

Biotechnology Impacting Cosmetic Science: Altering the Way Cosmetics Are Perceived?

KEY WORDS: *pharmaceuticals, biotech cosmetics, proteomics*

ABSTRACT: *Biotechnology knowledge, tools and technologies are leaping from the pharmaceutical to cosmetics industrial arena.*

The term ‘biotechnology’ was first coined in 1919 by the Hungarian engineer Karl Ereky. Humankind has been performing biotechnology experiments and processes ever since the first intentional cross breeding of plant and animal species and microbial fermentation for beverage production. Nevertheless, we generally consider the biotechnology industry to be still in its infancy. The first wholly ‘biotech’ companies were founded 25 years ago.

The biotechnology industry includes medical biotech, agricultural biotech, environmental and industrial biotech, but not firms that are primarily pharmaceutical companies, contract research organizations or equipment manufacturers. Environmental biotech uses biological agents to clean sites contaminated with hazardous wastes and reduce the use of chemicals, while industrial biotech deals with use of enzymes to replace chemical catalysts in various synthetic processes. Both the environmental and industrial biotechnologies have an impact on the cosmetics field, particularly its manufacturing and production aspects. However, the medical and agricultural branches of the biotech industry are the ones primarily impacting the cosmetics and personal-care industry, since these are the scientific fields traditionally acting as sources for ingredients and actives used in cosmetics.

The biotechnology industry appears to have a tremendous potential for further development based on its track record (**Table 1**). Consider the significant proportion of biotech companies acting as intensive research facilities, investing primarily in early- to middle-stage development technology platforms (e.g., functional genomics, proteomics). Also consider the gradual maturation of both the produced technologies so far and the public and investor confidence in the industry. These factors suggest that there may be more than mere frenzy in the optimistic projections by some that the biotech industry will be the economic powerhouse of the 21st century.

Transformation of the Pharmaceutical Industry

New developments in biotechnological knowledge and tools will undoubtedly have their greatest impact on the pharmaceutical industry.² Following publication of the initial draft of the human genome last year, most genomics companies are now trying hard to become some sort of drug development company. In fact, the most significant finding in the two papers determining the entire sequence of the human genome is that the total number of genes in our genome is only between 26,000 and 40,000 (compared to 19,000 genes for a roundworm). This immediately intensified the competition to determine and patent the use of genes responsible

Table 1. Biotechnology industry track record 1993-1999

117	Total number of commercially available biotech drugs
32	Biotech drugs, vaccines and new indications for existing medicines approved in 2000 by the US FDA
3 times as many	Number of biotech products approved by the US FDA during the last 6 years compared to the previous 13 years combined
350	Biotech medicines in late-stage development
1,275	Biotech companies presently in the market
2.1 billion	Capital invested in biotech firms by venture capitalists in 2000 (\$US)
79,000 (1993)	Employment in the biotech industry (per year)
150,800 (1999)	
1,500 (1985)	Patents issued to biotech companies by the USPTO (per year)
3,800 (1993)	
9,000 (1999)	

for specific diseases. It also led to a realization that fewer genes than anticipated are responsible for the production of many more than one protein in the body. This clarifies the importance of proteomics, which is the compilation of the complete list of proteins performing bodily functions.

Figure 1 (see color insert 1) represents schematically the ‘transformation’ of the pharmaceutical industry by advances in the most important scientific fields contributing to biotechnology (green circles in gray area), leading to new therapeutic modalities and, subsequently, drugs (orange circular area). It is extremely important to point out that almost all depicted fields of study are still at their very early stages, meaning that biotech drug development will be gradual and painstaking. Also, all depicted fields progress simultaneously, thus the ability to follow biotechnological developments requires multidisciplinary knowledge, to identify potential synergies between, say, genomics and tissue engineering, in order to realize opportunities. Therefore, there is still a long way to go before the transformation of the pharmaceutical industry is evident.

Biotechnological Cosmetics: Is the Future Already Here?

Traditionally, the transfer of knowledge and technology from the pharmaceutical industry to the cosmetic industry has been a natural occurrence. Faithful to this model, the cosmetics industry during the past 10-15 years has witnessed a gradual shift in the use of ingredients towards more ‘biologically derived’ products of marine and vegetable origin or products of fermentation processes. Typical examples³ include extracts from fish, the ocean, the Dead Sea, or seaweeds, to name just a few. The infamous fruit acids or derivatives from the noix de Grenoble walnut tree are examples of cosmetic ingredients of vegetable origin, as are derivative products from beer yeast or the *Halomonas elongata* bacteria from the salt lakes of Egypt.

Further evidence of the impact of the pharmaceutical industry on the cosmetics industry is the incorporation of the former’s jargon and science on both the product evaluation instrumentation and techniques and the product functionality fronts. As examples of the available product evaluation instrumentation and techniques, cosmetic scientists now are able to use kits and instruments to