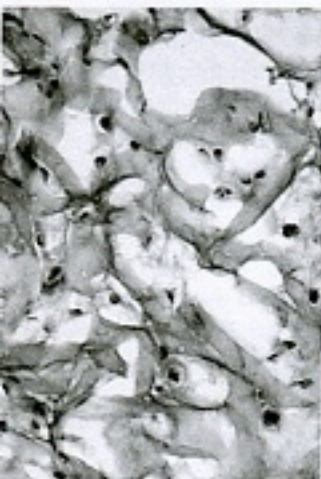


more intuitive, supple, and responsive "tools" that can function below the threshold of consciousness to improve human life. But as dependence on engineered objects intensifies, so do users' questions. Take the internal defibrillator, which prevents future heart attacks by sending small jolts of current into the heart muscle when the machine detects arrhythmia of a certain type. Is this an invisible and imperceptible life-saving device? Or—as its grateful recipients sometimes think—is it a training machine that uses biofeedback to curb patients' emotional extremes and encourage their adoption of a different "lifestyle"?³

Unlike our bodies, which allow us to feel a more-or-less easy (if mortal) sensation of control, machines seem to "want" us to adapt to their imperfections and idiosyncrasies, they "want" to control us. Biomimetics addresses this anxiety directly, in part by refusing the model of industrial machinery in favor of the subtle joints, fluids, and neuronal interfaces of (mostly human) bodies. The body's own engineering systems, such as those embedded in the skin or threading through the viscera's ventricles, veins, intestines, and lymph nodes, are seen as models for biomimetic engineering to adapt and improve. Researchers seek to isolate the function of each type of nerve in the skin, for example, in order to produce devices that can stimulate the precise nerves that register pressure (or texture, or thermal changes)—mimetically simulating the "touch" of a resistant object in virtual space.⁴ Biomimesis, if you will, is biological engineering that aims to function within the seamless fantasy of control we like to call human will. Where that will seems to be situated (inside or outside the biomimetically enhanced body, for example) has everything to do with our cultural acceptance of the results.

We now have centuries of experience dealing with machines. But as informatics penetrates every level of our technologies, the very word "machines" begins to seem archaic. There was some analogical relation that could be drawn between a hand-axe and a hammer, a hammer and a steam press, a steam press and a locomotive, a locomotive and a rocket. Biomimetics is driven by a new logic that is difficult to capture within the quintessentially Enlightenment entity, "machine." It is one thing to enlarge the scale of info-mechanical systems to a planetary level with the GriPhyN project (Grid Physics Network, a National Science Foundation-funded computational grid for global physics, astronomy, and other sciences sifting data at the petabyte scale). It is quite another to follow biomimetics into the body itself, at the level of nanotubes, engineered tissue, and cellular computing.



Fibroblast cells infiltrating a collagen-based scaffold for medical applications. Courtesy Jerome Werkmeister, from collaborative work between CSIRO Molecular Science and the University of Melbourne.