
第二十二章 抗心律失常药

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心律失常的概念与类型

▶ 缓慢型心律失常：

如窦性心动过缓，房室传导阻滞等；

▶ 快速型心律失常：

如阵发性室上性心动过速、室性心动过速、心室颤动等。

Cardiac arrhythmias

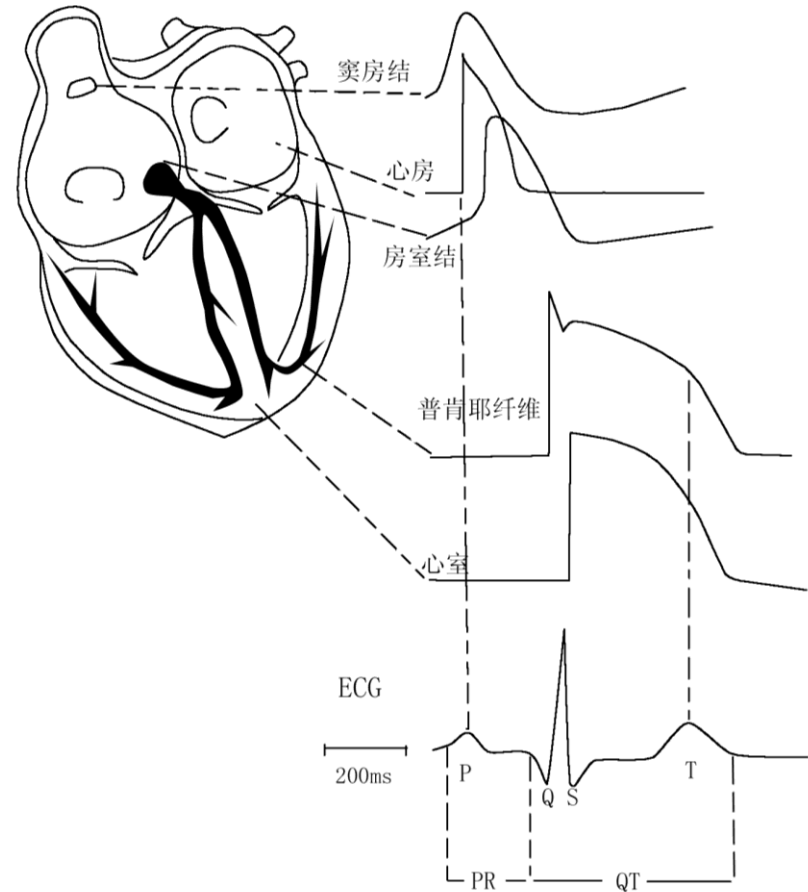
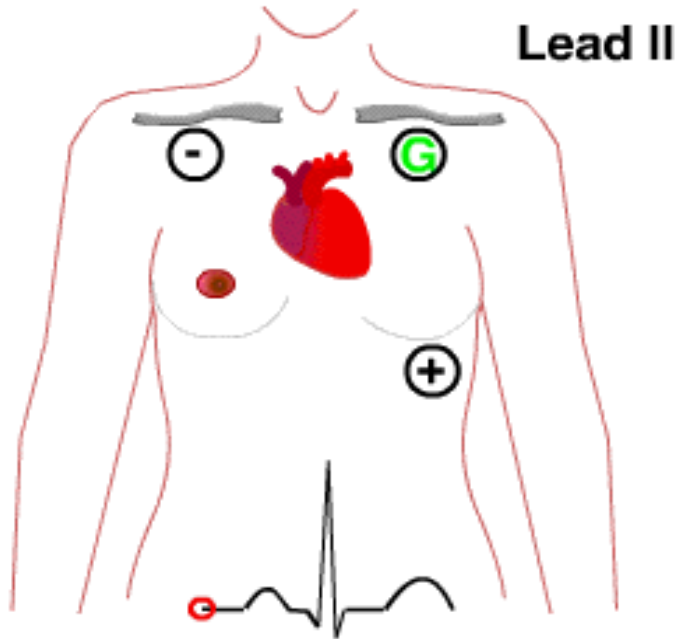
Tachy-cardiac arrhythmias

- Atrial-premature beats**
- Atrial flutter**
- Atrial fibrillation (AF)**
- Ventricular-premature beats (contractions)**
- Ventricular-tachycardia (VT)**
- Ventricular fibrillation (VF)**

Brady-cardiac arrhythmias

- Bundle branch blocks**
 - Sinus bradycardia (Sick Sinus Syndrome)**
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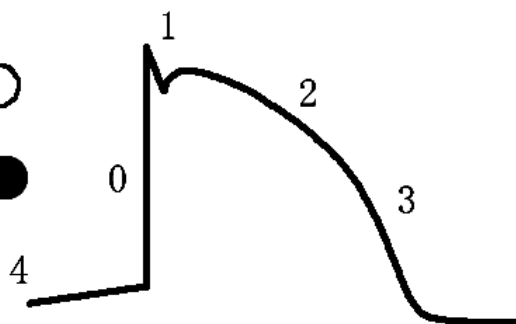
正常心脏电生理学基础



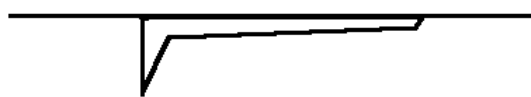
内向电流



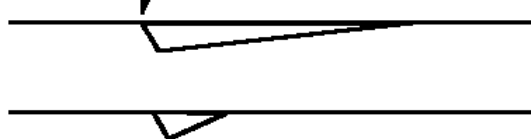
外向电流



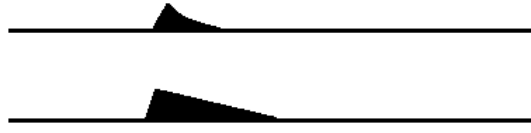
I_{Na}



I_{Ca} { $I_{Ca(L)}$
 $I_{Ca(T)}$



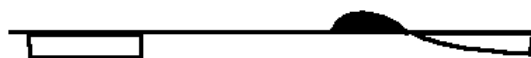
I_{to} { I_{to1}
 I_{to2}



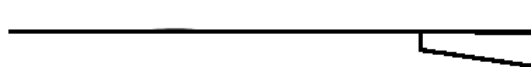
I_K { I_{Ks}
 I_{Kr}
 I_{Kur}



I_{K1}



I_f

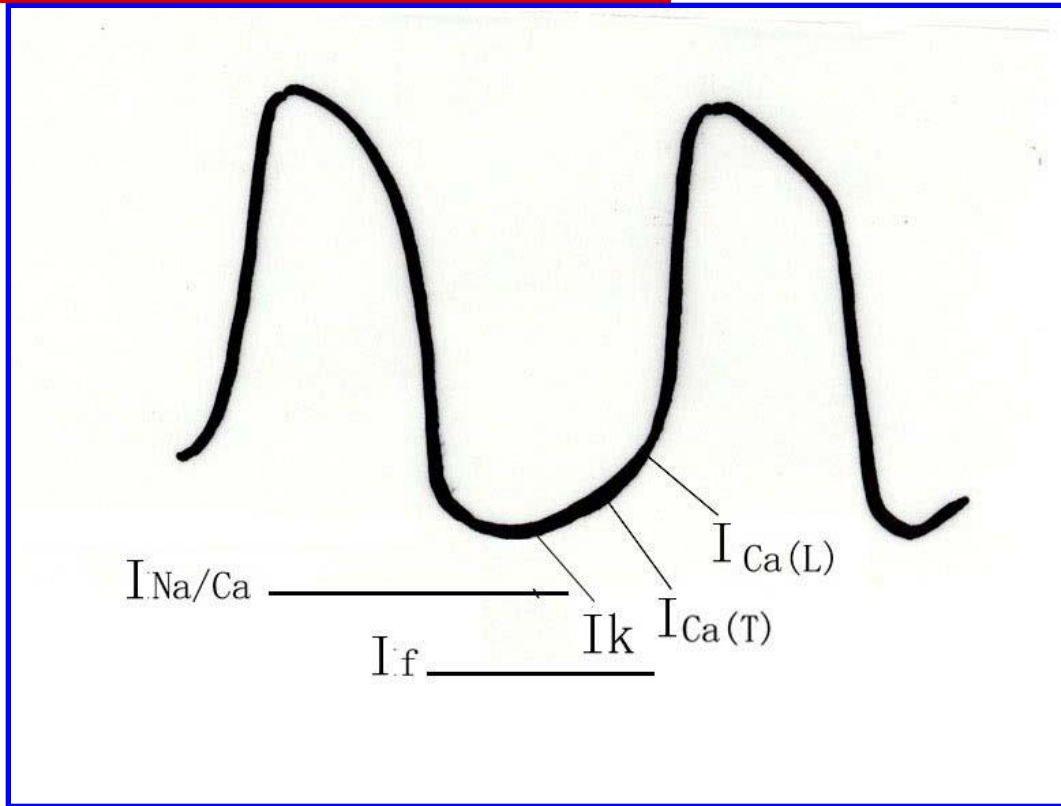


Na/Ca exchange



【快反应细胞】 快反应细胞包括心房肌细胞、心室肌细胞和希-普细胞。其动作电位0相除极由钠电流介导，速度快，振幅大。

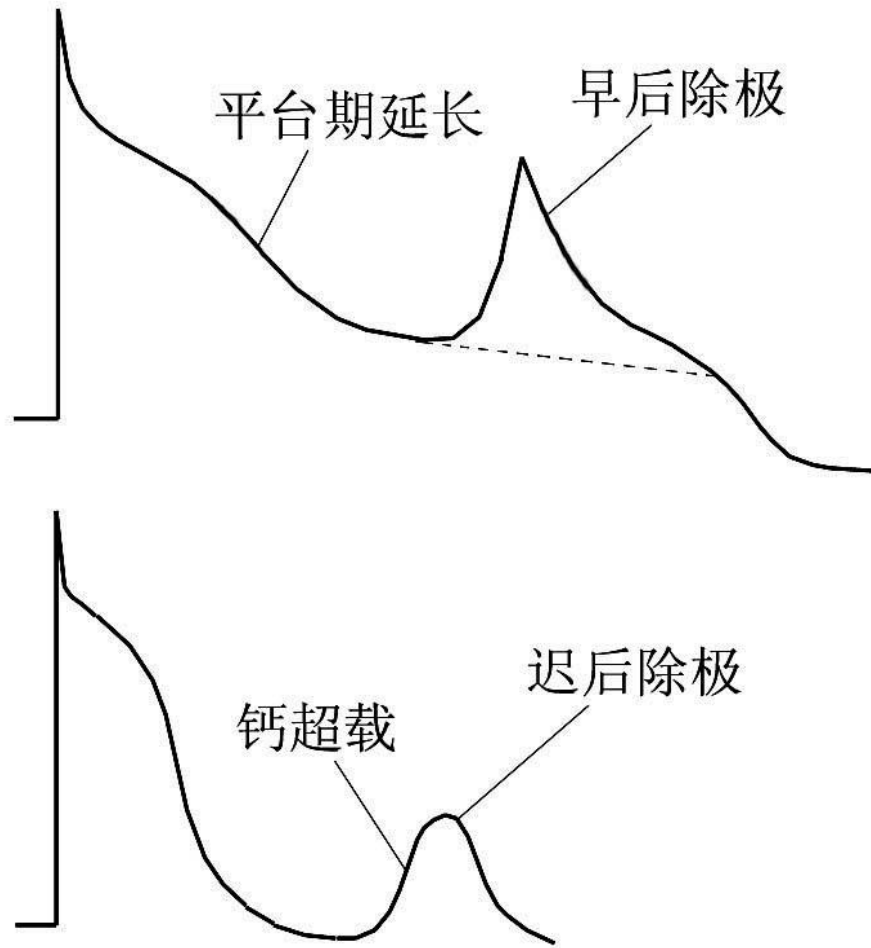
【慢反应细胞】 慢反应细胞包括窦房结和房室结细胞，其动作电位 0相除极由 $I_{Ca}(L)$ 介导，速度慢，振幅小。慢反应细胞无 I_{K1} 钾电流控制静息膜电位，动作电位是内向电流和外向电流相互消长的结果，静息膜电位不稳定，易除极，因此自律性高。



窦房结细胞动作电位时程中的参与电流

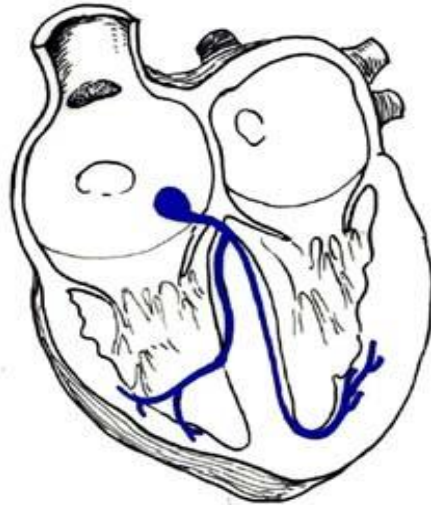
心律失常发生机制

- ▶ 自律性升高
 - ▶ 后除极
 - 早期后除极
 - 延迟后除极
 - ▶ 折返
 - ▶ 基因缺陷
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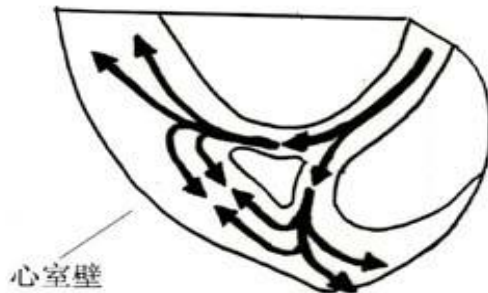


**心肌细胞的早期后除极和
延迟后除极(Two forms of
abnormal activity, early
and delayed after-
depolarizations)**

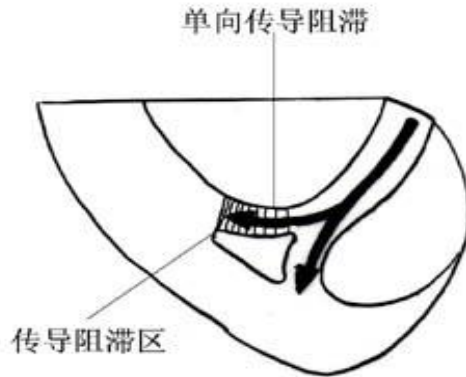
折返形成机制 (Unidirectional block and reentry)



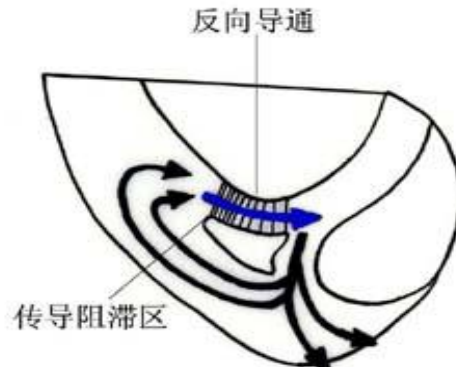
A 心脏传导系统



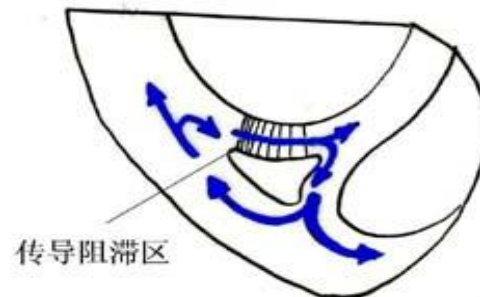
B 正常传导过程



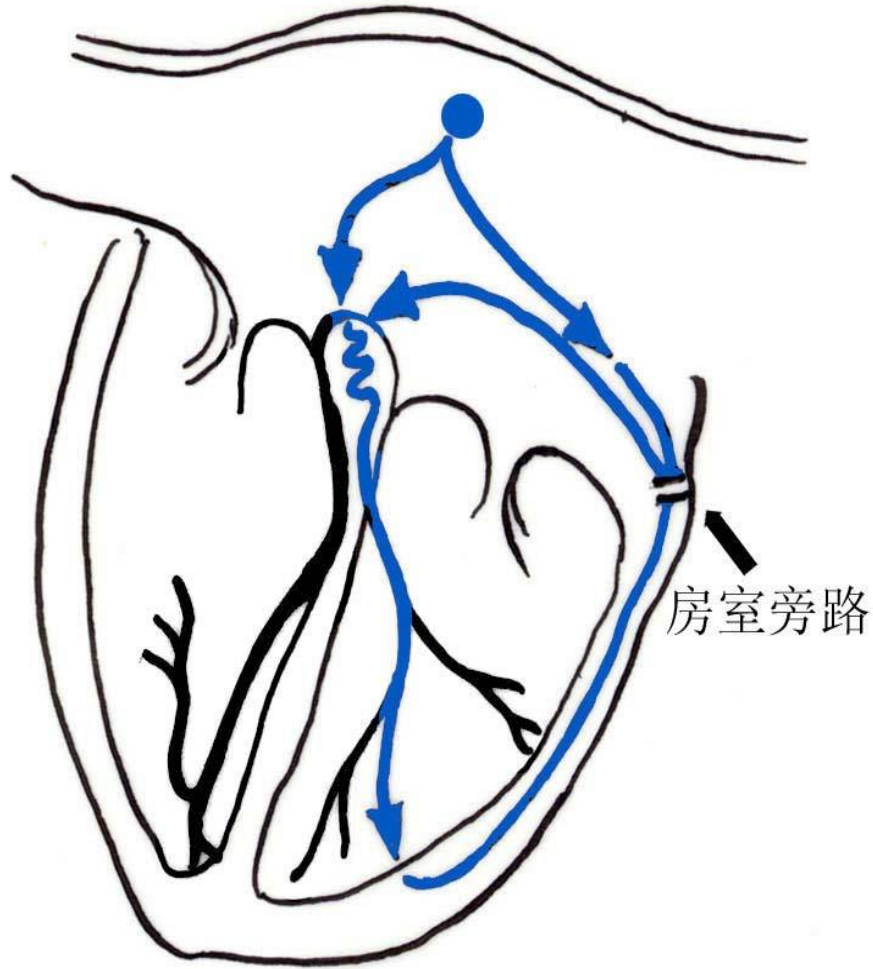
C 传导减慢并发生单向传导阻滞



D 传导阻滞区反向导通



E 折返形成



预激综合征中房室折返环路的形成

Atrioventricular
reentry in the
Wolff-Parkinson-
White syndrome

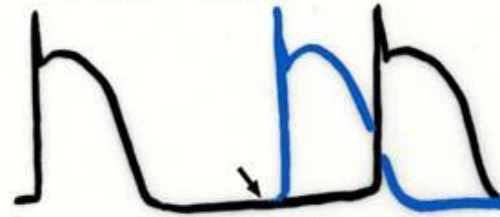
抗心律失常药物作用

- ▶ 降低自律性
 - ▶ 减少后除极
 - ▶ 消除折返
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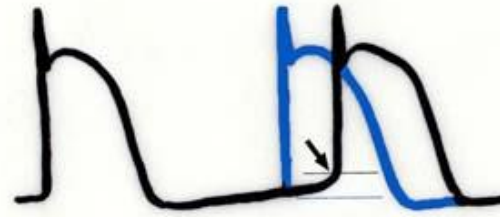
降低自律性的 四种方式

(Four ways to
reduce the
rate of
spontaneous
discharge in
automatic
tissues)

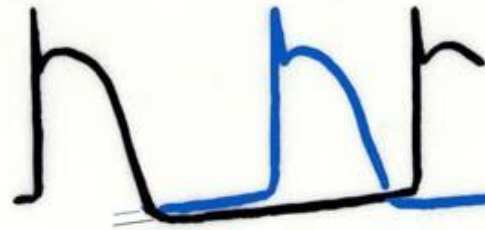
A 降低 4 相斜率



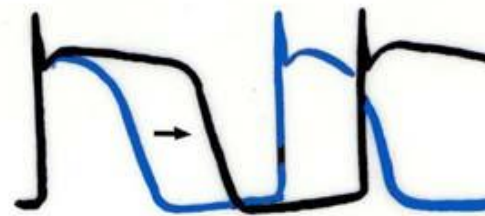
B 提高阈电位



C 增大最大舒张电位



D 延长动作电位时程



— 正常动作电位
— 药物作用

抗心律失常药物分类

Summary of antiarrhythmic drugs

Class	Drug example	Actions	Uses
Ia	Quinidine, Procainamide	Block of I_{Na} , I_K , and I_{Ca} , \uparrow ADP, \uparrow ERP, \downarrow Velocity, \downarrow Contractility	VT, AF
Ib	Lidocaine, Mexiletine	Block of I_{Na} (fast dissociation), \uparrow ERP	VP
Ic	Flecainide, Encainide	Block of I_{Na} (slow dissociation), \downarrow Velocity, \downarrow Contractility	VT
II	Propranolol, Metoprolol	Block of β -adrenoceptor \downarrow Contractility	AT, VT
III	Dofetilide, Ibutilide Amiodarone	Block of I_{Kr} , \uparrow ADP Block of I_{Na} (Inac), I_{Kr} , \uparrow ADP	AF, AT
IV	Verapamil, Diltiazem	Block of Ca^{2+} channels \downarrow APD, \downarrow A-V velocity	AF flutter