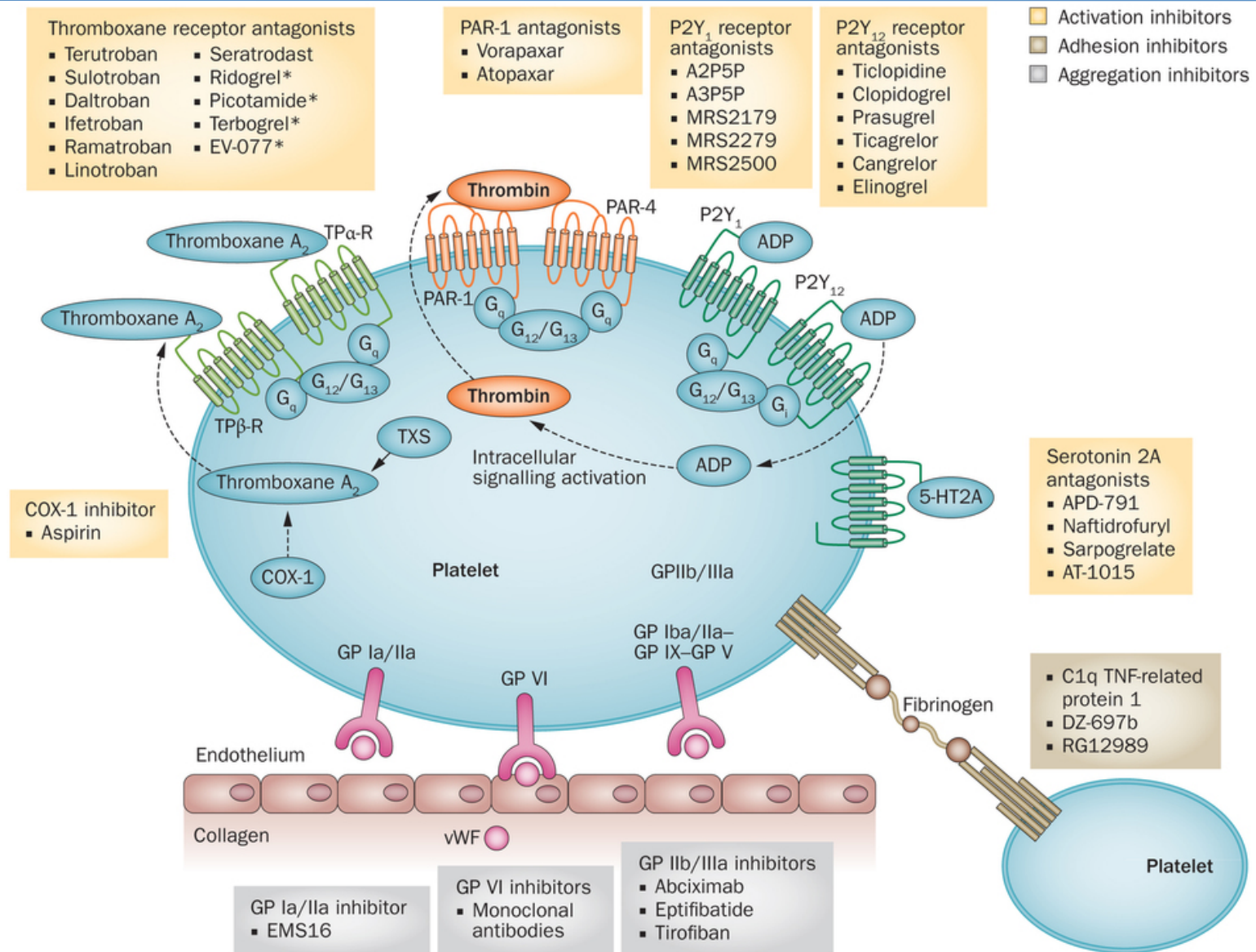
13、血栓是心肌梗死发生的关键



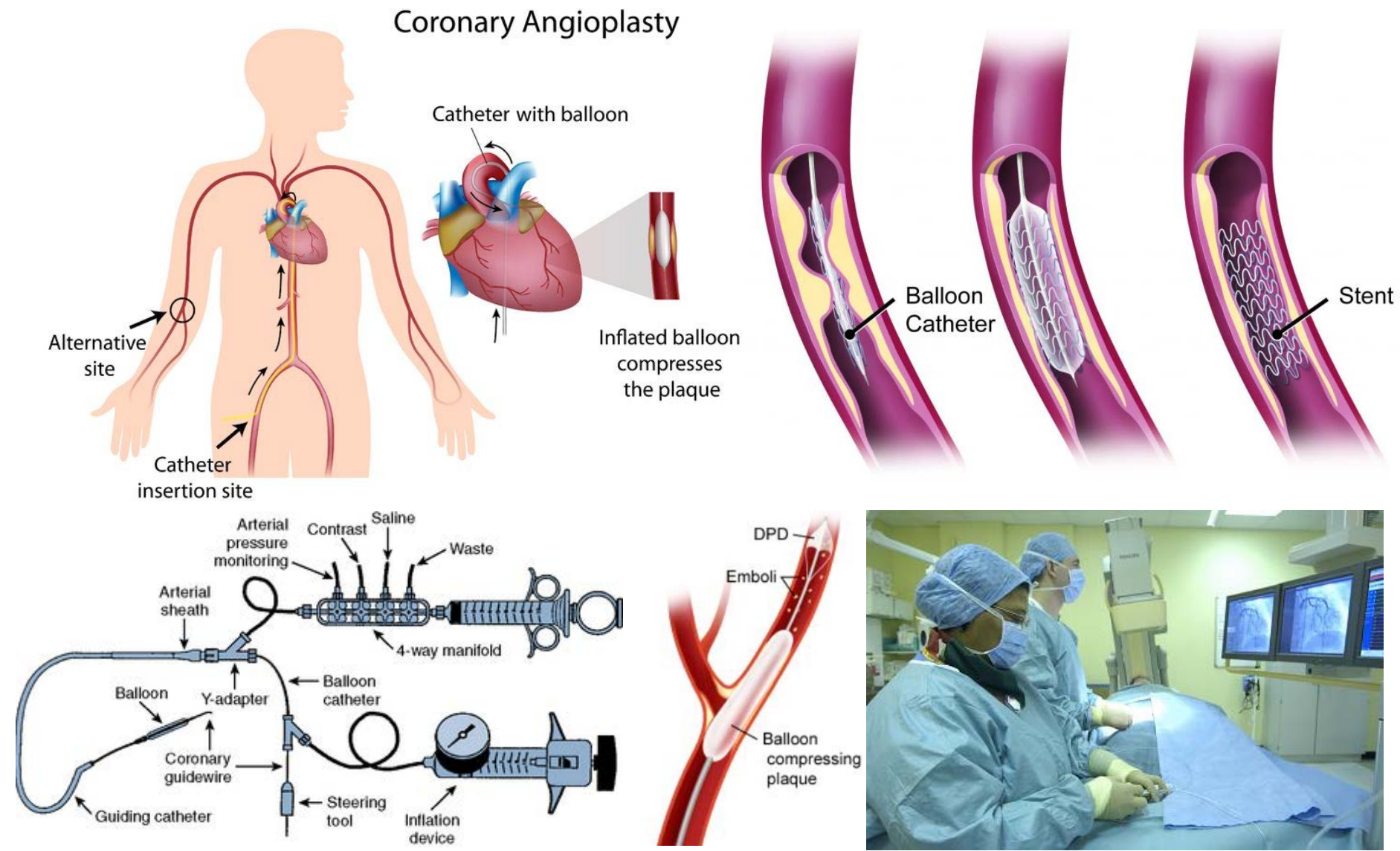
幼年既有发生，每增加10岁，动脉粥样硬化阳性率增加一倍，70岁以上100%

不稳定斑块形成和斑块破裂形成血栓是关键

冠心病治疗-常用抗血小板药物

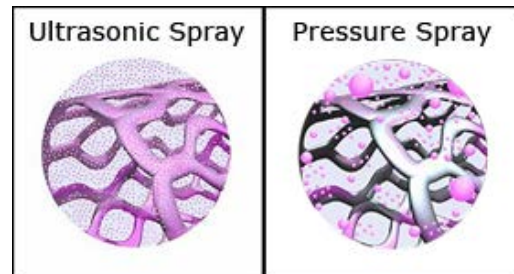
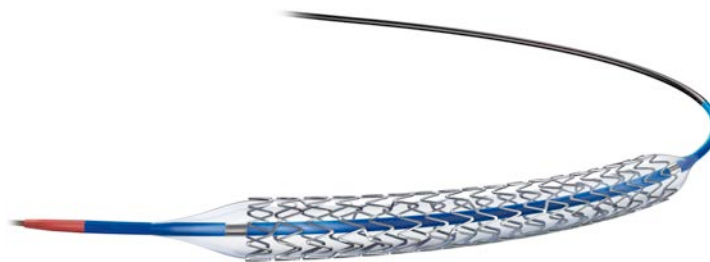


14、经皮冠状动脉介入治疗（percutaneous coronary intervention）



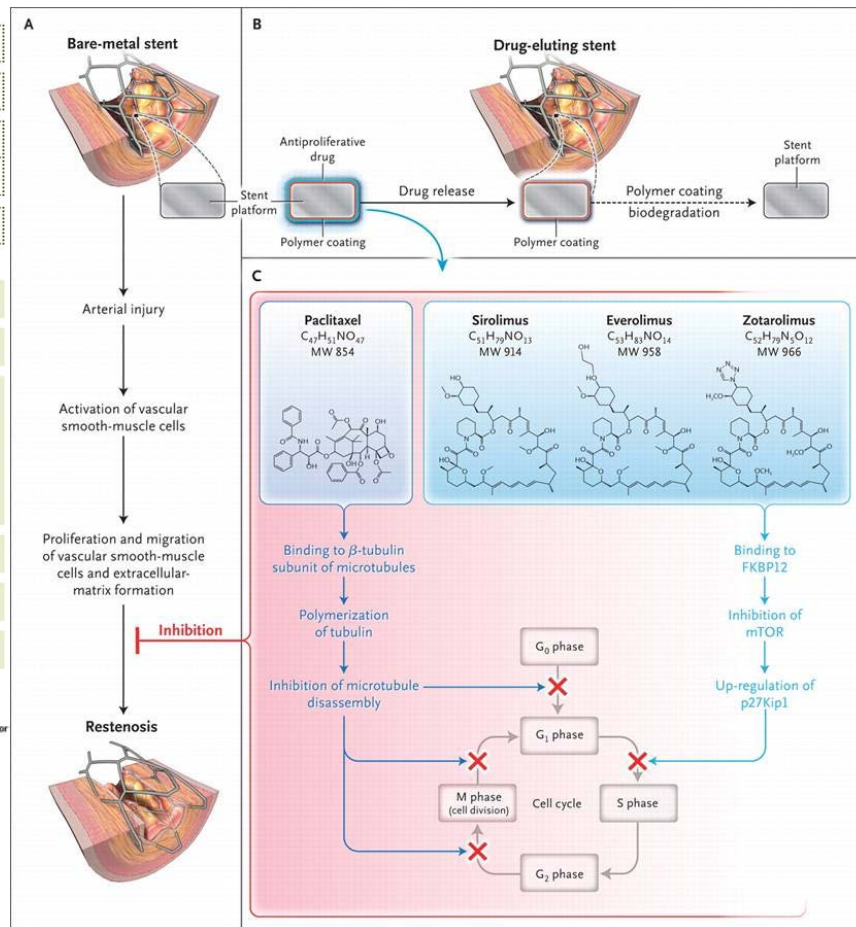
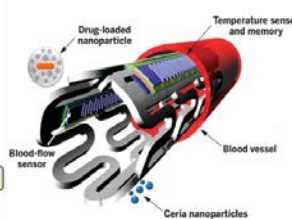
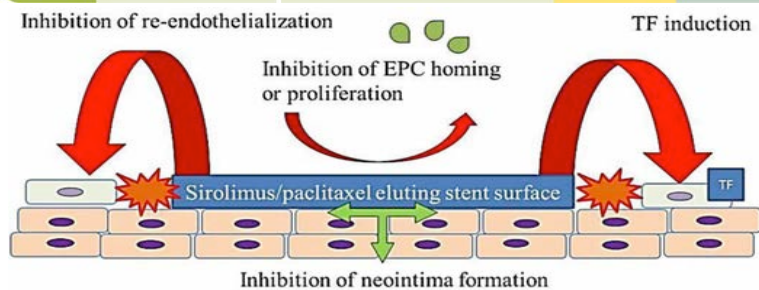
2016年度，中国大陆冠心病介入治疗（PCI）总病例数达到666495例

冠脉支架类型

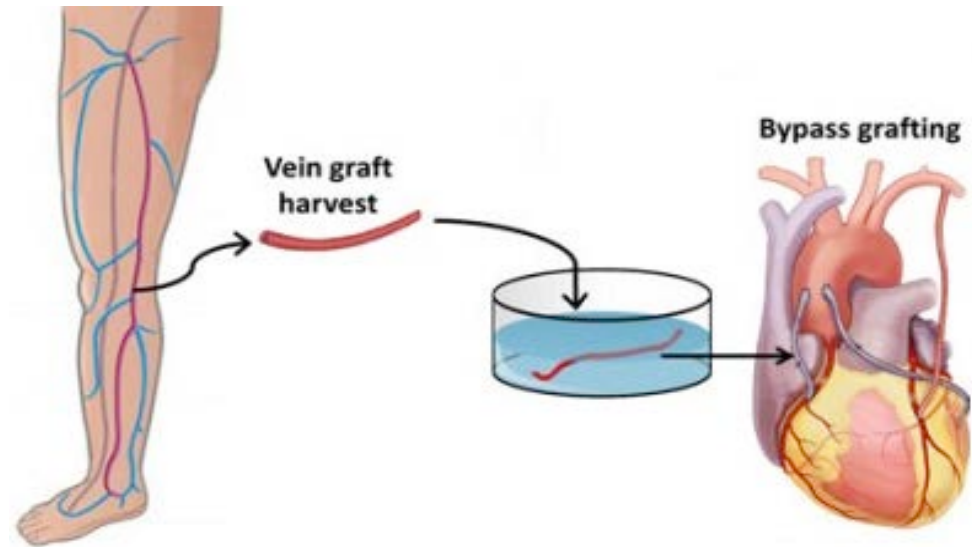
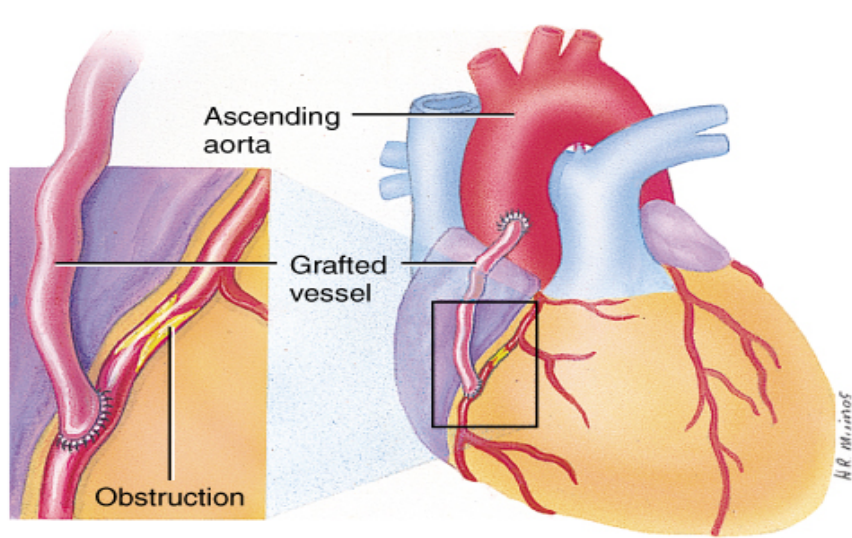


US FDA approval	Stent	Manufacturer	Generation	Type of stent: Platform	Drug eluted
2000	Bx Velocity	Cordis, Bridgewater, NJ	First	BMS: 316L Stainless steel	N/A
2002	Liberté → VeriFLEX*	Boston Scientific, Natick, MA	First	BMS: 316L Stainless steel	N/A
2003	Vision	Guidant/Abbott, Indianapolis, IN	Second	BMS: Cobalt chromium	N/A
2003	Driver/Integrity	Medtronic, Minneapolis, MN	Second	BMS: Cobalt chromium	N/A
Trials underway	Omega	Boston Scientific, Natick, MA	Third	BMS: Platinum chromium	N/A

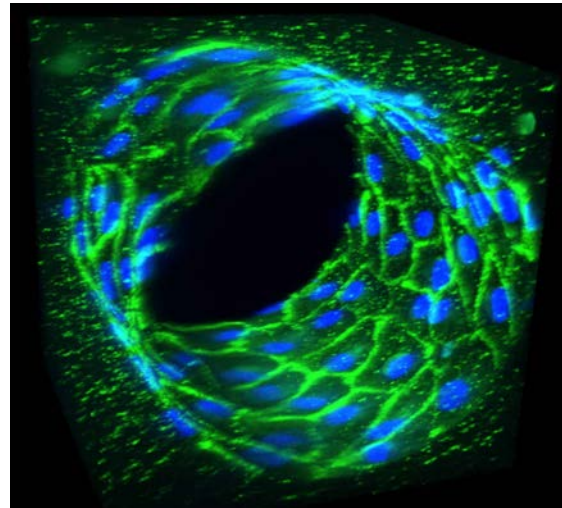
2003 [†]	Cypher	Cordis, Bridgewater, NJ	First	DES: 316L Stainless steel	Sirolimus
2004	Taxus Express	Boston Scientific, Natick, MA	First	DES: 316L Stainless steel	Paclitaxel
2008	Taxus Liberté	Boston Scientific, Natick, MA	First	DES: 316L Stainless steel	Paclitaxel
2008	Endeavor	Medtronic, Minneapolis, MN	Second	DES: Cobalt chromium	Zotarolimus
2008	Xience V/Prime	Guidant/Abbott, Indianapolis, IN	Second	DES: Cobalt chromium	Everolimus
2008	Promus	Boston Scientific, Natick, MA	Second	DES: Cobalt chromium	Everolimus
2011	Promus Element	Boston Scientific, Natick, MA	Third	DES: Platinum chromium	Everolimus
2012	Taxus Element	Boston Scientific, Natick, MA	Third	DES: Platinum chromium	Paclitaxel
2013	Resolute Integrity	Medtronic, Minneapolis, MN	Third	DES: Cobalt chromium	Zotarolimus



15、冠脉搭桥

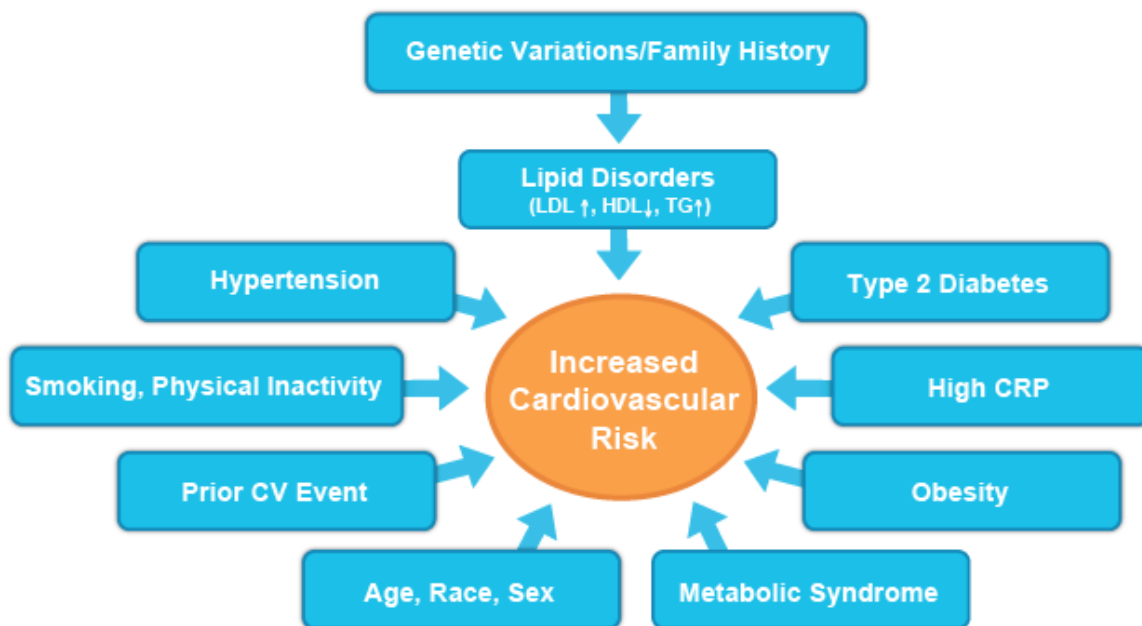


人造血管

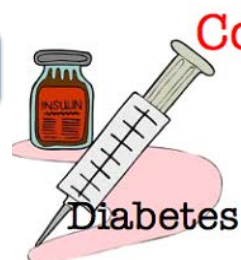
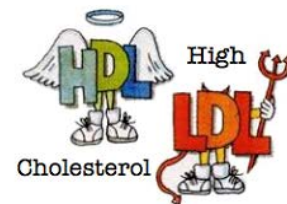


三、心血管疾病预防和急救常识

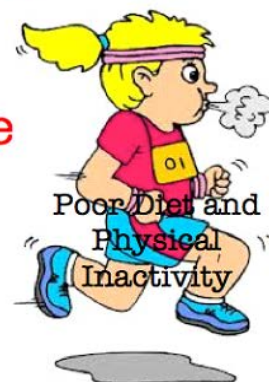
1、心血管疾病的危险因素



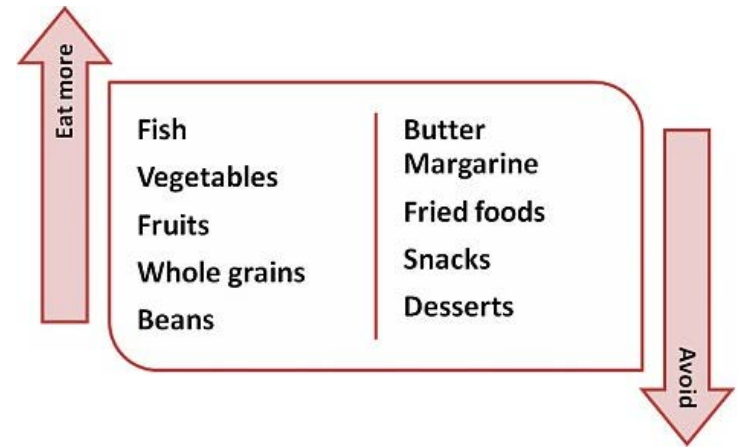
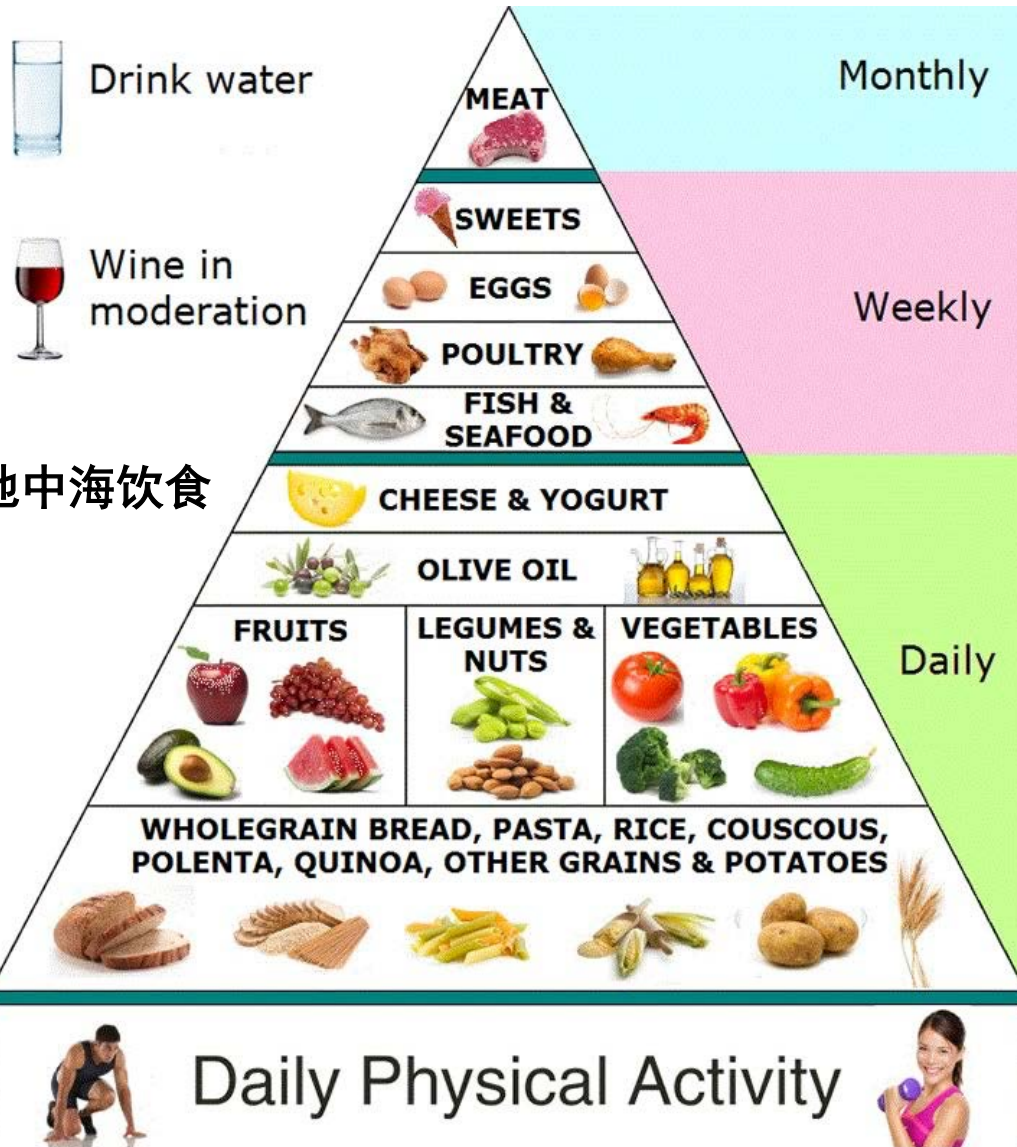
RISK FACTORS FOR HEART DISEASE



**Controllable
Risk
Factors**



2、饮食与心血管健康



3、职业与心血管健康

- 1. 久坐型工作。**工作需要长时间久坐的人群心脏病危险大。久坐会导致胰岛素敏感度降低，多种分解脂肪的酶水平下降。应经常起身或走动，或者站立工作。
- 2. 警察和消防队员。**在工作岗位上因心脏病发作而去世的警察和消防队员的比例分别高达22%和45%，其他工作岗位因心脏病去世的比例为15%。
- 3. 公交司机。**公交司机肯定是长时间坐着工作，而且精神高度集中，司机高血压的比例高达56%。
- 4. 倒班员工。**医生、护士、车间生产工人都属于倒班员工。倒班影响人体的生物钟节奏，生物钟则是人体调节血糖含量和血压的关键机制。
- 5. 酒吧服务员。**虽然已制定了餐厅和酒吧禁烟的规定，可往往执行不严格，服务人员经常被迫吸到顾客的二手烟，二手烟增加心脏病风险。
- 6. 桥梁隧道工人。**桥梁隧道建筑工人患心脏病的风险比普通人高出35%。因为建筑工人往往在密闭通道中工作，会吸入更多一氧化碳。
- 7. 流水线工人。**流水线的工作员工承受着巨大的工作压力，又无法控制生产线上其他领域工作，只能埋头做自己的事。不能掌控自己的环境是诱发心血管疾病的重要压力因素。
- 8. 长期超时加班工作。**每天工作11个小时乃至更长时间的人，相对于每天只工作七八个小时的人罹患冠心病的风险要高出67%。
- 9. 无健康保险的工作。**没医保的人健康状况普遍较差，特别是心脏健康情况不佳，而如果没医保的成年人一旦拿到医保，其健康水平往往会提升。
- 10. 失业。**失业之后的生存压力要大得多。失业的人本来身体没病，却可能在失业一两年之后出现新毛病，比如高血压、糖尿病和心脏病等。

4、生物钟与心血管健康

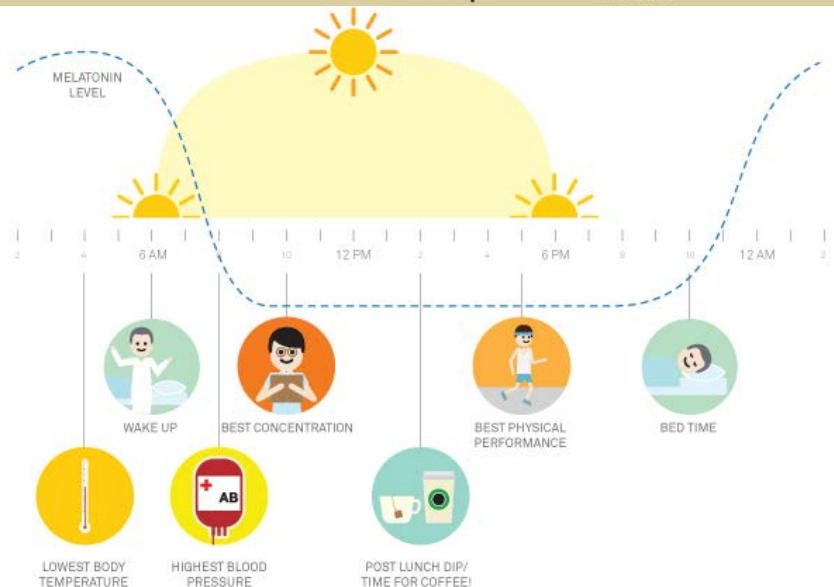
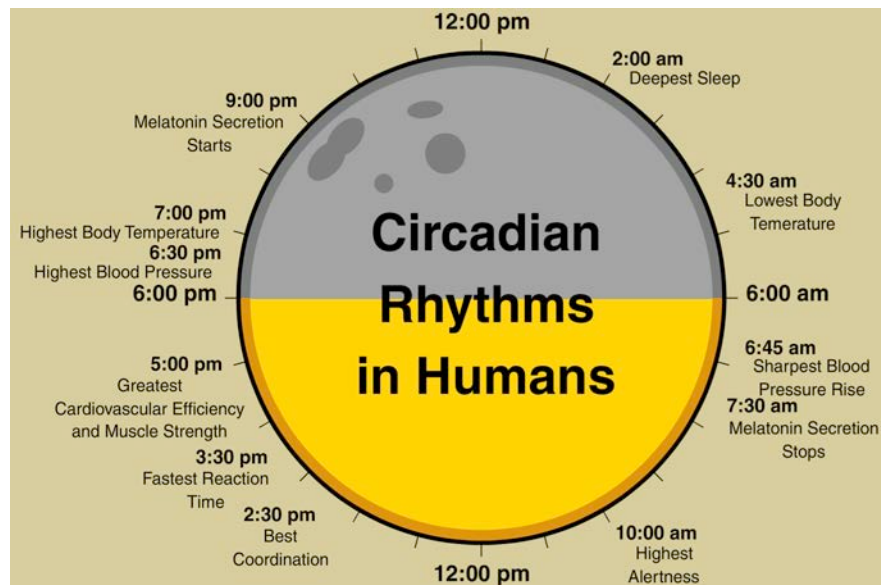
凌晨时分：脑中风、心梗高发。体内缺乏水分，血液浓缩，血液黏稠度增强，易血栓。清晨起床后要喝温开水，排便避免用力，早餐少吃油腻和过咸食品，不做剧烈运动。血压高的人最好此时服降压药，防止血压波动。

9-11am：心脏活动达到顶点，易发生严重心律失常。避免情绪波动，做演说前要服药。

12-3pm：饮食造成血压、血糖波动，尤其是有心血管疾病的老人，血压下降幅度比年轻人大，导致血流减慢，血管淤血，诱发血栓。午餐不宜过饱。饭后打个盹，半个小时最佳。不易过急过快。

3pm以后：适合做些快走、健身、游泳等运动，下午运动对睡眠帮助最大。

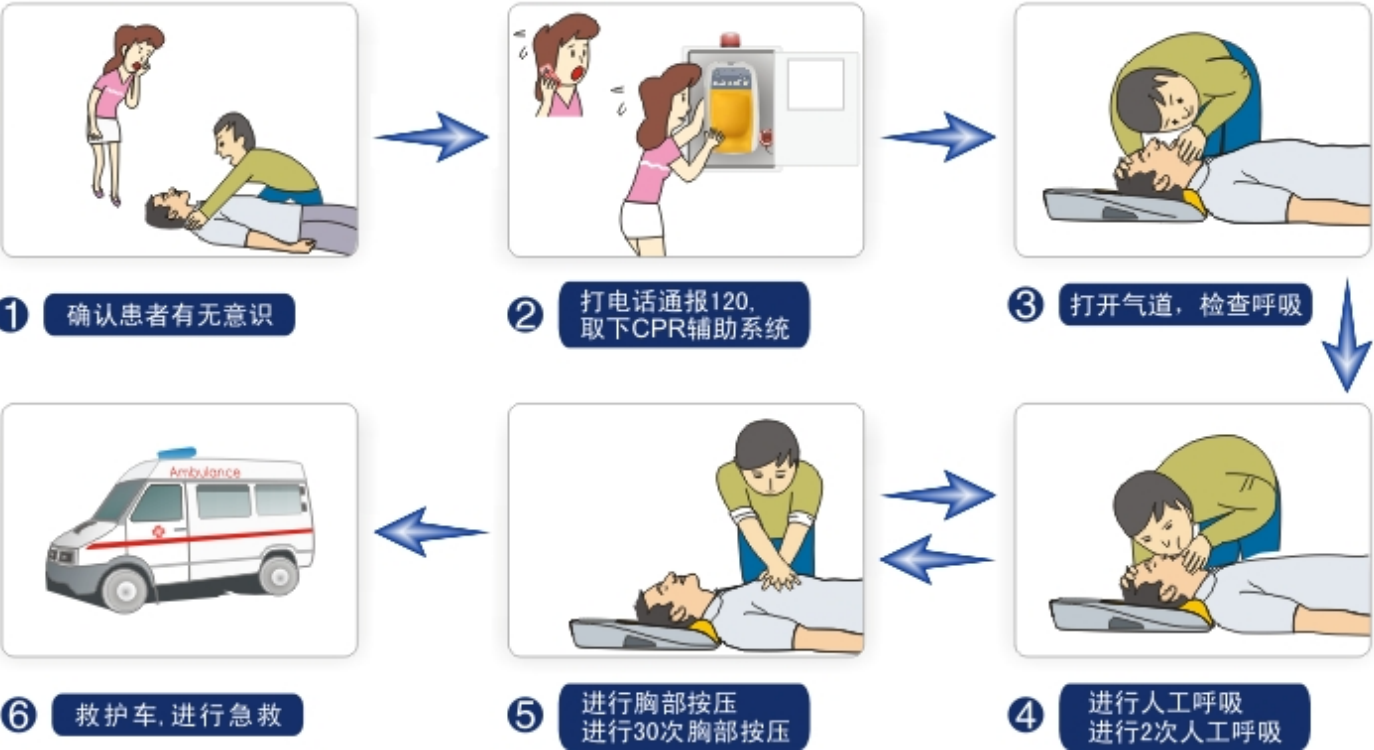
9-11pm：是免疫系统调节的关键时刻，在此时段暴饮暴食、情绪过于激动，时间久了容易患高血压、糖尿病、心脏病等多种疾病。建议：读书，听音乐，完全放松身心，进入睡眠的准备状态。人体肝脏合成胆固醇在晚上最活跃，此时服降脂药效果更好。10pm，身体和大脑容易进入疲劳状态，使人快速入睡。



5、心源性猝死急救常识-心肺复苏术(Cardio-Pulmonary Resuscitation)



- 中国心跳骤停急救成功率不到1%，而发达国家存活率达到60%
- 4~6分钟的急救“黄金时间”
- 100次以上/分钟
- 按压胸部和人工呼吸的比率为30：2
- 胸外心脏按压使胸骨下陷至少5厘米



HOW AN AED WORKS

AEDs—automated external defibrillators—are simple to use, providing computerized voice prompts that allow nonmedical people with a few hours of training to use them.

1 Place the two electrodes on the victim's chest. One between the right nipple and the right collar bone, the other between the left nipple and the left arm pit.

2 The AED searches for a heartbeat. If there is not one, it will advise through a computerized voice that a shock is not appropriate.

3 If there is some rhythm or ventricular fibrillation, the AED will advise for an electric shock.

4 The AED warns people to stand clear. Pushing the SHOCK button sets off a siren and the AED sends an electrical shock to the victim's chest.

Automated external defibrillator not drawn to scale.

Source: American Heart Association

FRED FLUKER/Detroit Free Press

谢 谢 !

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021-63846590-776345

liujl@shsmu.edu.cn