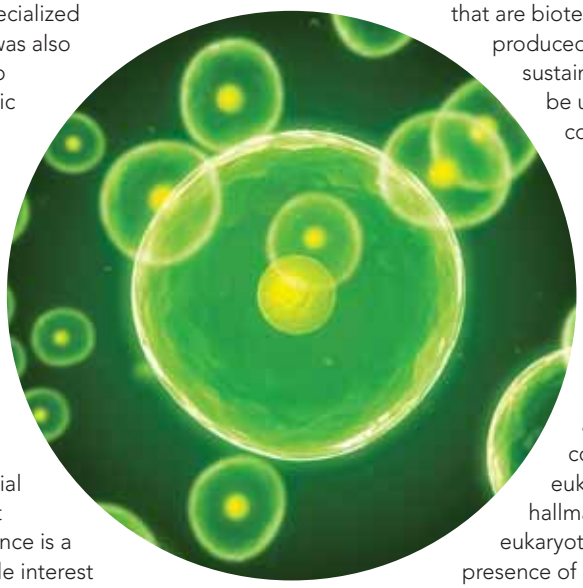
mibelle GROUP biochemistry

# Improving Skin Resilience with Moss Cell Technology

**MossCellTec™ is an innovative biotechnology that now makes it possible to benefit from the extreme resilience properties of moss. The resulting active ingredient MossCellTec™ No. 1 maintains cell nucleus health, a completely novel anti-ageing concept. Extensive studies have shown that MossCellTec™ No. 1 strengthens skin against urban aggressors and climatic changes for a more resilient skin**

About 470 million years ago mosses were one of the first plants that moved out of the water and conquered dry land. Mosses possess no vertical roots and have a high surface area which makes it difficult to replenish lost water and nutrients from the soil. Instead, mosses filter nutrients from the air and rain, which makes them susceptible to accumulated pollutants such as heavy metals. To cope with oxidative stress from pollution, mosses developed a particular anti-pollution matrix with a large set of antioxidants. The development of a specialized adaptation strategy was also needed for mosses to inhabit various climatic regions. They are masters in water retention, rehydration, fast recovery and cold resistance. It has recently been shown that mosses are even able to continue to grow after being frozen for 1,500 years in permafrost. The special mix of molecules that enables such a resilience is a matter of considerable interest for the cosmetics industry.



### MossCellTec™ – Biotechnology to grow moss sustainably in the lab

Although resilient, mosses grow slowly and are thus difficult to harvest in the wild. Additionally, wild mosses filter the air and retain toxins that prevents them from use for cosmetics. To harness their potential for cosmetics, an innovative biotechnology was developed to grow moss cells in a laboratory setting. Sterile cells of the wild-type moss *Physcomitrella patens* in liquid culture were produced. Additionally, a new cold pressing extraction method was established to harvest all water-soluble ingredients from the moss cells, which were then sprayed on an isomalt matrix resulting in the active MossCellTec™ No. 1. For the first time, moss cells that are biotechnologically produced in a clean and sustainable way can be used for cosmetics.

### Cell nucleus health – a novel anti-ageing concept

Higher organisms such as plants and animals are complexes of eukaryotic cells. A hallmark for eukaryotic cells is the presence of a cell nucleus. This organelle contains the DNA, the blueprint of the cell and is therefore considered the control centre of the cell. It is surrounded by a membrane called the nuclear envelope, which contains holes, the nuclear pores, through which traffic into and out of the nucleus takes place. Only small molecules can freely diffuse through the nuclear pore complexes; larger molecules such as proteins and messenger RNA complexes need to be actively transported to reach their destination. This transport process is highly complex: in a single human cell, there can be up to 5,000 nuclear pore complexes, and each can transport 1,000 molecules per second. This means that in one cell, up to 5 million molecules are transported into and out of the nucleus every second!

A timely transport of signaling molecules is crucial for the adaptation of cells to fast changes in temperature and humidity. This is especially true for skin cells which are in close contact with the environment. As we age, the transport becomes less efficient and less selective. This can lead to less resilient skin.

For many years it was believed that the function of the cell nucleus is merely DNA storage and that the nuclear envelope is just a container for the genetic material. This is far from the truth: recent research on premature ageing diseases has shown that the correct composition of the nuclear envelope is essential for the maintenance of nuclear shape, DNA stability, and regulated gene expression.

Maintaining the proper stability and shape of the nucleus, as well as ensuring an efficient transport into and out of the nucleus, can be summarized as the topic of *cell nucleus health*.

### MossCellTec™ No. 1 maintains cell nucleus health

To assess the ability of *Physcomitrella patens* to maintain cell nucleus health, the gene

expression of three nucleus health markers was determined in keratinocytes from an old donor which were treated or not (control) with *Physcomitrella patens* extract, and compared to keratinocytes from a young donor. It has previously been shown that the two nuclear-envelope-associated proteins Lamin A and LAP2B are downregulated in old skin, and are therefore suitable markers for skin ageing and nucleus health. Notably, RanBP17, a protein responsible for transport of protein cargo through the nuclear pore complex was shown to be downregulated in several aged cell types, including fibroblasts and neurons, and is therefore considered a universal ageing marker.

When comparing old and young keratinocytes, the reported downregulation of these three marker genes in old keratinocytes could be reliably reproduced. Treatment of old keratinocytes with *Physcomitrella patens* extract resulted in a concentration-dependent expression increase of the three marker genes LAP2B, Lamin A and RanBP17, compared to untreated old keratinocytes, closer to the expression of young keratinocytes. Therefore, treatment with the *Physcomitrella patens* extract has a rejuvenating effect on keratinocytes regarding cell nucleus genes.

### MossCellTec™ No. 1 improves skin adaptation to environmental changes

The timely and efficient adaptation of our skin cells to different environmental factors is important for a healthy and resilient skin. To test the influence of moss active on the ability of skin to adapt to climatic changes, 3D skin was incubated under different climatic stresses: hot/humid and cold/dry, to mimic the exposure of skin in different seasons and switching from heated/air-conditioned buildings to a different climate outside. Under these stress conditions, the dermal fibre structure was disorganized and collapsed, and fibre density was reduced. Furthermore, expression of the stress marker LCE1A increased. 3D Skin that was treated with 1% MossCellTec™ No. 1 did not display these drastic changes in dermal structure and gene expression of stress markers, and could therefore adapt more efficiently to these climatic stresses.

The efficacy of MossCellTec™ No. 1 was also tested in a placebo-controlled clinical study on a panel of Korean women who spent more than 2 hours per day outside in the summer in Seoul. After 14 days of treatment with 2% MossCellTec™ No.1, a significant improvement of skin hydration, TEWL and skin tone homogeneity compared to placebo was observed. The positive effect on skin tone homogeneity was also visible in photographs taken of the volunteers. Overall, despite stressful weather conditions, a skin improvement and improved skin adaptation to daily environmental changes were observed with moss active treatment.

These results show that MossCellTec™ No. 1 captured the resilient properties of moss through innovative biotechnology. MossCellTec™ No. 1 enables skin to adapt to environmental changes for a flawless complexion.

**Mibelle Biochemistry, Stand E30**