

## 2.2 Basic Mathematical Model of Cardiovascular System

### **Introduction of Mathematical Biology**

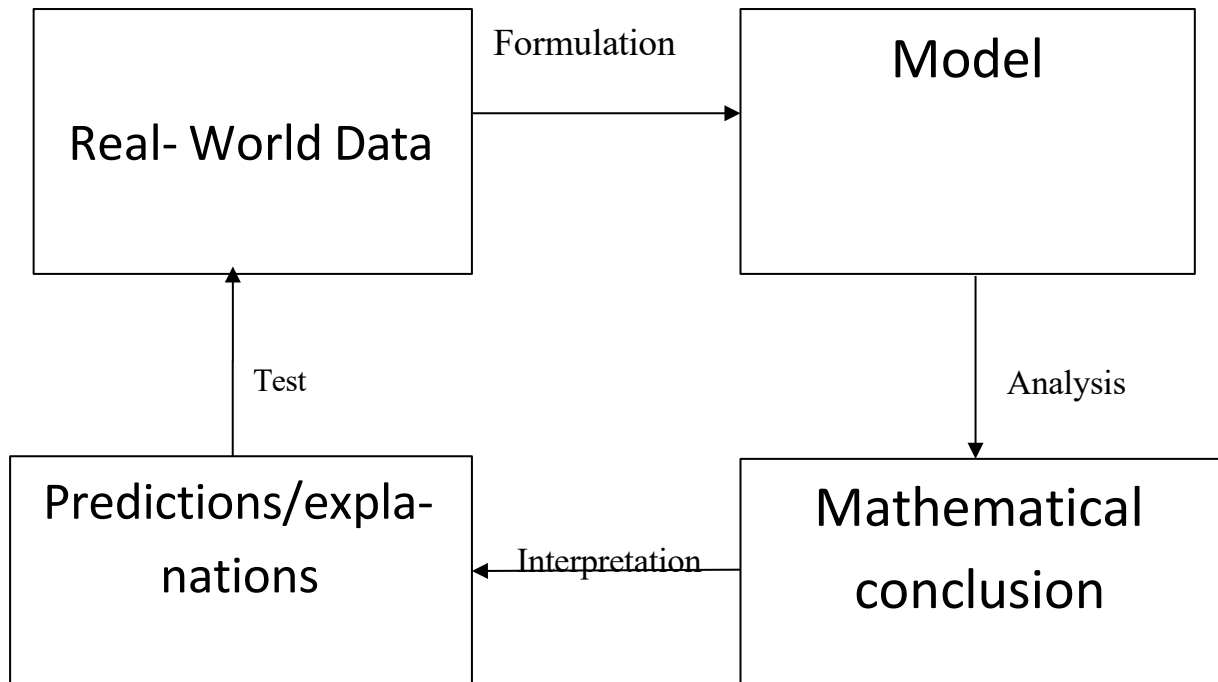
Mathematical biology aims at the mathematical representation and modeling of biological processes, using techniques and tools of applied mathematics. It can be useful in both theoretical and practical research. Describing systems in a quantitative manner means their behavior can be better simulated, and hence properties can be predicted that might not be evident to the experimenter. This requires precise mathematical models .

Mathematical biology is an interdisciplinary field that applies mathematical techniques, modeling, and computational methods to study and understand biological phenomena. It involves using mathematical models to describe and analyze various aspects of living organisms, from the cellular level to ecosystems. Mathematical biologists aim to gain insights into complex biological processes, predict outcomes, and test hypotheses.

This field encompasses a wide range of topics, including population dynamics, epidemiology, genetics, ecology, neurobiology, and more. Mathematical models can help researchers to simulate biological systems, make predictions about their behavior, and guide experimental design. Overall, mathematical biology plays a crucial role in advancing our understanding of biology and solving real-world problems related to healthcare, conservation, and more .

Mathematical biology is expanding and developing rapidly as scientists in biological sciences turn from descriptive experiments to more quantitative experiments. The diversity and complexity of living organisms means there are vastly more challenges for mathematicians to explain and predict biological systems through modeling.

The concept of mathematical Biology is not a new one. The Chinese, the ancient Egyptians, Indians, Babylonians and Greeks indulge in understanding and predicting the natural phenomena through their knowledge of mathematics. Mathematical Biology consists of simplifying real world problems and representing them as mathematical problems, solving the model and interpreting these solutions in the language of real world .



**Fig. 1.1: Process of mathematical modeling.**

### 2.2.2 Introduction To Human Physiology

Human physiology is the branch of biology that focuses on the study of how the various systems and organs in the human body function and interact to maintain life and health. It encompasses the study of processes such as digestion, respiration, circulation, nervous system function, and more, to understand how the body's internal mechanisms work to maintain homeostasis and support the overall well-being of an individual.

1. Homeostasis: Understanding how the body regulates and maintains a stable internal environment despite external changes.
2. Circulatory System: Discussions about the heart, blood vessels, and blood circulation, including topics like blood pressure, heart rate, and cardiovascular diseases.
3. Respiratory System: Exploring how the lungs and respiratory tract function, including the exchange of gases like oxygen and carbon dioxide.
4. Nervous System: Discussions on brain function, nerve signaling, and sensory perception, as well as neurological disorders.

5. Endocrine System: Examining the role of hormones in regulating various bodily functions and the impact of hormonal imbalances.
6. Digestive System: Understanding how the body processes food, absorbs nutrients, and eliminates waste, as well as digestive disorders

