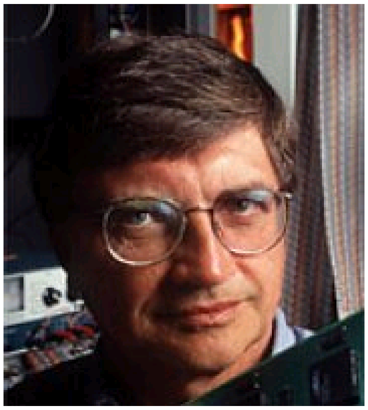
Olaf T. von Ramm, Professor



Dr. von Ramm's research interests include diagnostic ultrasound imaging systems, IR imaging, medical instrumentation and their new applications.

Ultrasound Imaging. The main direction of research is a development of new ultrasonic techniques for better visualization of the human anatomy, improved ultrasonic detection of tumors and other space occupying lesions as well as improved detection and visualization of blood flow. Several generations of phased array Ultrasound imaging systems have been designed and constructed in our laboratories to assist the clinical value of various novel Ultrasound imaging techniques. Research interests range from basic physics of acoustics and properties of materials required in transducer construction, through the design and construction of advanced imaging systems, to the clinical application and evaluation of new instruments or measurement principles. Of particular interest has been the quantization of cardiac function using Ultrasound.

High Speed Ultrasound Imaging is a project with a long-term goal to design, construct and clinically evaluate a real-time volumetric (3-D) ultrasonic imaging system which is also capable of visualizing and accurately representing blood flow in three dimensions. This instrument will permit the non-invasive assessment of tumor and organ volumes as well as cardiac chamber volumes. Such measurements have the potential of improving decision on tumor treatment, of assessing congenital and pathological states of various organs and of evaluating cardiac function on a serial basis. Incorporation of angle-independent 3-D flow measurements will permit the rapid noninvasive assessment of flow in major peripheral vessels, deep abdominal vessels and coronary arteries. Flow imaging will also delineate the lumen of the vessel thereby simplifying detection of atherosclerotic clacks.

Another project Real-Time 3-D Ultrasonic Data Acquisition, is aimed at the design, construction and evaluation of a new generation pulsed array Ultrasound imaging system based on VLSI ASICs and specialized linear integrated circuits. This system will eventually feature256 parallel receive channels with 64 to 1 parallel processing. Up to 64simultaneous B-mode will be acquired in real time so that virtually any view of the anatomy can be visualized on line.

Scatter Imaging is the focus of yet another research effort which is directed toward imaging with Ultrasound energies scattered at various angles from soft tissue. Studies are directed towards assessing the viability of such imaging and improving contrast between tissue types and generally improving image quality. This method may also permit the quantitative determination of physical tissue parameters such as ultrasonic propagation velocities.

Medical Center equipment totally dedicated to the Ultrasound work includes the second generation phased array instrument constructed at Duke, a VAX11/780, a Kontron image processor, electronic test equipment, extensive video equipment including an In star 240 frame per second instrument. In addition there are 9 commercial phased array instruments in clinical use with various transducer probes that can be scheduled for research purposes.

Cardiovascular Technologies. The National Science Foundation Engineering Research Center for Emerging Cardiovascular Technologies (NSF/ERC) at Duke University incorporates the latest knowledge and methodology in custom integrated electronics, biosensors, system design, and simulation to develop a new generation of Cardiac Interventional and Medical Imaging Systems. This interdisciplinary Center brings together the active research programs of well-established engineering and biomedical researchers and industrial investigators to advance biomedical systems, devices, and instrumentation in the coming decade. Research interests include the study of interventional stimulation and catheterization procedures aimed at the development of a new generation of devices and procedures for the treatment of arrhythmias, atherosclerosis, and other vascular diseases. Research contributors possess highly specialized skills in medical research, biomedical engineering, electrical engineering, mechanical engineering, materials science, and micro electronic technology. All of these skills are required in a systems approach to developing implantable devices and interventional methods.

Other research groups focus on the development of high speed 3-D imaging systems including two major projects: 3-D real-time ultrasonic imaging and magnetic resonance microscopy. The extensions of these modalities to dynamic, three-dimensional imaging capabilities should double the present Ultrasound and magnetic resonance imaging sales. These imaging and display systems will also be of major importance in the in vivo evaluation of the systems.

The vision of current cardiac stimulation research projects is to prevent sudden cardiac death by developing several different types of high technology devices to be implanted within the body. These devices will halt or prevent ventricular fibrillation, the primary cause of sudden cardiac death.

The key technical problems blocking advances in the development of devices to prevent sudden cardiac death are a lack of knowledge of (a) the distribution of the electrical field created throughout the heart by a set of stimulating electrodes, (b) the reaction of the heart cells to a given electrical field as a function of the cell's electrophysiologic state at the time of the shock, and (c) the individuals who are at risk for sudden cardiac death and thus are candidates for these devices.

The key research goals and objectives are to obtain and evaluate experimental knowledge by using specially constructed, computer-assisted data acquisition systems and electrode arrays to record the intrinsic electrical activity of the heart before and after a large electrical stimulus, as well as the potentials created throughout the heart by the stimulus itself. The correctness of bioelectric simulation and concepts are assessed by comparing these predictions to the measured data.

This work is strongly dependent on the circuits, sensors, and simulation research projects that are significant strengths of the NSF/ERC program. Investigators are developing systems requirements and specifications for array transducers, custom integrated circuits, integrated systems, biosensors, and simulations that focus the core research activities in micro electronics and biosensor design and fabrication.

A major goal of this Center is to improve engineering educational programs by expanding the opportunities for engineering students to interact with industrial investigators. In particular, the Center is initiating an approach to graduate and undergraduate engineering education in which NSF/ERC Fellows receive substantive advising and individually tailored instruction from leading engineers in industry.

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Education:

- PhD, Duke University, 1973
- MS, University of Toronto, 1970
- BS, University of Toronto, 1968

Specialties:

- Medical Imaging
- Medical Instrumentation
- 3D Ultrasound
- Ultrasound imaging

Research Interests:

Dr. von Ramm's research interests include diagnostic ultrasound imaging systems, IR imaging, medical instrumentation and their new applications.

Awards, Honors, and Distinctions

- Fellow, American Institute for Medical and Biological Engineering, 1998
- Fellow, American Institute of Ultrasound in Medicine, 1995
- Terrence Matzuk Memorial Award for Innovative Research in Ultrasonic Instrumentation, American Institute of Ultrasound in Medicine, 1991

Recent Publications (More Publications)

D. E. Dausch and J. B. Castellucci and D. R. Chou and O. T. von Ramm, *Theory and Operation of 2-D Array Piezoelectric Micromachined Ultrasound Transducers*, Ieee Transactions On Ultrasonics Ferroelectrics And Frequency Control, vol. 55 no. 11 (November, 2008), pp. 2484 -- 2492 [abs].

J. Kuo and O. T. von Ramm, *Three-dimensional motion measurements using feature tracking*, Ieee Transactions On Ultrasonics Ferroelectrics And Frequency Control, vol. 55 no. 4 (April, 2008), pp. 800 -- 810 [abs].

J. Kuo and G. R. Bredthauer and J. B. Castellucci and O. T. von Ramm, *Interactive volume rendering of real-time three-dimensional ultrasound images*, Ieee Transactions On Ultrasonics Ferroelectrics And Frequency Control, vol. 54 no. 2 (February, 2007), pp. 313 -- 318 [abs].

Kuo, Johnny and Bredthauer, Gregory R. and Castellucci, John B. and Von Ramm, Olaf T., *Interactive volume rendering of real-time three-dimensional ultrasound images*, IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, vol. 54 no. 2 (2007), pp. 313 - 318 [245] [abs].

Bredthauer, Gregory R. and Von Ramm, Olaf T., *Interactive rendering of real-time volumetric ultrasound images*, 2004 2nd IEEE International Symposium on Biomedical Imaging: Macro to Nano, vol. 1 (2004), pp. 524 - 526 [abs].

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