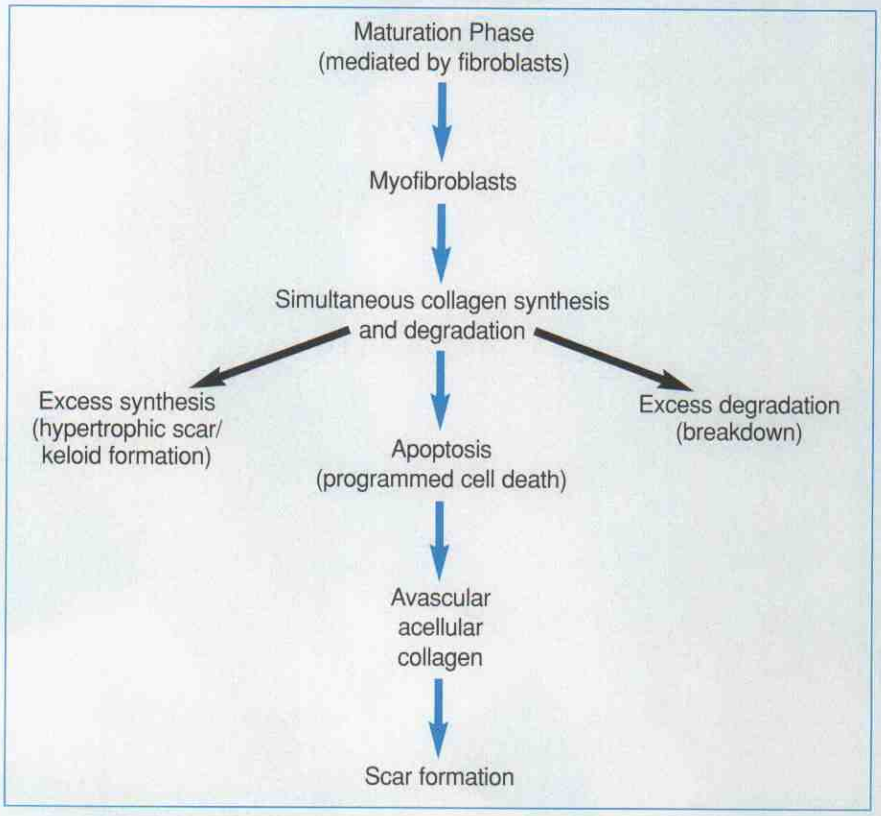
The Wound Healing Process: Part III – The Finale

Cynthia A. Worley

The final movement of a symphony is where "it all comes together." The *finale* weaves all the musical themes and textures experienced in the earlier movements, then molds them into a final musical declaration. The result can produce a variety of responses from the audience; from bringing the listeners to their feet in appreciation of the composer's genius to leaving them emotionally wrenched by its sheer musical beauty and impact. But remember, the impact of the finale is a result of the response to all the movements. And, thus it is with wound healing.

The final movement of the wound healing process is the *maturation* or *remodeling* phase (see Figure 1). This phase can continue for up to 1 year after complete re-epithelialization. During *proliferation* (2nd movement), three processes occur: collagen matrix formation, neoangiogenesis, and wound contracture (Worley, 2004).

Figure 1.
Maturation Phase



Renewal and Reorganization

In maturation, the predominant process is collagen renewal and reorganization. Degraded collagen is replaced with new collagen and soon forms fibrillar bundles. The collagen bundles provide stiffness and tensile strength to the repaired wound. The fibroblasts (woodwind section in 2nd movement) differentiate into myofibroblasts with resultant *apoptosis* (programmed cell death). The resulting "scar" is an avascular, acellular area mass of collagen which serves to fill in the defect and provide for some tissue continuity and tensile strength. The strength of the scar tissue remains less than that of normal skin (about 70%-80%) and is never fully restored.

An imbalance between matrix synthesis and breakdown can result in improper wound healing. Increased synthesis can result in hypertrophic scarring or keloid formation. Increased degradation will result in breakdown of the wound.

The Wound Healing Composition

You may have been wondering, "Why compare the wound repair process to a musical composition"? I have several, slightly twisted reasons.

First, wound healing is a very complex biochemical process (Cohen, Diegelmann, & Lindblad, 1992). In the past 20 years, many growth factors, cytokines, proteoglycans, matrix metalloproteinases, and other components have been identified (and they are legion). Many new factors and substances involved in the healing process are discovered every year. We just "scratched the surface" (if you'll pardon the pun) in this column. I thought up the symphony idea years ago when I first started educating nurses about the different cells and substances involved in wound healing. It seemed an easy way to explain some of these complexities.

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sory was issued after deaths or other significant risks were reported.

The FDA confirmed three deaths due to the use of lindane, which relate to the use of the product not in accordance with its label, including multiple topical applications and oral ingestion. Toxicity was confirmed in a child and was diagnosed in an adult. The third death was an adult who ingested the shampoo to commit suicide. Fourteen more deaths were associated with lindane but were not confirmed. All deaths occurred when lindane was applied topically, and in nine cases the drug was not used according to labeled instructions.

According to Craig Burkhart, MD, a Toledo, Ohio-based dermatologist who has conducted extensive research on products for lice and scabies, the "more practical concern is for general side effects to the central nervous system." These side effects could occur from increased percutaneous absorption in damaged skin, misuse, overuse, or accidental ingestion. The FDA determined that lindane products have benefits that outweigh the risks when used as directed.

PEDIATRIC DERMATOLOGY UPDATE

Children At Risk for Developing Peanut Allergy

The use of skin creams containing peanut oil to treat diaper rash, eczema, or other inflammatory skin conditions in babies may lead to peanut allergy in childhood, according to an article in the April 2003 issue of *Dermatology Times*. The prevalence of peanut allergy in children has increased over the last few years, but the factors contributing to allergic sensitization have not been well defined.

Analysis of data from ALSPAC, an ongoing study of nearly 14,000 children born between April 1, 1991 and December 31, 1992 in Avon, England, found that risk factors for the development of peanut allergy in childhood were occurrence of eczema or other severe skin rashes in early childhood, treatment with topical skin preparations containing peanut oil, exposure to soy protein in infancy, and family history of peanut allergy. In the study, children with peanut allergy were significantly more likely than control children to have had oozing, crusted rash, or rash over joints and skin creases as infants. Regression analysis indicated that peanut allergy was significantly associated with consumption of soy-based products in infancy.

Wound Assessment

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Second, a symphony is a group name for several smaller pieces of music. Each movement can be different from the other; for example, fast, slow, loud, soft, etc. Each movement portrays a different mood or scene, much like the differences very visible in wound healing. Each phase has different characteristics, a different look.

Third, music is science and art. It is *science* because it is exact and specific. A musical score is a chart and a graph, which indicates sound with exact control of time. Music is *art* because it contains the mathematical, historical, and physical and allows a human being to take all these elements and use them to create emotions and express feelings (Wisconsin Music Teachers Association Newsletter, 1988).

The wound healing process is pure science and art and the clinician pure artist.

References

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