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The Scar Book

**Formation, Mitigation,
Rehabilitation, and
Prevention**

**Andrew C. Krakowski, MD
Peter R. Shumaker, MD**



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Prevention**

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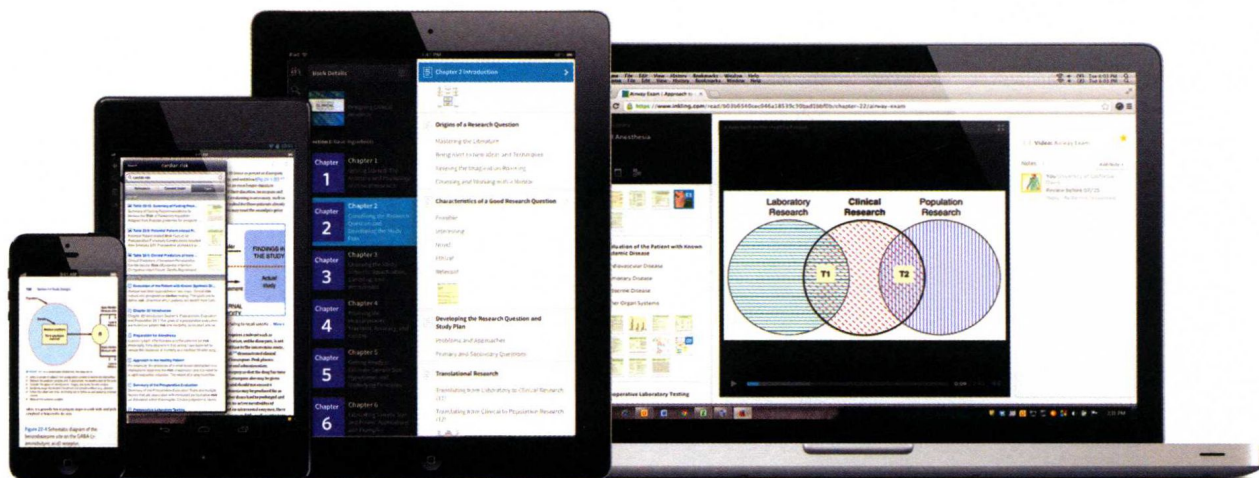
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Krakowski

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To my mother, Carol, my father, Frank, and my sister, Lauren . . . thank you for inspiring me to want to care for others and for teaching me what it means to lead by example. I am sorry for any scars I may have caused along the way.

To my greatest love, Carlisle, and to my greatest hope, Nathaniel and James . . . together, you are my life. Thank you for supporting/enduring me through this crazy endeavor. I love you more than you can possibly ever know. Yes, Nate, even bigger than the sky is blue!

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To all the hard-chargers who have given me the privilege of caring for them, and who constantly inspire me to do more.

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The roots of this book are nourished in the soil of collaboration. Few entities permeate medicine and impact as many people worldwide as scars and fibrosis, and no medical specialty is completely absolved of responsibility for the creation, or in managing the consequences, of scars. Reams of new information on scar pathophysiology and treatment are generated every year, but in our view, progress in scar management is impeded by the compartmentalization of the information by discipline and location. Thus, one of the primary objectives of the inaugural edition of *The Scar Book* is to aggregate a multitude of different perspectives into a single comprehensive source. It is an ambitious effort to help advance collective knowledge and discovery by remaining focused on the condition; a compendium of the state of the art in scar formation, treatment, and research, presented by many of the world's foremost experts.

The contributors to *The Scar Book* represent at least 10 different disciplines practicing in 7 different countries on 4 continents across the entire spectrum of care. They include thought leaders and inventors; past, present, and future Academy and Society presidents; institutional leaders and prolific authors and investigators. Many of the names will be readily recognizable to practitioners in their own respective fields, but perhaps as-yet little known in others. That is part of the point—we have much to learn from each other, and optimal care will arise from a combined approach. Whether one is helping to alleviate the burden of scars at an academic burn center or treating acne scars in the private practice setting, we hope this text offers a fresh perspective and a path forward.

We began our own earnest journey into scar management more than 8 years ago, lasers in hand. As happens so often in medicine, the observation that a judicious laser-mediated injury could help remodel a debilitating traumatic scar to a more functional and cosmetically appealing state was based largely on serendipity. It was not intuitive that reinjuring a traumatic scar in a specific way could help normalize its structure and function. Most of the lasers commonly used in scar management today were initially designed for other, often cosmetic, purposes; it required some astute observers (several of whom are contributors to this book) to turn observations into applications. Thus was the genesis of a new thread of exciting research, and the beginning of a stimulating new phase of our careers. Of course, laser treatment is just one small facet of scar management—but one that we have been eager to exchange with our colleagues for the benefit of our patients.

The textbook is divided into five sections—*Perspectives*, *Formation*, *Mitigation*, *Rehabilitation*, and *Prevention*—each highlighting a different aspect of wound healing, scar management, and research. *Perspectives*, as the name suggests, helps to introduce the current scope of the problem. Insights into the present state of trauma rehabilitation, reconstruction, and scar management are gained by learning about the past. A wide variety of medical conditions present with scars and scarlike lesions. A consideration of the similarities and differences in pathogenic pathways will undoubtedly direct future efforts in treatment and prevention. This section concludes by describing some of the ethical principles that serve to guide decision making by patients and providers in our current state of knowledge, and will help to inform future decisions fortified by new discoveries.

Formation addresses the biologic processes that begin with cutaneous injury and eventuate in normotrophic, hypertrophic, and atrophic scars. *Mitigation* introduces interventions that help to expedite wound healing after injury. *Rehabilitation* contains the largest number of chapters and reviews the current state of the art in scar management from a wide variety of perspectives. The words “mitigation” and “rehabilitation” may seem to have similar meanings. In the text, *Mitigation* is primarily dedicated to concepts that may help reduce the burden of scars as they form, and *Rehabilitation* to improving and managing the many sequelae of existing scars.

Rehabilitation includes chapters devoted to both “medical” and procedural interventions, but these divisions are indistinct. Medical management in this setting connotes primarily nonsurgical treatments (not involving “cold steel”), but actually includes a variety of minimally invasive procedures such as intralesional injections, laser, and radiation. Despite excellent new options in scar treatment, surgical scar revision remains a foundation of comprehensive care. The symptoms of pain and itch receive special attention owing to their potentially overwhelming impact on the quality of life of scar patients. Laser treatment and autologous fat grafting are highlighted given their enormous promise in scar management, and clues to future treatments may lie in further elaboration of their mechanisms of action. Since most providers employ a combination of

techniques and see patients from a variety of backgrounds, a degree of overlap (and perhaps even contradiction) is expected. *Rehabilitation* includes chapters that help synthesize the information based on treatment combinations and skin type, and the nearly universal nature of atrophic scars such as striae and those that follow inflammatory acne merit a dedicated discussion.

The number and range of chapters in *Rehabilitation* should be an indication that we need not, and probably should not, attempt to go it alone in the face of physically and cosmetically debilitating scars. Additional chapters describe the enormous value of a comprehensive program of therapy (e.g., physical and occupational) and an accounting for the psychosocial aspects of recovery from traumatic injury—the hidden scars. Other contributions introduce options for scar camouflage and medical tattooing as important adjuncts to reconstruction. The editors have benefited immensely from practice environments conducive to interdisciplinary and interinstitutional cooperation and are cognizant of the potential synergy of combined efforts. Therefore, we have included chapters highlighting our own experience (and that of our colleagues) from the military and pediatric settings. The final chapter in the section elaborates on some of the practical aspects of integrating novel scar treatments into clinical practice.

As noted by multiple authors, the ultimate goal for wound healing is tissue regeneration, not the reparative processes that eventuate in a scar. Despite the section name “*Prevention*,” the only way to prevent a scar in our current state of knowledge is to avoid significant injury. Equally as important as learning what to do for a scar is learning what NOT to do to avoid a scar, or to avoid exacerbating an existing scar. Selecting the name “*Prevention*” for the final section reflects optimism that a route to regenerative therapy will ultimately be found through ongoing research efforts. We all were capable of regenerative healing during early fetal development, but that capacity is sacrificed in the name of evolutionary compromise. Tantalizing clues to regenerative healing may therefore lie in the study of human fetal wound healing and in the regenerative capacity of other species. Since future advances obviously rely on ongoing discovery, scar-related research is discussed.

Embracing scar management into our own practices has been endlessly rewarding for multiple reasons. Scars, regardless of their origin or size, can be physically and emotionally devastating for the myriad patients affected by them. We currently have access to an array of effective tools and techniques that have the potential to incrementally improve the lives of our patients after virtually every encounter. It is no secret that these interventions are all too frequently imperfect, but the accelerating pace of innovation promises better treatments in the future. The ubiquitous nature of scars has also provided a vehicle for professional engagement with a wide variety of experts in other disciplines. Our common endeavor to share knowledge and better treat our patients was the inspiration for this book.

Peter R. Shumaker
Andrew C. Krakowski

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To our contributing authors . . . May the blood, sweat, and tears that you poured into this textbook inspire the next generation of physician-scientists and help relegate the morbidities associated with scarring to that of a distant memory.

From Andrew Krakowski:

To my East Coast mentors, Bernard Kaplan and Albert Yan . . . thank you for connecting me to the right people and for motivating me to be a lifelong "learner."

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From Peter Shumaker:

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