

# Cyborgs: Present and Future

By Deuce of FurryMUCK =^.^=

Additional art by Richard Bartrop  
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# What Do We Call Cybernetics?

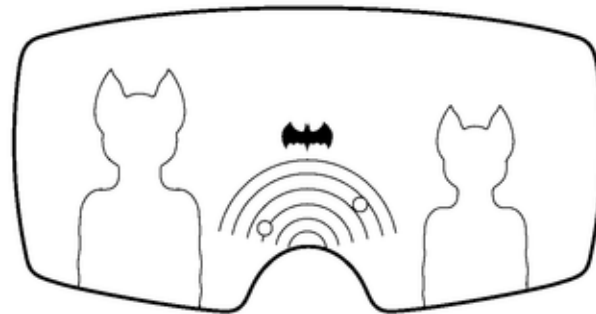
- Augmentation of human (or nonhuman) bodies with artificial components.
- What was once advanced is now mundane!
  - External: eyeglasses, hearing aids
  - Internal: artificial joints, pacemakers
- “Cybernetics” is a moving target.

# What's Advanced Today?

- Prostheses
  - Limited motor control, touch (via skin currents)
- Limited muscle interfaces
  - Pacemakers
- Limited sensory nerve interfaces
  - Cochlear implant hearing aids
- Theme is replacement of lost functions.

# Where Do We Want To Go?

- Rethink purpose: Augmentation.
- Even external devices help!
  - “Augmented reality”.
  - Mundane computers, cell phones.



# Tech: Talking to Neurons

- Neural recording and stimulation.
  - Signals are trains of current pulses (1 ms spikes)
  - Information encoded in activity level.
- Smart electrode arrays made using integrated circuit technologies.
  - For now, electrode combs, accessing near surface.
  - Analog/digital conversion done in-situ.

# Tech: Neural Interfaces

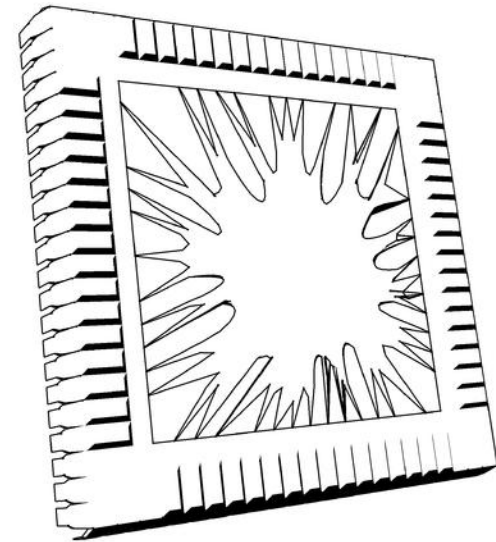
- Cochlear implants (in service as hearing aids)
  - Here now
- Retinal implants (replacing lost retina layers)
  - In active development
- Visual cortex brain implants (cutting edge)
  - In testing with humans

# Tech: Animal/Machine Hybrids

- Active research: linking electronics and machinery to insect nervous systems.
- Project: Cockroach car.
  - Roach muscle nerves wired to toy car controls.
- Project: Insect spies.
  - Electronics direct cyber-bug flight.

# Tech: Culturing Neurons

- Neural stem cells identified, and methods to culture them are known.
- Project: Bio-Chip
  - Nerve cells grown on chip and trained.



# Looking Forwards

- Future: Tighter integration with prosthetics
- Future: Organic (neural) extensions to nervous system
  - Grown using own neural stem cells.
- Future: Biocomputers
  - Structured networks grown on machine substrates.

# Looking Forwards

- Exciting field, already in wide use medically!
- Research opens the door to more applications, including augmentation (rather than rehabilitation).