

Computer Simulation and the Link between Alternatives in Education and in Research

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Since several years, teaching programs of the “*Virtual Physiology*” series, consisting of SimNerv, SimHeart, etc., are successfully used in practical physiology and pharmacology courses in medical, biological and related faculties at several hundreds universities and high schools all over the world.

While these programs originally might have been seen as only minor substitutes of the real labs it turned out in the course of teaching that they have major didactic advantages. The students are much more active in the virtual than in the real animal labs and they are doing the experiments without the negative emotions from the killing of animals and without fear to destroy the preparation. As a consequence, in many universities these programs have replaced the animal experiments, for example, with the frog sciatic nerve and gastrocnemius muscle or with isolated heart and smooth muscle preparations of rats and guinea pigs.

More recently, an advanced series of virtual computer labs (“*cLABS*”) has been developed which also allows to do experiments that would be too difficult for most students to be physically carried out but can be realized in a virtual lab: cLabs-Neuron and cLabs-SkinSenses (for more information see <http://www.clabs.de/>).

Moreover, such computer simulations are valuable tools not only for teaching but also for science and have drastically reduced the number animal experiments in many research laboratories. Also the pharmaceutical industry has recognized the power of computational approaches. Very recently, an EU “Network of Excellence” (*BIOSIM*) has been approved which brings together about 20 University groups from all over Europe with several pharmaceutical companies with the aim to make use of computer simulations for more effective drug development at reduced costs which shall be achieved by the reduction of clinical trials and also of animal experiments (see <http://chaos.fys.dtu.dk/biosim>).

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Hans A. Braun: Biographie

Hans Albert Braun is head of the Neurodynamics Group at the Institute of Physiology at the University of Marburg in Germany (www.uni-marburg.de/physiology/braun). He trained as an electronic engineer at the Technical University in Karlsruhe, where he obtained a degree in “Electrobiology”. In a supplementary study of “Human Biology” he obtained his PhD at the Medical Faculty of the University of Marburg.

His research involves experiments and models of neuronal encoding and neuromodulatory processes in peripheral sensory receptors and hypothalamic neurones, including computer modeling studies of affective disorders. The aim is the understanding of neuronal system dynamics at different levels and to elucidate their common functional principles. With the background of these experiences, the Neurodynamics Group has developed teaching software with virtual computer laboratories for practice-oriented learning including the award-winning teaching software *SimNerv* (www.cLabs.de).

Hans Braun is Workpackage Coordinator and Activity Area Head in a EU “Network of Excellence” called “BIOSIM” (started Dec. 01, 2004, see <http://chaos.fys.dtu.dk/biosim/>). This project aims to make use of computer simulations for drug development to reduce the costs for clinical trials as well as animal experiments and, therefore, is expected to have high impact also on the 3Rs. Hans A. Braun is member of several scientific societies and has been honoured with the fellowship of the Biophysics Division of the American Physical Society.