five-day urine analysis. Only parathion was tested on the scrotum; this anatomical location proved most penetrable of all sites tested and was 11 times more penetrable than the forearm. Malathion was placed on the forearm, palm, ball of foot, abdomen, hand dorsum, forehead, and axilla. Of all locations, malathion was most penetrable in the axilla (Table 12.2). Carbaryl was tested on the forearm and jaw angle; however, it was nearly completely absorbed at both sites (Table 12.2) (16).

12.3.1.6 1-OH Pyrene

VanRooij and colleagues (17) determined urinary excretion of 1-OH-pyrene, a metabolite of pyrene (a PAH), from application of PAH to a variety of anatomic locations. There were no significant differences in urinary 1-OH-pyrene metabolite excretion in urine based on body location (Table 12.1); however, there was a significant difference in the duration of time needed to excrete half of the total amount between those anatomic sites (17).

12.3.2 Stripping Methods

12.3.2.1 Estrogen and Testosterone

Oriba and colleagues (12) performed a tape-stripping study on premenopausal and postmenopausal females. Radiolabeled estrogen and testosterone were applied to the mid-labium majus and the ventral forearm, with protective chambers positioned over the application sites for 24 hours. The sites were cleaned at 24 hours, and a covering was placed over the application sites for an additional six days. In premenopausal women, the tape-stripped forearm stratum corneum contained significantly more hydrocortisone than that measured from the vulva. The tape-stripping method retrieved no testosterone from either the vulva or forearm (12). This potentially suggests that testosterone was energetically metabolized by enzymes in the stratum corneum.

12.3.2.2 4-Cyanophenol and Cimetidine

Tsai and colleagues (18) studied 4-cyanophenol (CP) and cimetidine (CM) to determine their permeability through the stratum corneum. CP was applied to the skin for 10 to 15 minutes and CM for three to five hours. At the end of the application periods, patches were removed and skin cleaned, followed by the stripping method and attenuated total reflection–Fourier-transform infrared (ATR-FTIR) spectroscopy of the tape strips. Permeability of both CP and CM was variable among five anatomic sites chosen in the study. CP permeability in descending order was as follows: back, forearm, thigh, leg, and abdomen. Permeability of CM in descending order of anatomic sites was as follows: back, forearm, thigh, leg = abdomen (Table 12.4) (18).

Tsai and colleagues (19) also investigated the effects of sebum production on percutaneous absorption by comparing absorption of CM from the forehead to the forearm and found the forehead absorbed four times more chemical. When they removed sebum from the forehead, there was 22% less absorption from that site. After they supplemented the forearm with sebum, over three times more absorption occurred at that site (Table 12.4) (19).

12.3.3 Fiber-optic Luminoscope Methods

12.3.3.1 Polycyclic Aromatic Hydrocarbons

VanRooij and colleagues (17) determined the percutaneous absorption of polycyclic aromatic hydrocarbons (PAH) from coal tar ointment placed on various body regions via fiber-optic luminoscope measurements/fluorescence detection of the chemicals on and within the cutaneous barrier. They found small, yet significant, variations in skin surface absorption of PAH based on body region (Table 12.3). Eleven PAHs were present in the coal tar, determined by fluorescence detection data in combination with high-performance liquid chromatography (17). The regional differences were much less than in other studies involving hydrocortisone or benzoic acid.