Heart and Smooth Muscle Experiments in Virtual Laboratories:
SimHeart and SimVessel

Hans A. Braun[1,2], Aubin Tchaptchet[1,2]
Jirka R. dell'Oro-Friedl[3,4], Daniel Mohnke[5], Tina Braun[6],
Friederike Stumpff[7], Robert Patejdl[8], Thomas Noack[8]

[1]University of Marburg; [2]BM&T GbR Marburg; [3]University of Furtwangen; [4]Entertrain GmbH Hinterzarten
[5]Educay Hallgarten; [6]Motion Design Berlin; [7]FU Berlin; [8]University of Rostock

Contact: braun@staff.uni-marburg.de

For more **information** and **downloads** of demo versions see **www.virtual-physiology.com**

Teaching physiology and pharmacology of the heart and blood vessels as well of smooth muscles of the intestine is most important in medical education because of the manifold of diseases of these organs with which the students, as physicians, later will be confronted.

The Virtual Physiology laboratories SimHeart and SimVessel offer valuable tools to consolidate and extend the students factual knowledge and to provide deeper insights and a more thorough understanding of heart and smooth muscle control by physiological transmitters and pharmacological substances.

The Virtual Physiology Laboratories SimHeart and SimVessel:
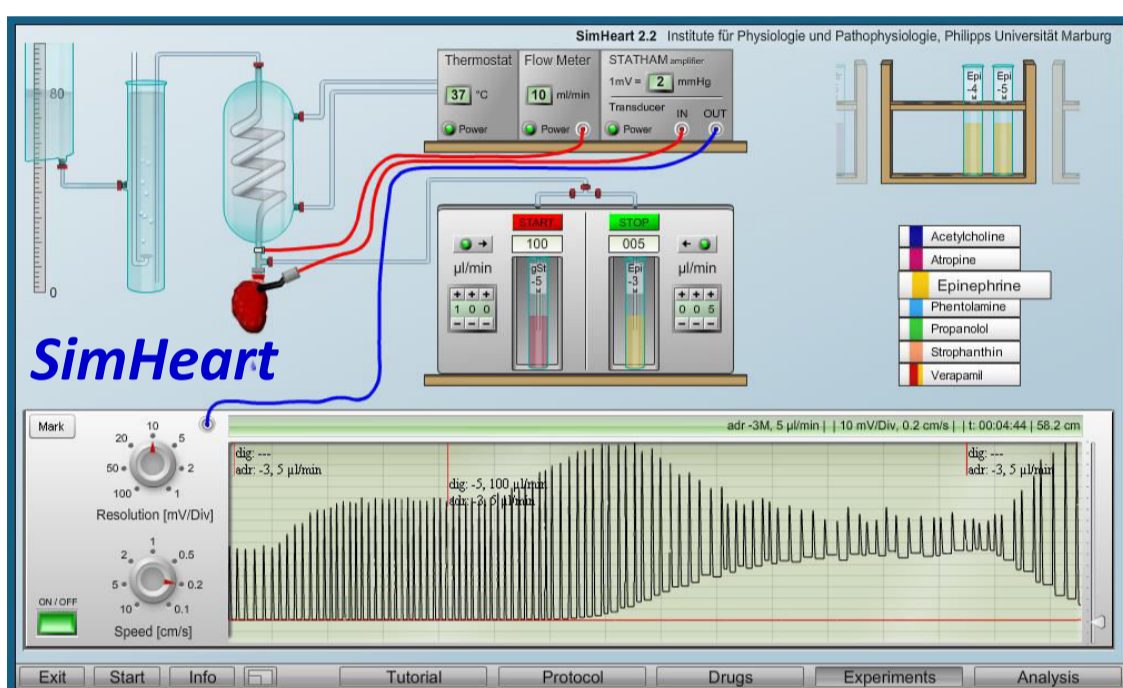
SimHeart offers a virtual laboratory for recordings of heart contractions in the Langendorff set-up in response to physiologically and pharmacologically relevant hormones and drugs.

Featured experiments:
- Effects of **Adrenaline** and **Acetylcholine** on the frequency and amplitude of heart contractions (inotrope and chronotrope effects).
- Effects of the competitive receptor blockers **Propranolol** and **Atropine**.
- Adrenaline dose-response curve and its shift by the ß-blocker **Propranolol** (competitive inhibition).
- Comparison with non-competitive inhibition by the Ca^{2+}-channel blocker **Verapamil**.
- Strengthening of the contractility by the heart-glycoside **g-Strophantine**, induction and treatment of arrhythmias and heart blocks in systole and diastole.
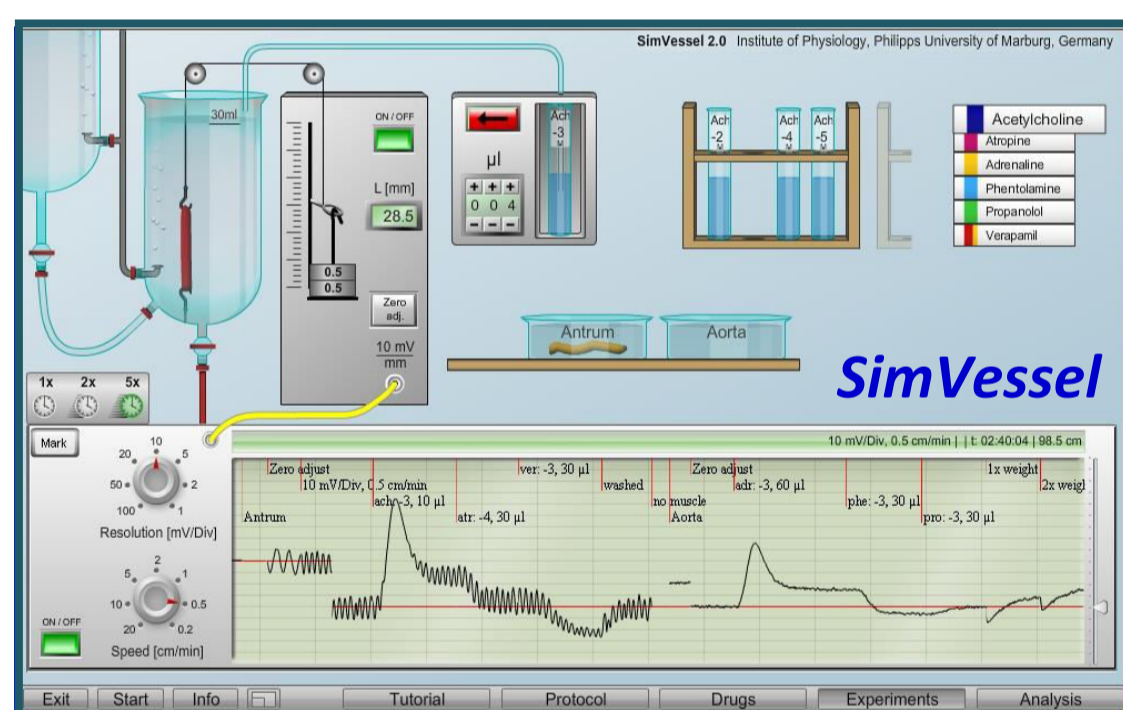

SimVessel provides a virtual laboratory for the examination of smooth muscle contractions of vessels and the intestine in an organ bath to which physiological signal substances and clinically used drugs can be added.

Featured experiments
- Comparison of **phasic** and **tonic** smooth muscle contractions.
- Effects of muscle stretching (**Bayliss effect**).
- Opposite reactions of vessels and the intestine on **Adrenaline** and **Acetylcholine**.
- Examining the effects of the cholinergic receptor antagonist **Atropine** as well as of adrenergic α- and β-receptor antagonists (**Phentolamine** and **Propranolol**).
- Effects of the Ca^{2+}-channel blocker **Verapamil**.
- Recording of **dose-response curves** and their alteration by competitive and non-competitive inhibitors.
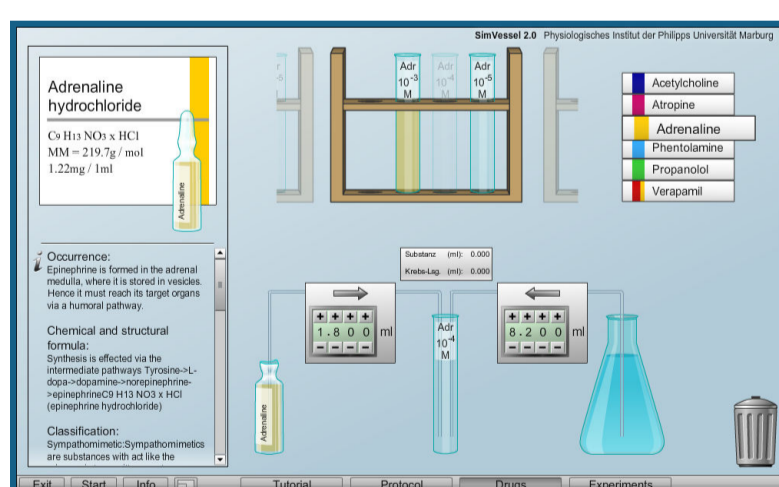
Drug Laboratories: Both programs, SimHeart and SimVessel, include a Drug Laboratory in which students can practice the correct preparation of the required drug dilutions.
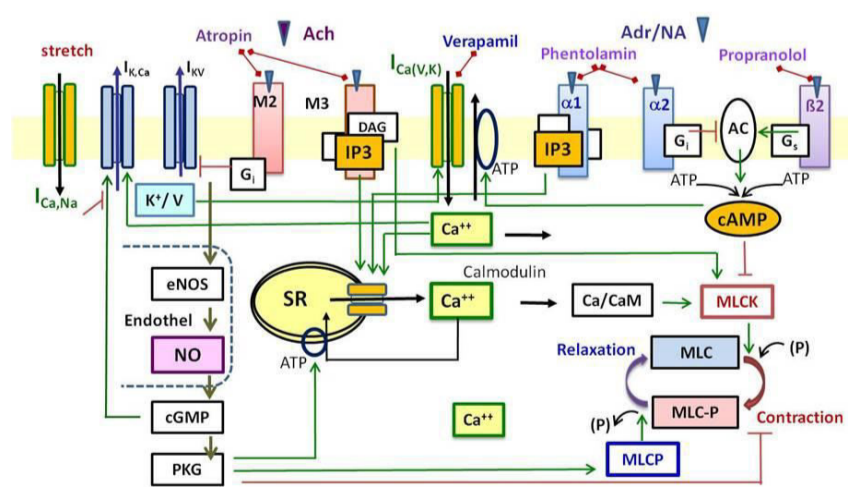
Tutorials: Detailed tutorials describe the experiments in the virtual laboratories and give an overview on the physiological and pharmacological background of the experiments.

Preparation Videos: Full HD Videos, also in Stereo-3D, show the surgical preparation of an isolated heart and of isolated smooth muscle stripes of the aorta, antrum and the small intestine of a rat.