an otherwise distasteful oil by dispersing it in a sweetened, flavored aqueous vehicle. The reduced particle size of the oil globules may render the oil more digestible and more readily absorbed or, if that is not the intent, more effective in its task, as for example, the increased efficacy of mineral oil as a cathartic when emulsified.

Emulsions to be applied to the skin may be o/w or w/o, depending on such factors as the nature of the therapeutic agents, the desirability for an emollient or tissue-softening effect, and the condition of the skin. Medicinal agents that irritate the skin generally are less irritating in the internal phase of an emulsified topical preparation than in the external phase, from which direct contact with the skin is more prevalent. Naturally, the miscibility or solubility in oil and in water of a medicinal agent dictates to a great extent the vehicle, and its nature in turn suggests the phase of the emulsion that the resulting solution should become. On the unbroken skin, a w/o emulsion can usually be applied more evenly because the skin is covered with a thin film of sebum, and this surface is more readily wetted by oil than by water. A w/o emulsion is also more softening to the skin because it resists drying and removal by contact with water. On the other hand, if it is desirable to have a preparation that is easily removed from the skin with water, an o/w emulsion is preferred. Also, absorption through the skin (percutaneous absorption) may be enhanced by the diminished particle size of the internal phase. Other aspects of topical preparations are discussed in Chapters 10 and 11.

Theories of Emulsification

Many theories have been advanced in an attempt to explain how emulsifying agents promote emulsification and maintain the stability of the emulsion. Although certain of these theories apply rather specifically to certain types of emulsifying agents and to certain conditions (e.g., the pH of the phases of the system and the nature and relative proportions of the internal and external phases), they may be viewed in a general way to describe the manner in which emulsions may be produced and stabilized. Among the most prevalent theories are the *surface tension theory*, the *oriented-wedge theory*, and the *plastic* or *interfacial film theory*.

All liquids have a tendency to assume a shape having the minimal surface area exposed. For a drop of a liquid, that shape is the sphere. A liquid drop has the shape of a sphere. It possesses internal forces that tend to promote association of the molecules to resist distortion of the sphere. If two or more drops of the same liquid come into contact with one another, the tendency is for them to join or to *coalesce*, making one larger drop having a smaller surface area than the total surface area of the individual drops. This tendency of liquids may be measured quantitatively, and when the surrounding of the liquid is air, it is referred to as the liquid's surface tension. When the liquid is in contact with a second liquid in which it is insoluble and immiscible, the force causing each liquid to resist breaking up into smaller particles is called interfacial tension. Substances that reduce this resistance encourage a liquid to break up into smaller drops or particles. These tension-lowering substances are *surface-active* (surfactant) or *wetting agents*. According to the *surface tension theory* of emulsification, the use of these substances as emulsifiers and stabilizers lowers the interfacial tension of the two immiscible liquids, reducing the repellent force between the liquids and diminishing each liquid's attraction for its own molecules. Thus, the surface-active agents facilitate the breaking up of large globules into smaller ones, which then have a lesser tendency to reunite or coalesce.

The *oriented-wedge* theory assumes monomolecular layers of emulsifying agent curved around a droplet of the internal phase of the emulsion. The theory is based on the presumption that certain emulsifying agents orient themselves about and within a liquid in a manner reflective of their solubility in that particular liquid. In a system containing two immiscible liquids, presumably the emulsifying agent is preferentially soluble in one of the phases and is embedded more deeply and tenaciously in that phase than the other. Because many molecules of substances upon