

# DISTINGUISHED LECTURER SERIES

T H E I N S T I T U T E F O R S Y S T E M S R E S E A R C H



**Bob Carlyon**

Medical Research Council  
Cognition & Brain  
Sciences Unit  
University of Cambridge  
Cambridge, England

Tuesday, November 7, 5:00 p.m.

## Listening in a Cocktail Party with Acoustic and Electric Hearing

One of the most challenging tasks facing the auditory system is the processing of speech under adverse listening conditions. My presentation will describe experiments investigating how normal-hearing (NH) listeners perform this task, and then discuss how this basic research can inform the future development of devices to restore hearing to deaf people. NH listeners can understand speech even at unfavourable signal-to-masker ratios, and even when the masker is another voice having statistical properties similar to that of the target speech. I will start my presentation with a brief overview of the ways in which the ear and brain together solve this “cocktail party” problem. Although many different strategies seem, *a priori*, possible, two monaural cues dominate concurrent sound segregation. The onset cue arises because the frequency components of one person’s voice tend to stop and start at the same time (such as in the middle of the word “about”), and at different times to those of competing speakers. Listeners can also use the pitch cue: the spectrum of the voiced portions of one speaker consists of a regularly-spaced series of harmonics, giving rise to the sound’s pitch, and this pitch usually differs from that of competing speakers. I will then turn to the issue of sound segregation by cochlear implant (CI) listeners. CIs have restored hearing to more than 100,000 patients world-wide, and do so by electrically stimulating the auditory nerve (so-called “electric hearing”). Although many CI users understand speech well in quiet, even the most successful have difficulty when competing sounds are present. One reason for this is that the way pitch is encoded by CIs is qualitatively different from that in NH. I will describe experiments that investigate the reasons for the poor pitch perception experienced by most CI users, and the implications for new strategies for improving pitch perception in electric hearing. I will also describe experiments investigating CI listeners’ use of the onset cue, which is encoded by CIs in a way qualitatively similar to that in NH. I will end by describing the problems that CI researchers should and shouldn’t be focusing on in an effort to improve sound segregation by CI users.

### Biography

Dr. Bob Carlyon has been studying the human auditory system since his Ph.D. in Cambridge, England, in the early 1980s. He is currently Programme Leader at the Medical Research Council’s Cognition & Brain Sciences Unit in Cambridge, England. He is also an Official Fellow of Clare Hall College, Cambridge. He was presented with the Acoustical Society of America’s R. Bruce Lindsay Award in 1994, and was elected a Fellow of that Society in 1998. Previous appointments include a scientific position at the Institute of Hearing Research (Nottingham, England), a Visiting Fellowship at Northeastern University (Boston, MA), and a Royal Society University Research Fellowship at the University of Sussex (England). Dr. Carlyon’s research has spanned a wide range of topics in human hearing, but has most recently focused on the problem of how we can listen to one voice in the presence of interfering sounds, such as other speakers. His research incorporates behavioural and electrophysiological experiments with normal-hearing listeners, and studies of hearing by deaf patients fitted with a cochlear implant.

### Reception

Tuesday, November 7, 2006  
4:30 p.m.  
Lobby, Computer Science Instructional Center

### Lecture

Tuesday, November 7, 2006  
5:00 p.m.  
1115 Computer Science Instructional Center

### Hosts

Eyad Abed and Shihab Shamma

**Questions? Call ISR at 301-405-6615**

The  
Institute for  
**Systems**  
Research



A. JAMES CLARK  
SCHOOL OF ENGINEERING