Nails have served our species well since the dawn of mankind, but fingernails are frequently traumatized functioning as tools. When man adopted closed shoes, the toenails were exposed to a generally warmer, moister atmosphere. Though shoes protect the nails from some trauma, ill-fitting shapes also damage the nail. Irritant environmental factors that cause nail damage may be categorized as mechanical, physical, chemical, and biologic. Frequently these factors act together to irritate the nail unit. Four keratinizing components of the nail unit are: posterior nail fold, nail matrix, nail bed, and hyponychium. Injuring any component may result in change in appearance of the horny nail plate. Irritant hand dermatitis from any cause involving nail folds or fingertips may cause nail changes. Isomorphic responses (Koebner phenomena) due to irritant reactions can subsequently lead to psoriasis or lichen planus of the nails.

### 10.1 Mechanical Irritation

#### 10.1.1 Recreational

Splinter hemorrhages form when blood leaks from the longitudinally oriented blood vessels of the nail bed and on some occasions, are related to trauma. More noticeable are the subungual hematomas that result from trauma. Athletes participating in sports such as tennis or track, commonly develop hematomas below the toenails.

Nail biting, tics, or habits of fiddling with nails at their base can cause injury to the matrix and produce nail plate dystrophies [1]. Chronic trauma from faulty ambulatory biomechanics can result in nail plate hypertrophy, subungual corns, ingrown toenails, and onychogryphosis [2]. Some cases of longitudinal melanonychia form from footwear causing friction, but frequently this diagnosis requires a biopsy to differentiate it from melanoma [3].

#### 10.1.2 Occupational

Acute injury with a tool such as a hammer can cause nail dystrophy and even permanent destruction, but this diagnosis is usually obvious. Nail dystrophy caused by repeated minor trauma is frequently not recognized. Distal onycholysis was reported in a chicken-processor who plucked the chickens with his bare fingers [4]. Mushroom growers who lift heavy plastic bags also develop onycholysis frequently accompanied by koilonychia, nail splitting, and splinter...
hemorrhages [5]. Koilonychia attributed to trauma has been reported in toenails of rickshaw pullers [6], and fingernails in a pin threader [7], a coil winder [8], and car mechanics [9]. Beau's and Mees' lines have both been observed caused by trauma [10].

10.1.3 Cosmetic

Manicures may include removal of remnants of nail polish, shaping the nail plate, and pushing back cuticle off the nail plate and/or clipping it. Rigorous attacks on the cuticle with instruments can temporarily injure the distal nail matrix below resulting in leukonychia striata [11], and in some cases permanent nail deformity [12]. Cuticle destruction leads to paronychia and nail plate dystrophy. Vigorously cleaning debris and dirt below the distal free end of the nail plate with sharp instruments injures the hyponychium causing onycholysis. Nails that are buffed too vigorously become transversely grooved [13].

10.1.4 Miscellaneous

Challenges to the clinician's acumen arise when nail hemorrhages are noted in a seriously ill patient unable to provide a history to designate the cause as trauma rather than bacterial endocarditis. In a reported example, a neurologist's maneuver of pushing the base of the nail with a pen to prompt a pain response in a comatose patient resulted in puzzling subungual hematomas. An observant nurse's history led the dermatologists to the correct conclusion about the traumatic origin [14].

10.2 Physical Agents

10.2.1 Irradiation

The nail plate is rather resistant to ultraviolet light damage. However, patients who ingest photosensitizing drugs, such as the tetracyclines, followed by intense ultraviolet light A (UVA) exposure, develop photo onycholysis. Inadvertent exposure to microwave radiation in two snack bar employees was implicated in the development of Beau's lines [15]. Chronic, small, irregular, occupational X-ray exposure has been noted to cause the nails to become brittle and crack easily [16]. In the example of koilonychia in a pin threader sited above under mechanical injury, local heat was also involved in the working conditions and was a contributory factor [7].

10.2.2 Foreign Matter

Barbers and hairdressers may have the skin of their fingertips or hyponychium invaded by small pieces of hair, and these foreign bodies cause onycholysis. Similar injury to the posterior nail fold causes paronychia to form. Onycholysis develops with penetration of thorns, splinters, bristles, fibrous glass, and pieces of metal in other occupations [17]. Granulomatous lesions and split nail deformities develop from penetrating wounds from sea urchin spines in fishermen and divers.

10.2.3 Moisture

Immersion of the hands in liquid that leads to maceration of the skin of the posterior nail fold ultimately predisposes to chronic paronychia. Many occupations require immersion of the hands or conditions which keeps the hands moist—custodians, cooks, kitchen helpers, health care workers, and housewives to name only a few. Invasion of the posterior nail fold by microorganisms can follow, leading to chronic inflammation. Kern discusses the early occupational diseases literature, which showed that immersion accompanied by mild trauma also leads to onycholysis [19]. In 1931, in a ketchup bottling plant, workers who removed excess glue from bottles immersed in warm water by picking it off with their fingernails developed onycholysis within 48 h. As with washerwomen, observed previously, the combination of water immersion and trauma led to nail changes. Irritant reactions of the nail often involve different combinations of mechanical, chemical, physical, and biological injuries.

The role of hydration in the development of onychoschizia (lamellar dystrophy) has been studied experimentally by soaking pieces of nail plate in liquid. Onychoschizia was produced by successive hydration and dehydration of these pieces of nail over 3 weeks but not by hydration alone [20].

10.3 Chemical

10.3.1 Medicinal

Irritant concentrations of chemicals are used for therapeutic purposes. By applying 40% urea paste under occlusion to the nail plate, South and Farber refined a technique for nonsurgical avulsion of dystrophic toenails [21]. The paste is occluded for 7 days. Application of the dressings requires exquisite care so the