enzymological processes to separate the membranous layers of the stratum corneum from whole skin (7, 8). However, it is time consuming and in some cases difficult to control the size and thickness of a sheet of stratum corneum. Moreover, it is often difficult to locate a suitable skin source.

Powdered human stratum corneum (PHSC) prepared from callus (sole) is thus substituted for the intact membranous stratum corneum. Podiatrists routinely remove and discard PHSC from the human foot, so it is easily obtained. The callus can be cut easily and quickly into smaller pieces and ground with dry ice to form a powder. In our laboratory, PHSC particle sizes between 180 and 300 μm were selected with the aid of a suitable sieve. Because a corneocyte is only about 0.5 μm thick and about 30 to 40 μm long, the selected PHSC contains both intact corneocytes and intercellular medium structures and thus retains its original physical-biochemical properties. Moreover, the greater surface area of the PHSC enhances solute penetration. In a typical experimental procedure, a test chemical in a transport vehicle—water—is mixed with the PHSC and the mixture is incubated. After a predetermined period, a solution is separated from the PHSC by centrifugation and samples are measured (9).

This chapter reviews PHSC as an in vitro model for studying chemical interactions with human skin, with reference to studies conducted in our laboratory over the last decades. The results demonstrate that PHSC (callus) offers an experimentally easy in vitro model for the determination of chemical partitioning into the SC and may be useful in many skin research areas.

5.2 PHSC AND PHYSICAL-CHEMICAL PROPERTIES OF THE STRATUM CORNEUM

The callus is derived from human stratum corneum (SC) and thus should retain some of its physical and chemical characteristics (10). SC lipid plays an important role in the determination of skin functions. However, the average lipid content of the SC varies regionally, from 2.0, 4.3, 6.5 to 7.2 wt.% of dry SC from plantar, leg, abdomen, and face, respectively (11). Table 5.1 shows that the average lipid content of the dry PHSC samples derived from various regions were 2.29 and 0.25 wt.% after extraction. This result is consistent with that in human plantar, as determined by Lampe et al. (11).

The water content of the SC is of importance in maintaining SC flexibility. Three possible mechanisms of water absorption and/or retention capacity of the SC have been suggested: (1) Imokawa et al. (12) suggested that SC lipids play a critical role because their removal by the application of

TABLE 5.1
Lipid Content and Water Uptake of Powdered Human Stratum Corneum (PHSC)

Stratum Corneum Source	Lipid Content (% w/w dry PHSC)	Water Uptake (μg/mg dry PHSC)			
			Delipidized PHSC		
		Untreated PHSC	Lipid[a]	Protein[b]	Total
1	2.38	495.85	26.44	452.40	478.84
2	2.21	452.49	39.26	364.96	404.22
3	2.39	585.62	23.09	498.40	521.49
4	2.69	554.27	40.05	492.31	532.36
5	2.08	490.04	49.86	363.30	413.16
6	2.01	381.61	14.82	324.18	339.00
Mean	2.29	493.31	32.26	415.92	448.18
SD	0.25	72.66	12.97	74.50	75.47

[a] Lipid part extracted from the PHSC.
[b] Remaining part of the PHSC after lipid extraction.