Effects of solar radiation on both skin barrier function and cutaneous oxidative stress using a reconstructed human epidermal model

Benedetta Petracca[a,b], Irini Dijkhoff[a,b], Barbara Rothen-Rutishauser[b], Marc Eeman[a]

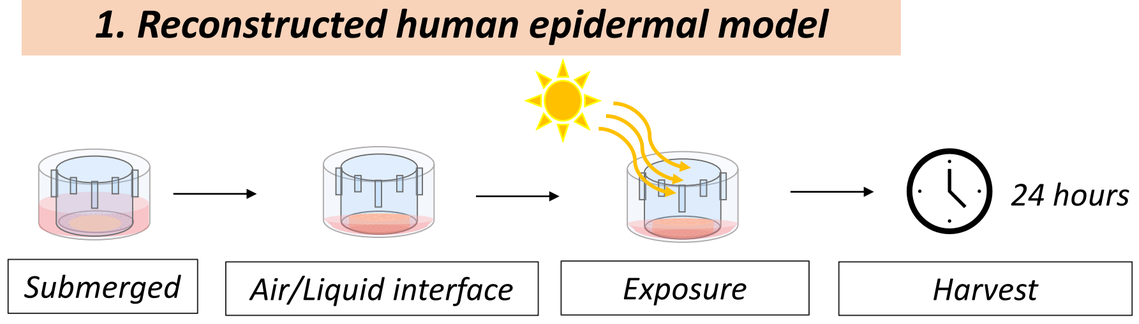
[a] Dow Silicones Belgium, Seneffe, Belgium; [b] Adolphe Merkle Institute, University of Fribourg, Fribourg, Switzerland

INTRODUCTION

The skin is the outside protective barrier against the external environment[1]. It is constantly exposed to pollutants such as ground level ozone (O_3), fine particles and solar radiation. A 3D *in vitro* reconstructed human epidermal model (RHE) is used to study how skin barrier functions are affected after exposure to solar radiation, O_3 and the combination of the two. This work highlights the preliminary results following the exposure of the RHE model to increasing solar radiation doses.

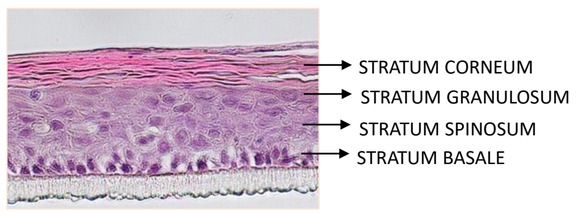
MATERIALS AND METHODS

1. Reconstructed human epidermal model

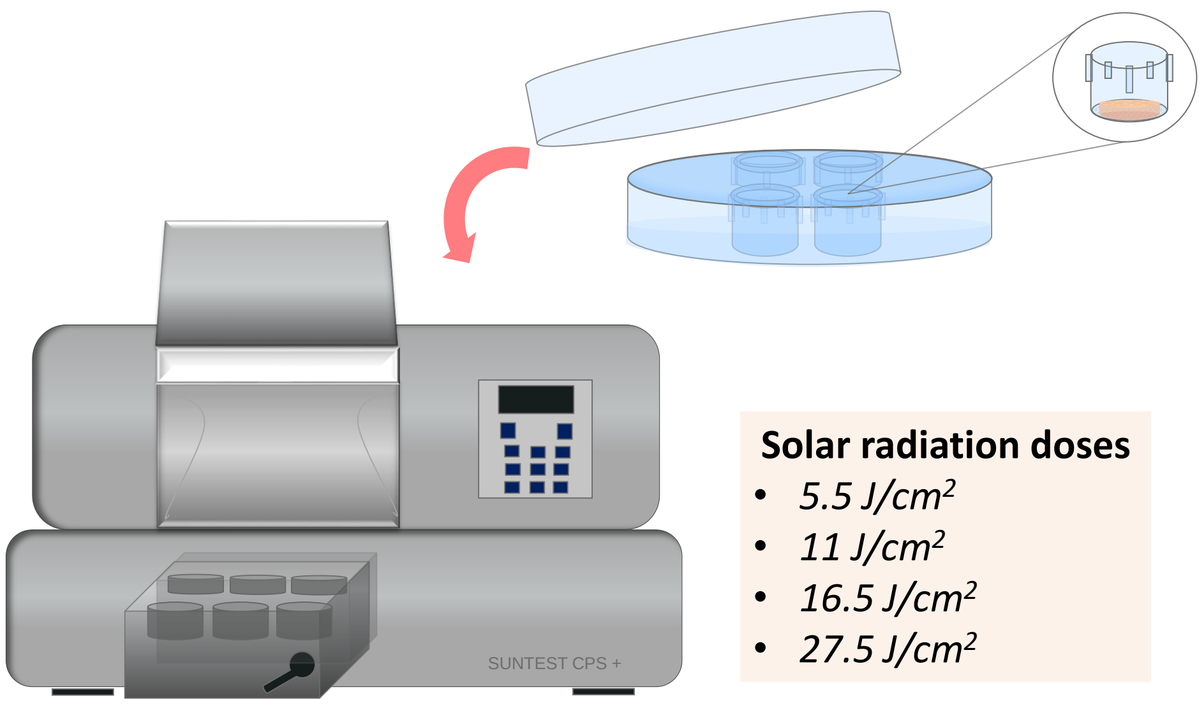


2. Morphology

Hematoxylin and Eosin staining



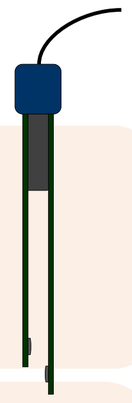
3. Solar radiation exposure (λ 290-800 nm)



Solar radiation doses

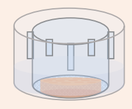
- *5.5 J/cm²*
- *11 J/cm²*
- *16.5 J/cm²*
- *27.5 J/cm²*

4. Performed analysis



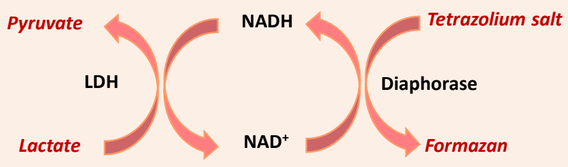
- **Barrier integrity**

Trans epithelial electrical resistance (TEER) measurement



- **Cytotoxicity**

Lactate dehydrogenase (LDH) activity



- **Pro-inflammatory response**

Enzyme-linked immunosorbent assay (ELISA)
Interleukin 8 (IL-8) release

PRELIMINARY RESULTS

Barrier integrity

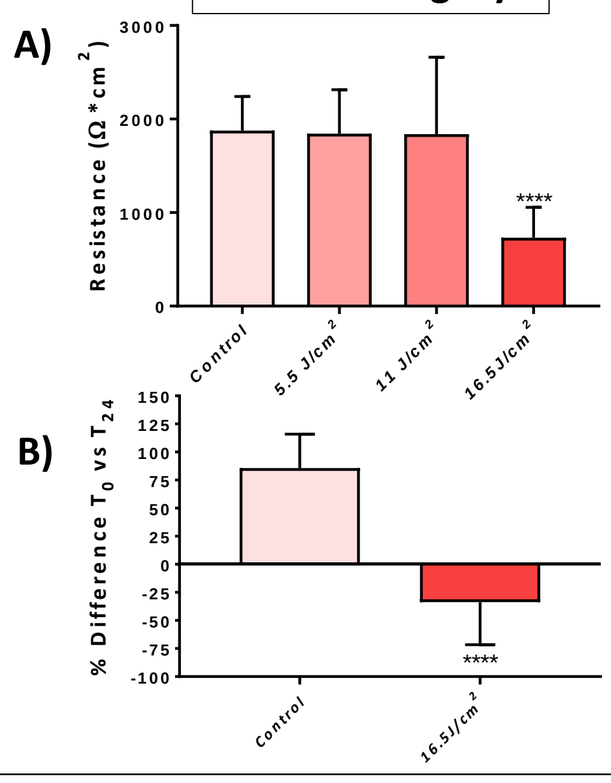


Figure 1. A) TEER values 24 hours after solar radiation exposure. *Bars represent mean of biological replicates, n=12. Error bars represent standard deviation. One-way ANOVA, Dunnett's multiple comparison test compared to control. (*) represents adjusted P-value (****< 0.0001).*
B) % difference between T_0 (before exposure) and T_{24}. *T-test, Welch's. (*) represents adjusted P-value (****< 0.0001).*

Cytotoxicity

$$cytotoxicity\ (\%)\ \frac{(measured\ value - control)}{(pos.control\ - control)} x100$$

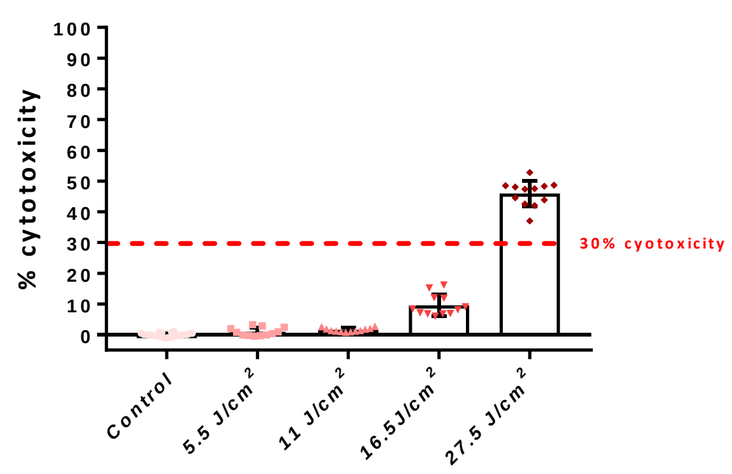


Figure 2. Increased cytotoxicity upon solar radiation exposure. Pos. control: 0.2% Triton-X 100. *Bars represent mean of biological replicates, n=12. Error bars represent standard deviation.*

Pro-inflammatory response

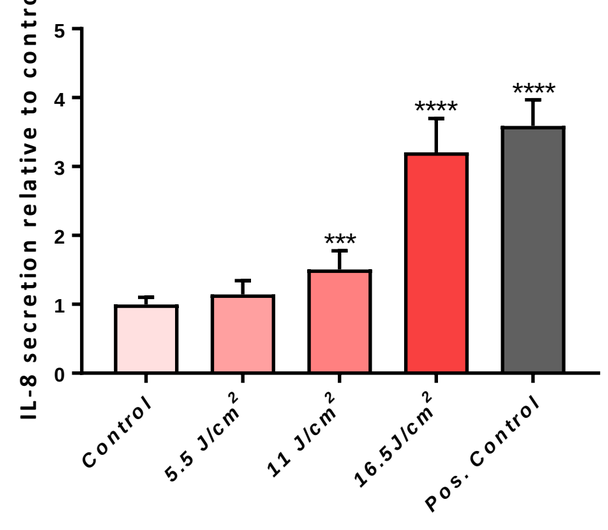


Figure 3. Increased IL-8 secretion upon solar radiation exposure. **Pos. control: 200 µg/mL lipopolysaccharide (LPS).** *Bars represent mean of biological replicates, n=12. Error bars represent standard deviation. One-way ANOVA, Dunnett's multiple comparison test compared to control. (*) represents adjusted P-value (***< 0.001; ****< 0.0001).*

CONCLUSIONS AND EXPECTATIONS

The CITYCARE RHE model appears to be a useful tool for the evaluation of solar radiation effects on skin also in combination with other pollutants. A co-exposure approach will be used to elucidate possible *in vitro* synergistic effects of pollutants on skin.

[1] Y. Barbotteau *et al.* "Reconstructed human epidermis: A model to study the barrier function" Nucl. Instruments Methods Phys. Res. Sect. B Beam Interact. with Mater. Atoms, vol. 231, no. 1–4, pp. 286–291, 2005

CONTACT
Benedetta Petracca
benedetta.petracca@unifr.ch
www.citycare-itn.eu

The CITYCARE project has received funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No 765602.