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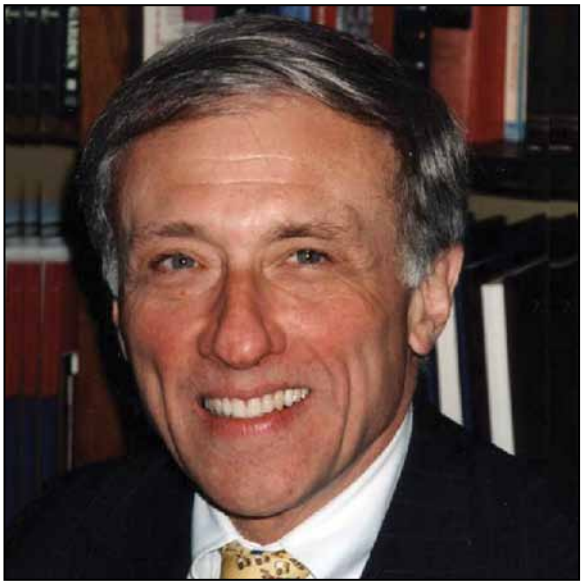
John Ebling Lecture



Bioengineering the Hair Follicle: Paradigm and Paradox

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The future of modern medicine is tissue regeneration. The challenges to this end are legion and difficult, but like all great successes in medicine and science that goal will be attained incrementally. It is our goal to regenerate the human hair follicle.

While mainly of cosmetic value in man, the hair follicle, nonetheless, presents all the challenges that regenerating any other organ might present; for example, : finding the right cells, purifying those cells, expanding the cells, stabilizing the cells, implanting the cells, and then realizing a fully mature functional organ. To accomplish this end we are confronted with most of the major problems of modern biology: stem cell biology, cell differentiation, control of gene expression, cell adhesion, cell- cell communication, apoptosis, epithelial-mesenchymal interactions, cell and growth cycles, pigmentation, etc.

When we began this study we knew that hair follicle morphogenesis resulted from extensive and intimate communication between an active mesenchyme and a receptive epithelium. So, we assumed that we would need both of these cell types. Our study has taken us over an iterative odyssey of experiments. The first step was to develop and analyze a robust animal model for measuring hair growth starting with dissociated cells. The next was to describe how follicles are reconstituted. We found that depending on the conditions new hairs will results from different mechanisms: reformation (neogenesis) or transformation.

Once the animal model was demonstrated to be robust, we turned our attention to a human model, well aware of the traditional disconnect between most animal models and the clinical application. For these studies we initially used a chimeric cells assay and then human cells in female facial xenografts. To facilitate and optimize this approach we have been detailing the molecular characterization of trichogenic cells in situ and in vitro. We have now moved on to clinical trials with all the uncertainty preclinical studies present vigilant of adverse events and robust efficacy. As the clinical studies are in progress we do not know at this time if our laboratory conclusions will bear fruit in the clinic.

This research lecture will focus on the biology of the hair follicle and the lessons we have learned while trying to formulate its regeneration.