Pre-clinical assay for predicting the impact of nutraceuticals and cosmeceuticals on human hair shaft quality

Partnership between:

MONASTERIUM LABORATORY
Skin & Hair Research Solutions

TRI Princeton
RESEARCH EDUCATION SERVICE

in-cosmetics global Rising Star Award 2019 Finalist

Our method: Human hair follicle organ culture ex vivo (Edelkamp et al., Methods Mol Biol. 2020, Langan et al., Exp Dermatol 2015)

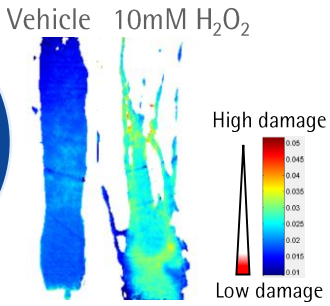
Stressor: H_2O_2 which is known to induce bleaching in the „dead" hair shaft and oxidative responses in the „living" hair follicle

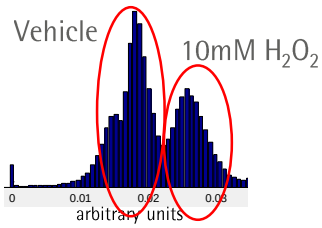
1. Peroxide treatment of hair follicles *ex vivo* induces dystrophy and tissue destruction, resulting in shedding of connective tissue sheath

Representative images of amputated hair follicle treated with vehicle or 10mM H_2O_2.

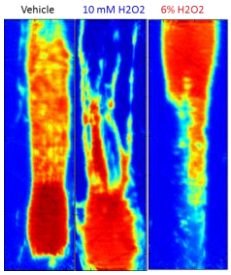
Vibrational Spectroscopy (ATR-FTIR Imaging): "Dead Hair" quality

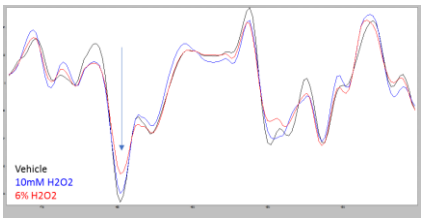
2. Peroxide treatment *ex vivo* leads to oxidative damage in the hair shaft and damage of α-helix structures





ATR-FTIR imaging of amputated hair follicle treated with vehicle or 10mM H_2O_2.



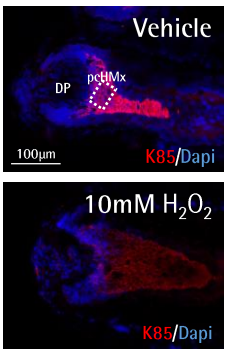


ATR-FTIR imaging and structural modification (α-helix) – Second derivative spectra of amputated hair follicle treated with vehicle, 10mM H_2O_2, or 6% H_2O_2.

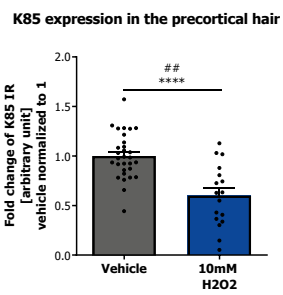
In addition: increase in overall lipid content and DNA in the hair shaft

Immunofluorescence and Immunohistochemistry: "Live Follicle" responses

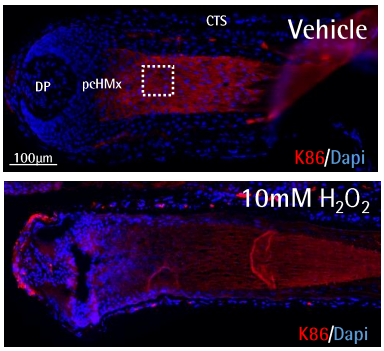
Peroxide treatment of hair follicles *ex vivo* decreases K85 expression in the pre-cortical hair matrix, K86 expression in the mid-to-upper hair cortex, and KRTAP3.3 expression in the inner root sheath



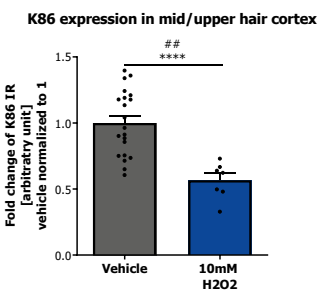
Representative images of K85 in HF after *ex vivo* treatment. DP: dermal papilla; pcHMx: precortical hair matrix.



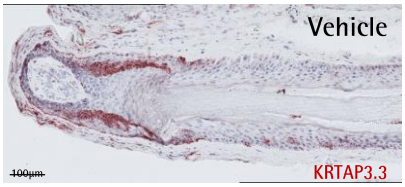
Pooled data from n = 17-30 HFs/group from 4-7 healthy donor. K85 expression was measured in the precortical hair matrix (demarcated area). Mean±SEM, ##p<0.01, ****p<0.0001.

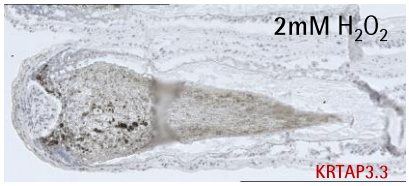


Representative images of K86 in HF after *ex vivo* treatment. CTS: connective tissue sheath; DP: dermal papilla; pcHMx: precortical hair matrix.



Pooled data from n = 7-21 HFs/group from 2-5 healthy donor. K85 expression was measured in the precortical hair matrix (demarcated area). Mean±SEM, ##p<0.01, ****p<0.0001.





Representative images of n = 15-26 HFs/group from 3-7 healthy donor.
CTS: connective tissue sheath; DP: dermal papilla; HS: hair shaft; IRS: inner root sheath

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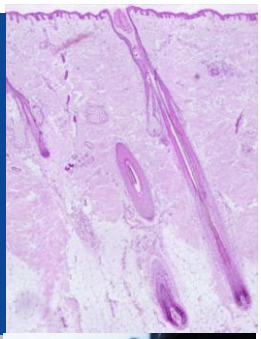

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