

*Solar spectrum UV, even at low doses applied to ex vivo human scalp, causes hair follicle damage that can be prevented with topical caffeine: Is UVR protection important for healthy hair?*

The team at Monasterium Laboratory GmbH has investigated the impact of UVR on hair follicles using a new scalp skin UV irradiation *ex vivo* assay. The results of this study, supported by DR. KURT WOLFF GMBH & CO. KG., Bielefeld, Germany, were published online on 11<sup>th</sup> Feb 2019 in the International Journal of Cosmetic Science<sup>1</sup> (<https://onlinelibrary.wiley.com/doi/abs/10.1111/ics.12521>). By employing an optimized, highly clinically relevant human scalp full thickness skin *ex vivo* organ culture model, the team reveals for the first time, that solar spectrum UV radiation (UVA+UVB) impacts on hair follicle homeostasis. As expected, both high and low UVA+UVB doses led to epidermal cytotoxicity and DNA damage. However, our study shows that hair follicles are also similarly affected! UVR induced oxidative DNA damage and cytotoxicity in human hair follicles, and decreased proliferation and promoted apoptosis in both outer root sheath and hair matrix keratinocytes, which stimulated catagen development. Molecular studies demonstrated that UVR regulated the expression of those growth factors that induce catagen and induced perifollicular mast cell degranulation. Such UVR-mediated hair follicle damage was more severe after irradiation with higher UVR doses and also reached deeper hair follicle compartments.

This suggests that healthy hair needs protection from UVR and we used our model to demonstrate the benefits of a widely used nutraceutical, caffeine, which is contained as a cosmetic ingredient in many hair care formulations. Topically applied 0.1% caffeine provided protection towards UVR-mediated follicle cytotoxicity and dystrophy, prevented keratinocyte apoptosis and protected against the effects of a catagen-promoting growth factor.

Our findings provide the first evidence that trans-epidermal UV radiation negatively affects important human hair follicle functions, suggesting that it is a sensible prophylactic strategy to integrate protective agents such as caffeine into sun-protective cosmeceutical and nutraceutical formulations.

This research also highlights the clinical relevance of our scalp skin UV irradiation *ex vivo* assay which is now available as a commercial pre-clinical test system at Monasterium Laboratory <https://www.monasteriumlab.eu/uv-damage.html>.

1. Gherardini, J. , Wegner, J. , Chéret, J. , Ghatak, S. , Lehmann, J. , Alam, M. , Jimenez, F. , Funk, W. , Böhm, M. , Botchkareva, N. , Ward, C. , Paus, R. and Bertolini, M. (2019), UV radiation on scalp skin surface induces scalp hair follicle damage *ex vivo* and is alleviated by the topical treatment with caffeine. Int J Cosmet Sci. Accepted Author Manuscript. doi:10.1111/ics.12521