What is Bioengineering?

<u>Wikipedia, the source of all useful information, says a few things:</u>
Biological engineering, biotechnological engineering or bioengineering (including biological systems engineering) is the application of engineering principles to address challenges in the fields of biology and medicine. The overlap with Biomedical Engineering can be unclear, as many universities now use the terms "bioengineering" and "biomedical engineering" interchangeably. But whenever a distinction is made, "biological" engineering (like biotechnology) tends to emphasize the use of biological substances - applying engineering principles to molecular biology, biochemistry, microbiology, pharmacology, protein chemistry, cytology, immunology, neurobiology and neuroscience. Neither bio-engineering nor biomedical engineering is wholly contained within the other, as there are non-biological products for medical needs and biological products for non-medical needs.

The word bioengineering was coined by British scientist and broadcaster Heinz Wolff in 1954.[1] The term bioengineering is also used to describe the use of vegetation in civil engineering construction. The term bioengineering may also be applied to environmental modifications such as surface soil protection, slope stabilisation, watercourse and shoreline protection, windbreaks, vegetation barriers including noise barriers and visual screens, and the ecological enhancement of an area.

The first biological engineering program was created at Mississippi State University in 1967, making it the first Biological Engineering curriculum in the United States.[2]

Biological Engineering employs knowledge and expertise from a number of pure and applied sciences, such as mass and heat transfer, kinetics, biocatalysts, biomechanics, bioinformatics, separation and purification processes, bioreactor design, surface science, fluid mechanics, thermodynamics, and polymer science. It is used in the design of medical devices, diagnostic equipment, biocompatible materials, and other important medical needs that improve the living standards of societies.

Biological Engineers or bioengineers are engineers who use the principles of biology and the tools of engineering to create usable, tangible products(e.g. the vulva of a rabbit is bioengineered to have the same 'specs' of a human vulva; therefore allowing transplant.)In general, biological engineers attempt to either mimic biological systems in order to create products or modify and control biological systems so that they can replace, augment, or sustain chemical and mechanical processes. Bioengineers can apply their expertise to other applications of engineering and biotechnology, including genetic modification of plants and microorganisms, bioprocess engineering, and biocatalysis.

Because other engineering disciplines also address living organisms (e.g., prosthetics in mechanical engineering), the term biological engineering can be applied more broadly to include agricultural engineering and biotechnology. In fact, many old agricultural engineering departments in universities over the world have rebranded themselves as agricultural and biological engineering or agricultural and biosystems engineering. Biological engineering is also called bioengineering by some colleges and Biomedical engineering is called Bioengineering by others, and is a rapidly developing field with fluid categorization. The Main Fields of Bioengineering may be categorised as:

- Bioprocess Engineering: Bioprocess Design, Biocatalysis, Bioseparation, Bioinformatics
- Genetic Engineering: Synthetic Biology, Cell Engineering, Tissue Culture Engineering, Horizontal gene transfer.
- Biomedical Engineering: Biomedical technology, Biomedical Diagnosis, Biomedical Therapy, Biomechanics, Biomaterials.

(http://en.wikipedia.org/wiki/Biological_Engineering, accessed 8/10)

Biomedical engineering is the application of engineering principles and techniques to the medical field. This field seeks to close the gap between engineering and medicine. It combines the design and problem solving skills of engineering with medical and biological sciences to improve healthcare diagnosis and treatment.[1]

Biomedical engineering has only recently emerged as its own discipline, compared to many other engineering fields; such an evolution is common as a new field transitions from being an interdisciplinary specialization among already-established fields, to being considered a field in itself. Much of the work in biomedical engineering consists of research and development, spanning a broad array of subfields (see below). Prominent biomedical engineering applications include the development of biocompatible prostheses, various diagnostic and therapeutic medical devices ranging from clinical equipment to micro-implants, common imaging equipment such as MRIs and EEGs, biotechnologies such as regenerative tissue growth, and pharmaceutical drugs and biopharmaceuticals.

(http://en.wikipedia.org/wiki/Biomedical_engineering, accessed 8/10)

The NIH used to say:
Bioengineering integrates physical, chemical, or mathematical sciences and engineering principles for the study of biology, medicine, behavior, or health. It advances fundamental concepts, creates knowledge for the molecular to the organ systems levels, and develops innovative biologics, materials, processes, implants, devices, and informatics approaches for the prevention, diagnosis, and treatment of disease, for patient rehabilitation, and for improving health. (http://www.becon.nih.gov/bioengineering_definition.htm, accessed 8/06)

Now under the National Institute of Biomedical Engineering and Bioengineering, they say:
The discipline of biomedical engineering lies at the forefront of the medical revolution. Advances in biomedical engineering are accomplished through interdisciplinary activities that integrate the physical, chemical, mathematical, and computational sciences with engineering principles in order to study biology, medicine, and behavior.

Examples of research that might be conducted by a biomedical engineer include:

- The design and development of viable replacement tissues that are biologic rather than synthetic, as well as implantable artificial materials
- Automated technologies for patient testing and care
- Medical imaging systems
- Biological sensors capable of monitoring blood chemistry or environmental toxins or hazards
- Biomechanics of injury or wound healing
- Prosthetic development
- Novel systems for drug screening and development

The goal of bioengineering is to promote biomedical advances to diagnose and treat disease and to prolong a healthy and productive life.
(http://www.nibib.nih.gov/HealthEdu/ScienceEdu/BioengDef, accessed 8/10)

The Oxford Dictionary of Biology says it is:
The use of artificial tissues, organs, or organ components to replace parts of the body that are damaged, lost or malfunctioning
(http://www.med.uwo.ca/ecosystemhealth/education/glossary.htm, accessed 8/10)

The Free Dictionary says it is:
1. The application of engineering principles to the fields of biology and medicine, as in the development of aids or replacements for defective or missing body organs. Also called biomedical engineering. 2. Genetic engineering.
(http://www.thefreedictionary.com/bioengineering, accessed 8/10)