

*Second Edition*

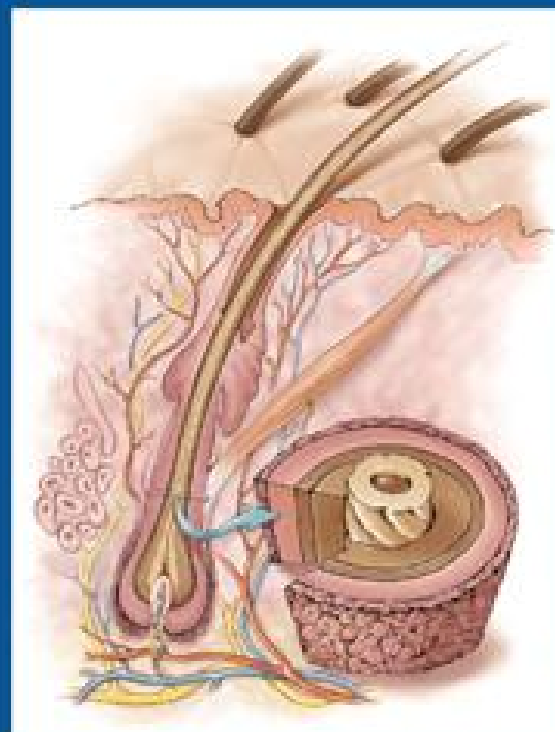
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# Hair Transplantation

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The Art of  
Follicular Unit  
Micrografting  
and  
Minigrafting

Alfonso Barrera  
Carlos Oscar Uebel



# HAIR TRANSPLANTATION

The Art of Follicular Unit  
Micrografting and Minigrafting

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# HAIR TRANSPLANTATION

## The Art of Follicular Unit Micrografting and Minigrafting

Second Edition



Edited by

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# FOREWORDS



Over the past half-century I have witnessed the tremendous evolution of plastic surgery, from a budding specialty to a complex, multidisciplinary field of ever-expanding knowledge. Today plastic surgery can be performed on any region of the body, from the hair to the lower extremity. It has become nearly impossible for a single surgeon to develop technical skills in so many areas; consequently, a tendency for specialization has occurred. Hair restoration surgery is one such area. Precise technique and instrumentation require personal aptitude and many hours of dedicated training. Because of the advances achieved through the painstaking efforts of surgeons who have refined the techniques of hair transplantation, today's patients need not expect the suboptimal results produced with punches and flaps. Currently nothing less than a natural-looking result is deemed acceptable.

Alfonso Barrera and Carlos Uebel are internationally recognized as leaders in hair transplantation. This new edition of *Hair Transplantation: The Art of Follicular Unit Micrografting and Minigrafting* is a praiseworthy book that addresses the challenges faced by both the novice and the experienced surgeon when performing hair restoration. The scope of the book is exceptional: basic procedures are covered, progressing to more advanced concepts and techniques. Up-to-date information is provided about the frontier of stem cell research and platelet-rich solutions, opening the exciting possibility of follicular stimulation and replication.

I am very pleased to recommend this book and to congratulate Drs. Barrera and Uebel for sharing their vast experience with their readers.

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I was delighted to learn that Drs. Alfonso Barrera and Carlos Uebel have united to publish this excellent book on hair transplantation. Both colleagues are outstanding experts in the field, and they have gathered a group of excellent contributors who focus on specific topics regarding hair restoration. The authors review the fundamentals of hair anatomy and physiology, the importance of preoperative planning, and the value of having a well-coordinated, skilled team working in concert during the harvesting and transplantation process.

In the past hair transplantation procedures were performed with local anesthesia only; the authors present their experience combining local anesthesia with intravenous sedation, which means less discomfort for the patient. The correction of male pattern and female pattern baldness is well described and illustrated. A chapter by Dr. Souza is devoted to the specific handling of baldness in the crown area. Dr. Crisóstomo discusses using the untouched strip technique in combining FUE and FUT.

The text details postoperative care and the instructions to be given to patients to obtain optimal healing. Also addressed is the progressive nature of baldness and why it is important to educate the patient about the potential need for a future session of hair transplantation.

Some surgeons stretch the skin significantly during hair transplantation, deforming the limits of the hair-bearing tissue and thus creating alopecic areas. These expert surgeon-authors have developed special techniques for correcting these problems. Dr. Vogel provides a discussion on revision of unfavorable results from previous sessions of hair transplantation. The authors also present hair transplantation in reconstructive procedures to repair the beard and mustache. They describe their experience using platelet-enriched growth factors to obtain better results.

Drs. Barrera and Gandelman report techniques for reconstructing the brows and eyelashes. For transgender patients, Dr. Barrera describes the technique of feminization of the frontal hairline. Another chapter describes the procedure for combining a face lift and hair transplantation in one single session.

Dr. James Harris describes follicular unit extraction, Dr. Jerry Cooley covers the exciting potential of hair cloning and tissue engineering, and Dr. Greco describes autologous tissue transfer in androgenetic alopecia and in inflammatory illnesses resulting in loss of hair. Dr. Barrera provides a helpful report on photographically documenting the patient's appearance preoperatively and postoperatively. Drs. Barrera and Uebel also describe their results, the complications associated with hair transplantation, and incorporating hair transplantation into a plastic surgery practice. The illustrated results confirm the success of their techniques.

I congratulate Drs. Barrera and Uebel on this outstanding publication which expands our knowledge in this important area of plastic surgery. All plastic surgeons who perform hair transplantation will benefit greatly from reading *Hair Transplantation: The Art of Follicular Unit Micrografting and Minigrafting*.

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Premature hair loss is a source of concern and embarrassment for men and women alike. Fortunately, current hair transplantation techniques offer natural and aesthetic hair restoration for a broad range of male and female alopecia problems, whether typical male or female pattern baldness or sideburn, eyelash, or eyebrow loss resulting from surgery or traumatic injury.

This new second edition by Dr. Alfonso Barrera and Dr. Carlos Uebel presents state-of-the-art knowledge and techniques in this burgeoning field by two of the world experts on the subject. Both Drs. Barrera and Uebel have written extensively about their work, and 10 years ago both published separate outstanding texts on the topic. Now they have joined forces and have brought us the most advanced publication ever written on this complicated subject.

In this book they discuss their individual approaches to patient evaluation, determining patient expectations, and devising plans to meet those expectations. These plans include patient education preoperatively and postoperatively as well as the details of the operation and the postoperative course for a complete recovery, with expectations met.

The book points out that not all cases of hair loss are the same; there are a variety of causes and patterns to be considered, and each patient requires an individualized approach that takes into account the individual's hair growth pattern, age, specific expectations, and the potential problems to be addressed. Specific operative procedures are well described and discussed, as well as sophisticated approaches such as follicular stimulation employing advanced concepts such as stem cells. The authors are assisted by a small group of worldwide experts who present alternative techniques for achieving excellent results.

The authors are to be congratulated for putting together this major work, which is destined to be standard reading for any surgeon performing hair replacement surgery.

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# PREFACE



Since the first edition of *Hair Transplantation: The Art of Follicular Unit Micrografting and Minigrafting*, published more than 10 years ago, many advances and refinements have occurred in the field of hair transplantation. For that reason, Carlos Uebel, my close friend, colleague, and mentor, and I felt it was important to produce a new edition of this book to share these innovations with other plastic surgeons who perform hair restoration. In compiling this book, we have drawn on our three decades of experience and observations in hair transplantation. In an effort to improve our results and make follicular unit transplantation easier and safer, with more predictable results, over time we have modified our techniques and our philosophy, as we explain in detail throughout this book.

Adhering to meticulous technique and proper patient selection, we are now able to consistently and predictably:

- Produce natural and aesthetically pleasing results in hair transplantation for male pattern baldness, female alopecia, and restoration of facial (mustache, beard, eyebrows, and eyelashes) and body hair
- Achieve undetectable recipient site scarring
- Improve the donor site scar by incising longer, narrower donor site ellipses and closing the site with no tension, often without the need to undermine the edges
- Dissect the donor strip into follicular unit micrografts and minigrafts with even greater safety and accuracy, minimizing follicular transection (occurring in less than 1% to 2% of hair shafts; formerly 5% to 10%)

In this book we describe improvements in managing the patient's postoperative course and recovery. In the past, patients commonly developed significant facial edema after surgery, which would peak at about the second or third postoperative day, and he or she would experience pain in the donor site for the first 7 to 10 days. We have significantly minimized and in many cases completely eliminated postoperative edema and pain by modifying our tumescent solution.

Improvement in graft survival by using platelet-enriched growth factors has allowed enhanced results. The text discusses revision of undesirable results from previous hair transplantation procedures and refinements on the treatment of

crown baldness. We also have an update on tissue engineering and cloning and the use of injectable protein-rich plasma to speed healing and convert miniaturized hair into terminal hair.

In facial hair transplantation we now use finer blades and needles to create the recipient sites on the eyebrows, improving the density and direction of hair growth in a single session. For the mustache, beard, and eyebrows, we have modified our technique by making the recipient site incisions first and then inserting the follicular unit grafts, facilitating denser packing of the grafts in a given session. The use of a French needle for eyelash reconstruction is also presented and updated.

There is an update on follicular unit extraction for donor hair harvesting from the scalp and body, which in selected cases has definite advantages, and a chapter on combining the strip method and the FUE technique. I (A.B.) prefer to use a composite scalp strip as opposed to follicular unit individual grafts, accomplishing reasonable density in one session.

A DVD is included with the book, presenting videos on follicular unit graft dissection; reconstruction of the eyebrows, eyelashes, mustache, and beard; face lift and hair transplantation in a single session; reconstruction of the lost sideburn secondary to face lift surgery; advances in aesthetic and reconstructive hair transplantation; and follicular unit megasessions.

We feel privileged to have had the help of our expert colleagues who contributed so generously to this book. They remind us that the future of hair transplantation will be dynamic, challenging, and fulfilling for our patients as well as ourselves.

**Alfonso Barrera**  
**Carlos Oscar Uebel**

# ACKNOWLEDGMENTS



I would like to thank my six children, Alfonso, Fernando, his precious wife, Alana, and my first grandchild, Rita; and my daughters, Laura, Ana Cristina (Kiki), Veronica, and Marisa for their patience as we brought this project to completion.

Thanks also to my dear colleague and close friend, Carlos Uebel, who introduced me to hair transplantation; he is a wonderful mentor and has been an inspiration to me for so many years in the field of hair transplantation.

Karen Berger and her QMP team are an amazing group of professionals; I would like to thank them for their invaluable help in putting the information together and making this project possible.

My appreciation to our distinguished colleagues, who contributed their expertise so admirably to this book: Drs. Francisco Jiménez, Fernando F. Barrera, James Harris, Márcio Crisóstomo, James Vogel, Marcelo Gandelman, Clerivaldo Almeida Souza, Anajara Gazzalle, Jorge Moojen da Silveira, Joseph Greco, and Jerry Cooley.

**Alfonso Barrera**

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My gratitude to my lovely family: to Walderez, my wife, who encourages me every day; to my children, Juliane and Hiddo, Paulo and Mariana, and to my dearest grandsons, Matheus and Philip. Thank you forever.

**Carlos Oscar Uebel**

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# HAIR TRANSPLANTATION

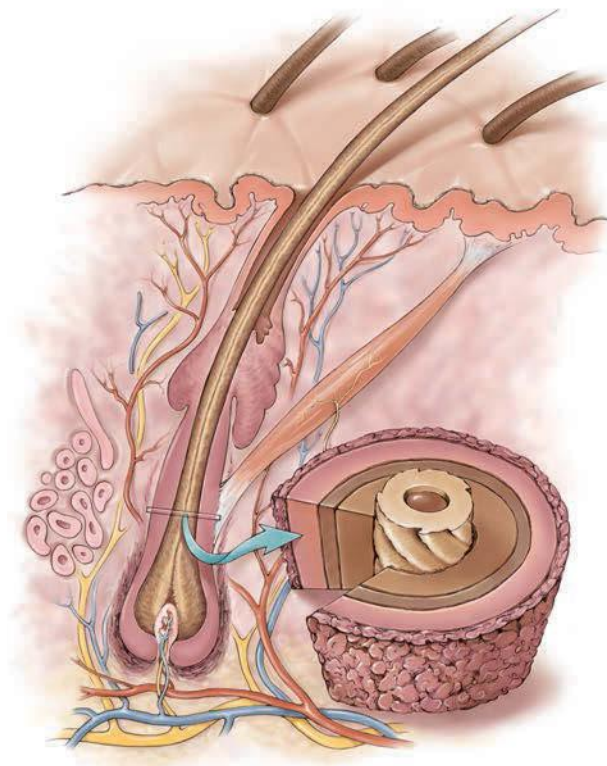
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# PART I



# FUNDAMENTALS

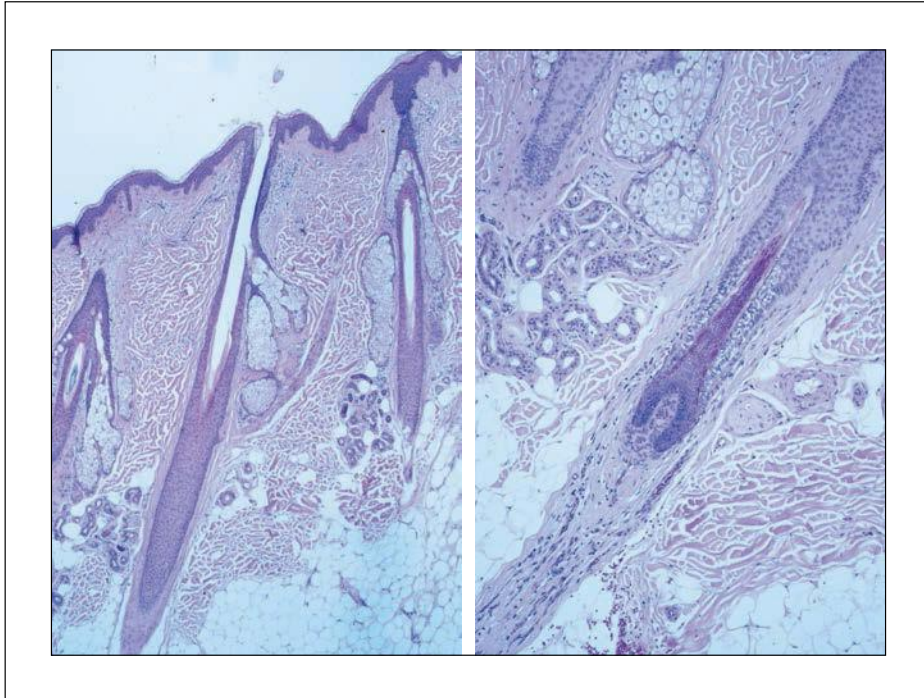


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# CHAPTER 1



# ANATOMY AND PHYSIOLOGY OF HAIR



Francisco Jiménez, Alfonso Barrera,  
Carlos Oscar Uebel

Historically, hair has been a source of pride to humans and is a distinguishing feature that adorns as well as protects. It is also one of our most variable characteristics. Wide differences in color, density, texture, length, and style distinguish different races and ethnic groups. Hair styling and adornment have evolved throughout the ages. Today men as well as women place a premium on hair fashion and products to enhance their appearance. Considering the significance placed on hair, it is easy to understand why hair loss often causes severe emotional distress and why people seek hair restoration. A surgeon performing hair transplantation must have a basic understanding of the anatomy and physiology of human hair. Hair transplantation demands excellent technical skills, a nuanced technique, and an appreciation of a natural, aesthetically pleasing result to produce an optimal restoration.

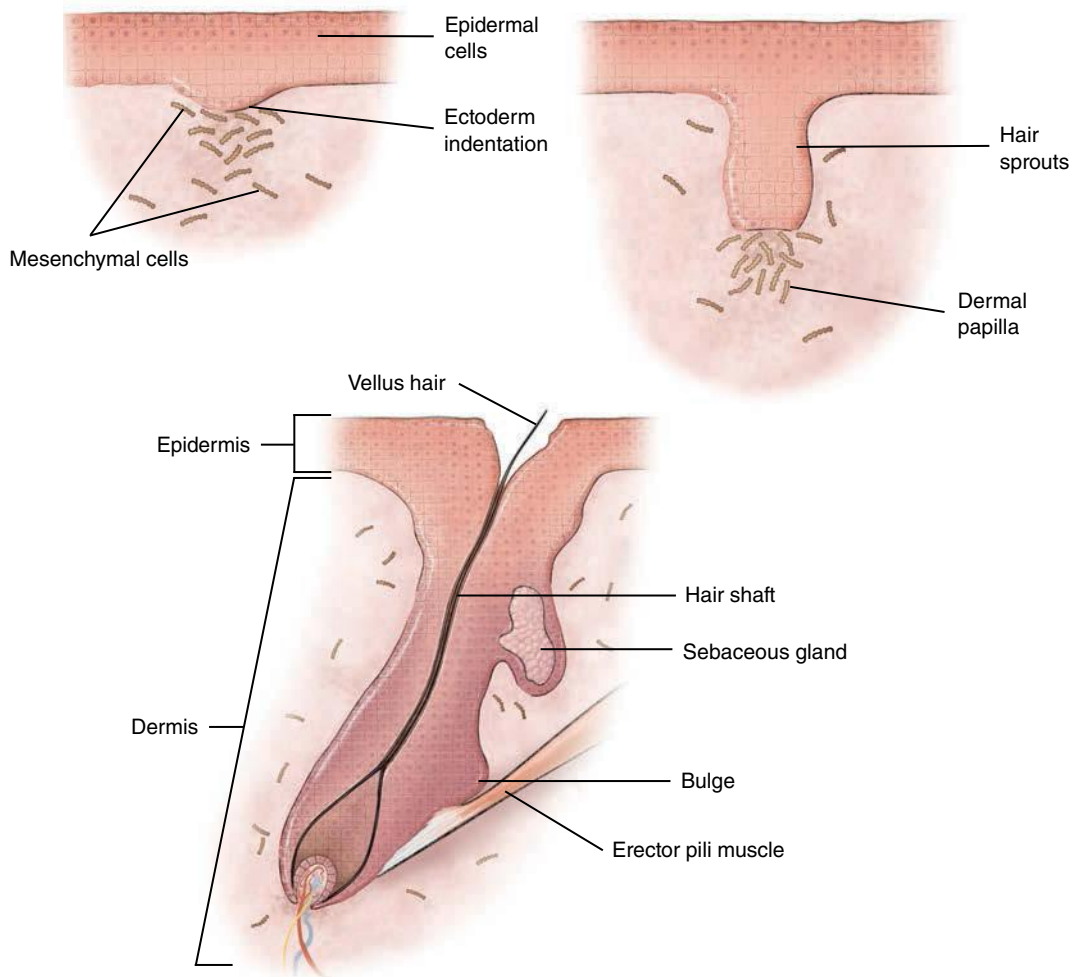
## TYPES OF HAIR

Although all human hair has the same basic structure, it varies considerably in size, shape, and density, depending on its location and stage of development. Hair shafts are mainly composed of fibrous alpha-keratin proteins. Two types of hair shafts are recognized:

1. *Vellus hairs* are the soft, hypopigmented, unmedullated, almost invisible hair seen on the forehead. These hairs are less than 0.03 mm in diameter and less than 1 cm in length. Vellus hairs spread over the body surface and are difficult to see without appropriate magnification.
2. *Terminal hairs* are longer, coarser, and of variable pigment. They characterize the adult years and exceed 0.06 mm in diameter and 1 cm in length. Subtypes of terminal hair are found on the scalp, eyebrows, upper lip, chin, axillae, chest, and pubis.<sup>1</sup>

Roughly 5 million hair follicles cover the human body at birth. It is generally accepted that new follicles cannot develop in adult skin, although the size of the follicles can change with time, primarily under the influence of androgen hormones. For example, in adolescent males facial vellus hairs may turn into the terminal hairs of the beard and mustache. In contrast, terminal hairs on the scalp may turn into thin vellus hairs in men with male pattern baldness and in women with androgenetic alopecia.

## HAIR FOLLICLE DEVELOPMENT



Embryogenesis of capillary unit by interaction of mesenchymal and epidermic cells, and generation of the hair sprout with all histologic structures

Hair grows from follicles, which are stockinglike invaginations of the superficial epithelium. In an embryo, the hair follicles originate from both ectoderm and mesoderm in the third gestational month and continue to develop over the next 3 months. The first morphologic sign of hair follicle development is the appearance in the fetal epidermis of regularly spaced thickenings of epithelial cells known as *placodes*. The placodes signal the underlying mesenchyme to form a cluster of cells called the *dermal condensate*, which will develop into the dermal papilla. The proliferation and growth of placode cells into the dermis will form a primitive *hair germ*. Along the length of this primitive follicular epithelium, two bulbous protuberances are formed: the upper protuberance will give rise to the sebaceous gland, and the lower one, also known as the *bulge region*, coincides with the insertion site of the erector pili muscle. The bulge region has lately attracted considerable attention because it is the main reservoir of cutaneous stem cells.<sup>2</sup>



## Primitive Hair Follicle



A longitudinal section of fetal skin of 21 weeks' gestational age stained with hematoxylin and eosin is shown. Note the two protuberances of the follicular epithelium: the upper one develops into the sebaceous gland, and the lower one, known as the bulge, is the insertion site of the erector pili muscle.

The cells that form the hair matrix and the melanocytes are of ectodermal origin. The melanocytes produce the color granules in the central, hollow core of the hair shaft that give hair its natural color. The cells from the matrix divide and are pushed upward; they are continuously replaced by new cells forming beneath them.