Ex vivo porcine ear model for space and time resolved determination of dermal penetration efficacy

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In classical dermal penetration studies, efficacy is typically assessed through either in vivo or in vitro methods. While in vivo tests are expensive and limited in their scope, in vitro tests can be misleading due to potential deviations from physiological conditions. The Marburg ex-vivo pig ear model addresses this challenge by utilizing pig skin, closely resembling human skin, in its original physiological state. The model, established in 2020, allows for accurate dermal penetration testing, by obtaining vertical skin cuts from skin biopsies of treated pig ear skin, that are visualized through epifluorescence microscopy and quantified using digital image processing [1-6].
Over the years, the Marburg ex-vivo skin model has proven to be highly sensitive. It not only serves to compare the dermal penetration efficacy of active compounds from different formulations but also excels in detecting small changes in biophysical skin properties—such as transepidermal water loss, skin hydration, and skin roughness—that may arise from dermal product treatments. With this, the model is not limited to assessing penetration efficacy; it can also evaluate the impact of formulations on various skin properties at the same time.
Using this model, we have successfully identified formulation principles and skin treatment methods, including microneedles or dermabrasion, that enhance the penetration of active compounds into the skin remarkably. Our findings also indicate that the process by which active ingredients enter the skin is more complex than current textbook knowledge suggests. To date, we have uncovered at least five previously unknown dermal penetration mechanisms [1-9], with the expectation of discovering more in the near future.

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