Action Potentials in Cardiac Muscle

Excitation-Contraction Coupling—Function of Calcium Ions and the *Transverse Tubules*

Duration of Contraction

Cardiac Cycle

## Diastole (The Atria Function as Primer Pumps for the Ventricles)

and

Systole

Function of the Papillary Muscles

Period of Isovolumic (Isometric) Contraction.

Period of Ejection. the *period of rapid ejection,*and the last two thirds are called the *period of slow ejection.*

Period of Isovolumic (Isometric) Relaxation

Relationship of the Heart Sounds to Heart Pumping

Increasing Heart Rate Decreases Duration of Cardiac Cycle.

End-Diastolic Volume, End-Systolic Volume, and Stroke Volume Output.

Events of the cardiac cycle for left ventricular function, showing changes in left atrial pressure, left ventricular pressure, aortic pressure,

Work Output of the Heart

*volume-pressure work*or *external work.*

*kinetic energy of blood flow*

Graphical Analysis of Ventricular Pumping

“Volume-Pressure Diagram” During the Cardiac Cycle; Cardiac Work Output.

Concepts of Preload and Afterload

Efficiency of Cardiac Contraction.

Regulation of Heart Pumping

Intrinsic Regulation of Heart Pumping

What Is the Explanation of the Frank-Starling Mech­anism

Ventricular Function Curves

Control of the Heart by the Sympathetic and Parasympathetic Nerves

Effect of Sympathetic or Parasympathetic Stimulation on the Cardiac Function Curve.

Effect of Potassium and Calcium Ions on Heart Function

Increasing the Arterial Pressure Load (Up to a Limit) Does Not Decrease the Cardiac Output

Rhythmical Excitation of the Heart

Sinus (Sinoatrial) Node

Mechanism of Sinus Nodal Rhythmicity.

Internodal and Interatrial Pathways Transmit Cardiac Impulses Through the Atria

The Atrioventricular Node

The Left and Right Bundle Branches.

Spread of the Cardiac Impulse Through the Heart

Role of the Purkinje System in Causing Synchronous Contraction of the Ventricular Muscle

“Ectopic” Pacemaker

Sympathetic and Parasympathetic Nerves Control Heart Rhythmicity and Impulse Conduction by the Cardiac Nerves

Mechanism of the Vagal Effects

Mechanism of the Sympathetic Effect

Characteristics of the Normal Electrocardiogram

## Depolarization Waves Versus Repolarization Waves

Flow of Electrical Currents in the Chest Around the Heart

## Recording Electrical Potentials from a Partially Depolarized Mass of Syncytial Cardiac Muscle

Intervals

Electrocardiographic Leads

Three Bipolar Limb Leads

Einthoven's Triangle

Augmented Unipolar Limb Leads (aVR; aVL; aVF )

Chest Leads (Precordial Leads)