

# Mechanical Oscillation:

## *The theory behind the technology*

### Exfoliation

The SkinBella Exfoliation Function utilizes a piezoelectric device called the “bi-elastic blade” to produce mechanical oscillation. The pre-programmed exfoliation function produces micro-vibrations at frequencies as high as 26,000 cycles per second. These frequencies are above the limit of human hearing. The bi-elastic blade utilizes a piezoelectric quartz crystal to produce mechanical oscillation when an oscillating voltage is applied to it. These stress waves from mechanical oscillation transform the medium through which they are passing.

The waves cause the formation of vapor bubbles. These vapor bubbles occur in places where the liquid medium (in this case, liquid skincare products) has been accelerated to high velocities. The liquid ruptures and forms small cavities that expand as the pressure rises. As the pressure starts to fall the cavities collapse very rapidly. At the end of the collapse, the highly compressed gas within the cavity produces active vapor bubbles.

When applied to the skin with carefully controlled power and a peeling solution, the phenomenon provides efficacious exfoliation and cleansing. Rapid mechanical oscillation helps to safely detach and remove skin cells from the outer layers of the stratum corneum. This process provides for particle-free, gentle dermabrasion.

### Benefits of Mechanical Oscillation

SkinBella’s bi-elastic blade transmits vibrations called “elastic waves” (stress waves) at a frequency as high as 26,000 cycles per second to the skin and underlying tissues. The bi-elastic blade oscillates at high frequencies to provide the benefits of both the mechanical action and the thermal action. The benefits afforded by these actions include:

1. Exfoliation of dead skin cells
2. Extraction of debris and removal of sebum and makeup residue
3. Improved product penetration
4. Evening of irregularities

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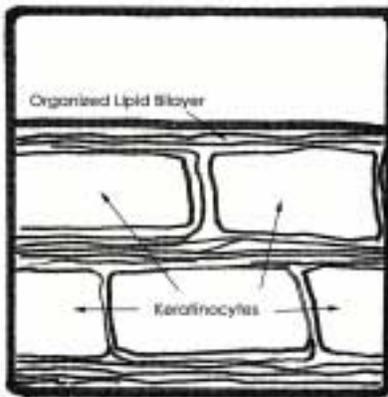
### Product Penetration

The stratum corneum is the outer layer of the epidermis. It is the protective layer that nature has created to interface with the environment, and it has a number of important functions.

1. Protection: It keeps out water, sunlight, germs, heat, cold, chemicals, and dirt.
2. Maintain Equilibrium: The underlying biochemistry of the skin works hard to keep a balance of temperature, pH, moisture content, etc. The stratum corneum provides a protective layer to help maintain this equilibrium throughout the many variations of the environment.

The stratum corneum does its job very well. It provides such an impenetrable barrier that in most cases it is virtually impossible to actually get topically applied product into the skin. Countless cosmetic products are being sold today with promises of “deep penetration,” and hundreds of other benefits, under the assumption that these products are actually getting through the epidermis when, in fact, most of them are not capable of doing so.

The stratum corneum consists of flat, dead skin cells filled with keratin fibers and surrounded by lipid bilayers. Lipids are water-insoluble, oily substances and include triglycerides, cholesterol and fatty acids. The skin cells in the stratum corneum layer are arranged in a brick-and-mortar configuration. Despite the fact that the stratum corneum is only about as thick as a sheet of paper, it confers high resistance to the transport of ions and molecules in and out of the human body. The highly ordered structure of the lipid bilayers (shown at left) is the key to the highly impermeable character of the stratum corneum.



### The Solution

Recent research has shown promising results for high frequency mechanical oscillation devices in enabling molecules to penetrate the protective shield of the stratum corneum. A high frequency device utilizing

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frequencies in the range of 20 KHz is applied to the skin with fluid or a liquid coupling medium. The fluid or coupling *medium* facilitates the propagation of bubbles, which affects the permeability of the stratum corneum. Twelve to twenty-four hours after a session, the protective properties of the stratum corneum are fully restored.

High frequency mechanical oscillation is based on the observation that the effects of the vapor bubbles increase as the mechanical frequency is raised. The scientific theory for the effect of mechanical oscillation on the epidermis is that the vapor bubbles cause oscillation of the air pockets in the keratin fibers of the skin. The oscillations somehow disorganize the intervening lipid bilayers, which eases the flow of skincare products through the skin (as show in the diagram at right.)

