Two research opportunities at the intersection of neuroscience, organismal biology and ecology, physical science, and engineering

timely opportunities uniquely suited to NSF

John G. Hildebrand
Arizona Research Laboratories
Division of Neurobiology
University of Arizona
PO Box 210077
Tucson AZ 85721-0077
jgh@neurobio.arizona.edu
http://neurobio.arizona.edu/faculty/hildebrand/index.php

Evolution and adaptation of sensory systems to deal with biologically significant stimuli in natural environments

- Sensory ecology: quantitative analysis of sensory channels from stimulus generation, structure, propagation, and interaction with the environment to detection, information processing, and behavioral and physiological responses by an animal receiver and the consequent effects on ecological interactions

  e.g. David B. Dusenbery (1992)
  Sensory Ecology: How Organisms Acquire and Respond to Information
  W.H. Freeman (pub.)

- Neural representations of the external world

  e.g. Rüdiger Wehner (1987) *J. Comp. Physiol A* 161:511-531
  'Matched fliters' – neural models of the external world

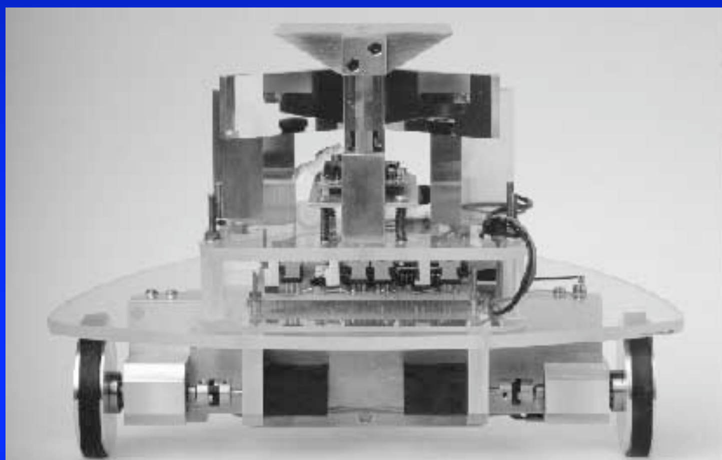
- Sensory integration

  e.g. Barry E. Stein & M. Alex Meredith (1993)
  The Merging of the Senses
  MIT Press

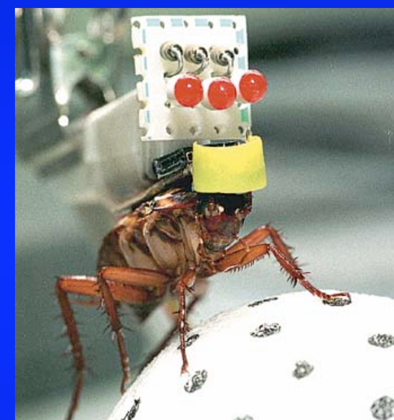
Biologically inspired robotics

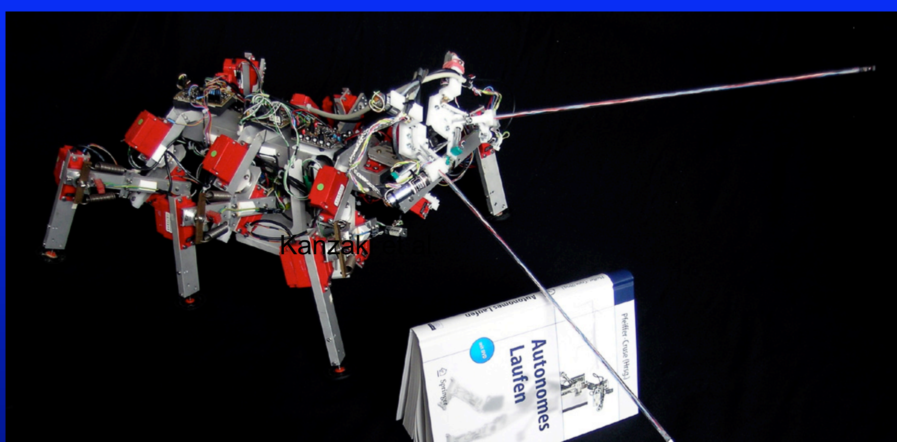
"from R&D by Natural Selection to R&D by engineering"
Examples: insect-based systems

- wheeled and multi-legged robots with control systems based on insect sensory systems (e.g. olfactory, visual, mechanosensory)
- "biobots" with machine-animal interfaces between a vehicle and an insect "pilot"



Srinivasan et al.
http://cvs.anu.edu.au/bioroboticvision/brv.asp





V. Dürr, University of Bielefeld
http://www.fraunhofer.de/fhg/EN/bigimg/2005/md5fo2g.jsp

Willis, et al.
http://flightpath.neurobio.arizona.edu/Model/robot.html