Supplementary Materials

Table S1. Constituents of the Vehicles used for NP penetration study.

Eucerin Smoothing Essentials (Fast Absorbing Lotion for Dry Skin) Beiersdorf Inc. (Based in Germany)
Ingredients: Gluco-Glycerol Enhanced Formula Water, Glycerin, Caprylic/Capric Triglyceride, Cetearyl Alcohol, Urea, Hydrogenated Cocoglycerides, Isopropyl Stearate, Octyldodecanol, Sodium Lactate, Dimethicone, Arginine HCL, Glyceryl Stearate SE, Myristyl Myristate, Carnitine, Chondrus Crispus (Carrageenan), Sodium Cetearyl Sulfate, Lactic Acid, Sodium Citrate, Citric Acid, Acrylates/C10–30 Alkyl Acrylate Crosspolymer, Phenoxyethanol, Benzyl Alcohol, Propylparaben, Potassium Sorbate.
Eucerin Calming (Itch Relief Treatment) Beiersdorf Inc. (Based in Germany)
Ingredients: Active Ingredient: Menthol Inactive Ingredients: Water, Glycerin, Octyldodecanol, Caprylic/Capric Triglyceride, Isopropyl Stearate, Myristyl Myristate, Cetyl Alcohol, Colloidal Oatmeal, Cetearyl Alcohol, Dimethicone, Glyceryl Stearate SE, Oenothera Biennis (Evening Primrose) Oil, PEG-40 Castor Oil, Caprylyl Glycol, , Sodium Cetearyl Sulfate, Sodium Citrate, Citric Acid, Polyglyceryl-3 Methyl Glucose Distearate, Benzyl Alcohol, Phenoxyethanol, DMDM Hydantoin, Potassium Sorbate.
Eucerin Daily Protection SPF 15 Sunscreen Lotion Beiersdorf Inc. (Based in Germany)
Ingredients: Active Ingredients (sunscreens): Homosalate 5.0%, Octinoxate 5.0%, Octisalat 4.0%, Titanium Dioxide 1.0%. Other Ingredients: Water, Glycerin, Butylene Glycol, Cetearyl Alcohol, Urea, C18-36 Acid Triglyceride, Caprylic/Capric Triglyceride, Dimethicone, Octyldodecanol, Sodium Lactate, Arginine HCL, Tocopheryl Acetate, Glyceryl Stearate SE, Chondrus Crispus (Carrageenan), PEG-40 Castor Oil, Sodium Cetearyl Sulfate, Disodium EDTA, Sodium Citrate, Lactic Acid, Carbomer, Citric Acid, Trimethoxycaprylysilane, Benzyl Alcohol, Phenoxyethanol, Methylparaben, Propylparaben, Potassium Sorbate.
Vaseline Intensive Rescue Clinical Therapy Lotion Unilever
Ingredients: Water, Glycerin, Petrolatum, Stearic acid, Glycol stearate, Dimethicone, Isopropyl isostearate, Dihydroxypropyltrimonium chloride, Hydroxyethyl urea, Tapioca starch, Cetyl alcohol, Glyceryl stearate, Magnesium aluminum silicate, Stearamide amp, Carbomer, Isopropyl myristate, Cedrol, triethanolamine, Disodium edta, Phenoxyethanol, Ethylparaben, Propylparaben.
Dermovan Healthpoint Ltd
Ingredients: Water, Glyceryl stearate (and) stearanidoethyl diethylamine, glycerin, mineral oil, cetyl esters, cetyl alcohol, butylparaben, methylparaben, propylparaben.

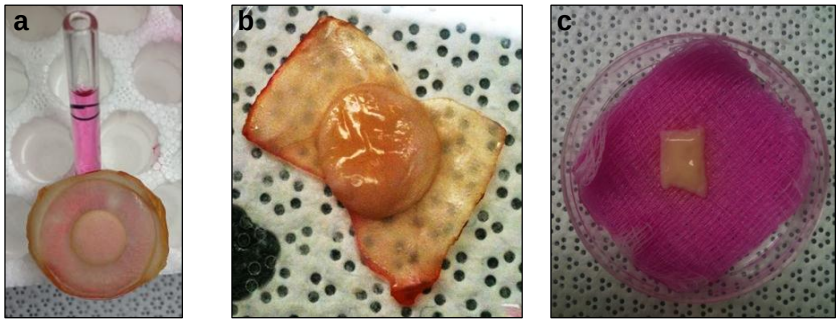

Figure S1. Comparison between the exposure models show that the mouse skin swells up after a 24 h duration in the Franz diffusion cell. (**a**) Mouse skin placed in the Franz Chamber for swelled up after a 24 h exposure. (**b**) Mouse skin removed from the Franz chamber after a 24 h exposure shows that the portion of the skin exposed to the bottom chamber with the circulating media swells up. (**c**) No gross physical changes were observed in the mouse skin treated using the petri dish protocol.

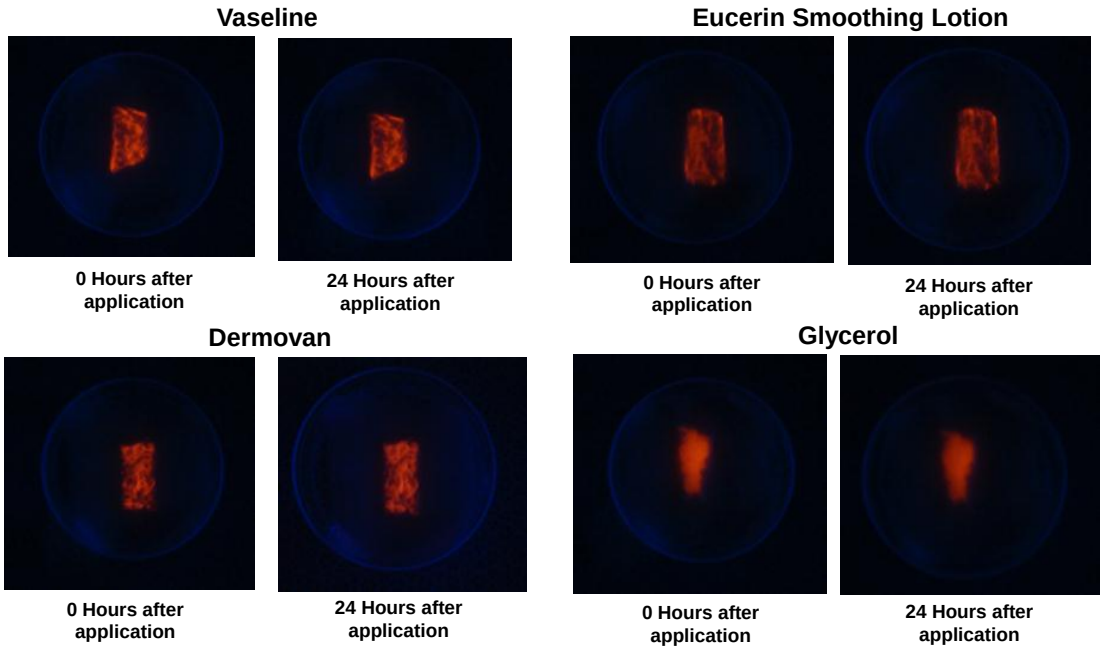

Figure S2. Samples under a hand-held UV Lamp. Mouse skin samples were photographed under a hand-held UV lamp immediately after and 24 h after the application of the vehicle with QDs in the Petri dish protocol. The vehicles do not affect the QD intensity in the 24 h duration. Lowest QD penetration was observed in the Vaseline group after confocal imaging, however it can be observed that QD intensity is intact in this vehicle. Pictures are not to scale.

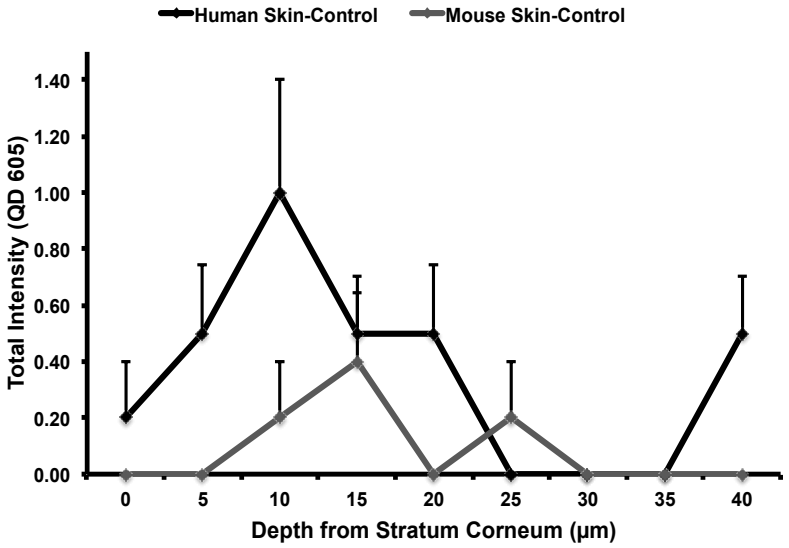

Figure S3. No autofluorescence was measured in untreated *ex vivo* mouse and human skin using CLSM. No autofluorescence was measured in the two skin types using the QD605 filter.

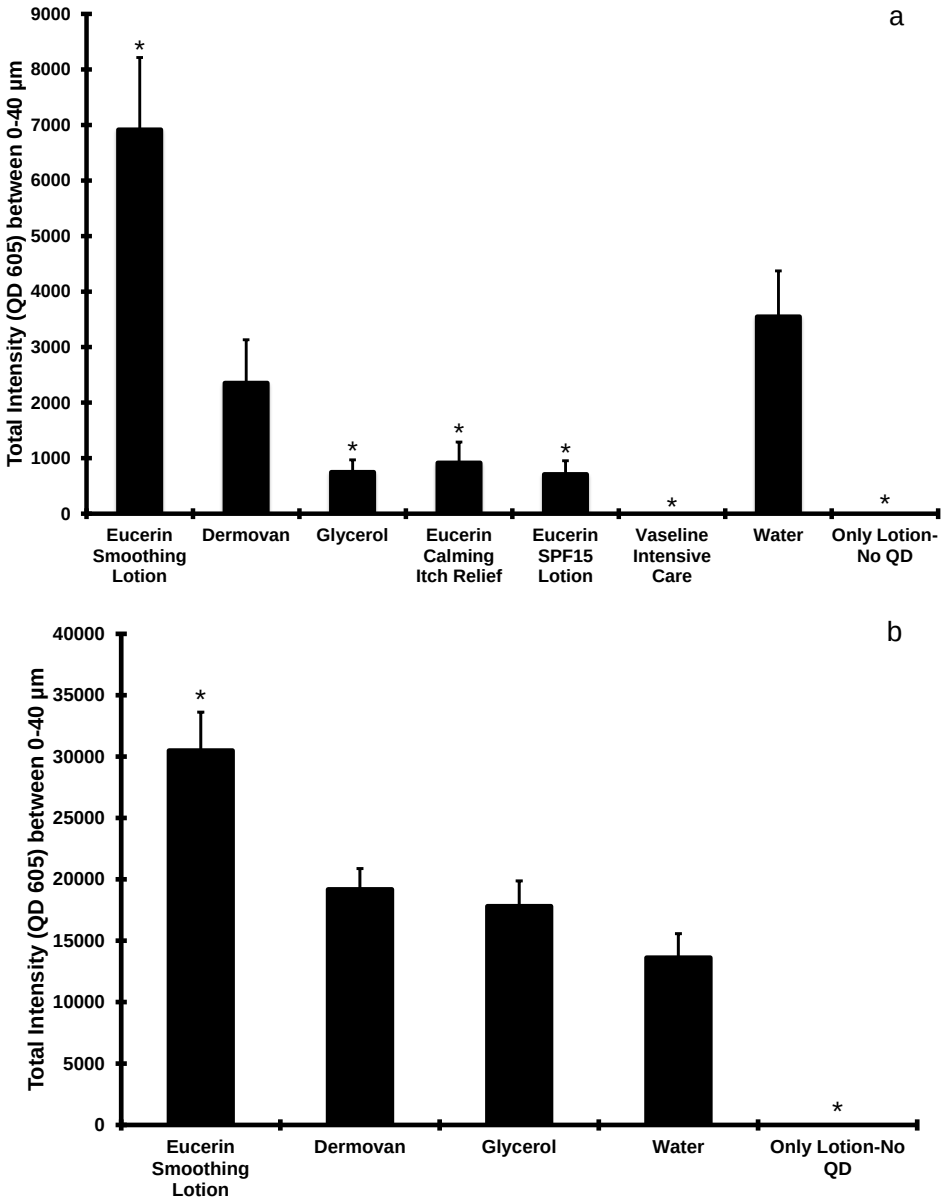

Figure S4. Eucerin Smoothing lotion enhances QD penetration in *ex vivo* mouse skin using the petri-dish protocol. (**a**) Integrated QD fluorescence signal in the Eucerin smoothing lotion group was 2 fold higher than water. QD penetration in the Dermovan group was comparable to water. QD presence between 0 and 40 µm depth in all other vehicle groups was significantly lower compared to water alone; (**b**) Integrated QD fluorescence signal in the Eucerin smoothing lotion group was 2.2 fold higher than water. QD penetration in the Dermovan and glycerol test groups was comparable to water. Means ± SEM ($N = 4$, $n = 3$). * $p < 0.05$ *vs.* Water. Lotion with no QD is the Control.

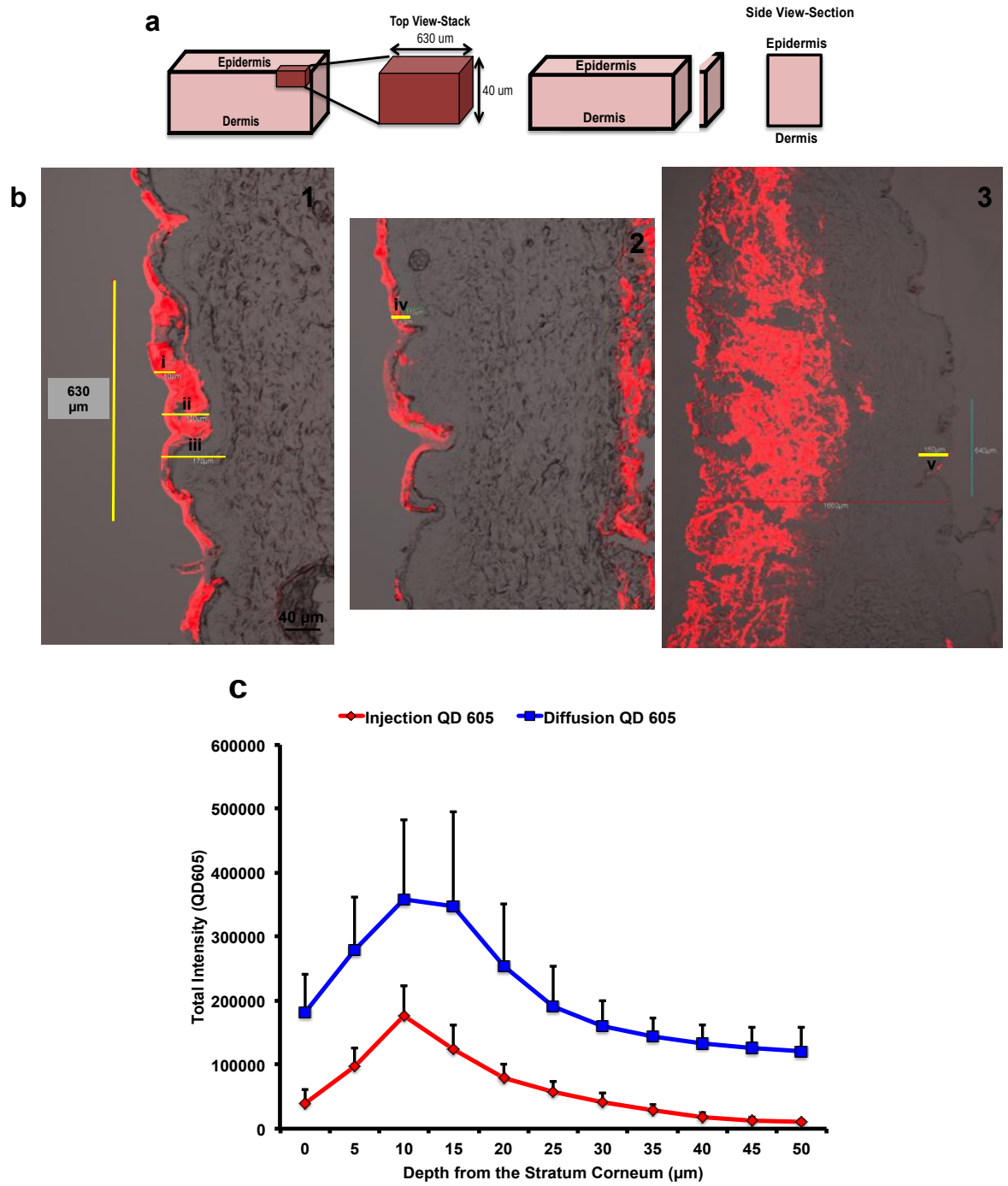

Figure S5. Injection and diffusion of QDs in *ex vivo* human skin demonstrate that epidermal scattering and absorption generate a decay in the intensity profile with an increase in depth from the stratum corneum. (**a**) QDs were either injected intradermally into *ex vivo* human skin or the skin was immersed in a QD solution for 24 h prior to CLSM imaging. The top view was obtained using the stacks from 0 to 50 µm. Skin was cryosectioned and imaged to obtain the side profile views. (**b**) 1 & 2. Cryosection of human skin showing high QD presence at the periphery of the tissue. The QD diffusion front produced over the 24 h immersion was sufficient to yield homogenous QD presence to depth exceeding 40 µm. (b) 3. Cryosection of human skin showing high QD presence in the dermis after a sub-dermal injection. Scale Bars (i) 50 µm (ii) 120 µm (iii) 170 µm (iv) 40 µm (v) 150 µm. (**c**) Stacks obtained using CLSM were quantified using ImageJ. Similar trends were observed for both exposure conditions with intensity values peaking around 10 µm followed by a subsequent decay in the intensity profile; Means ± SEM ($N = 4$, $n = 3$).

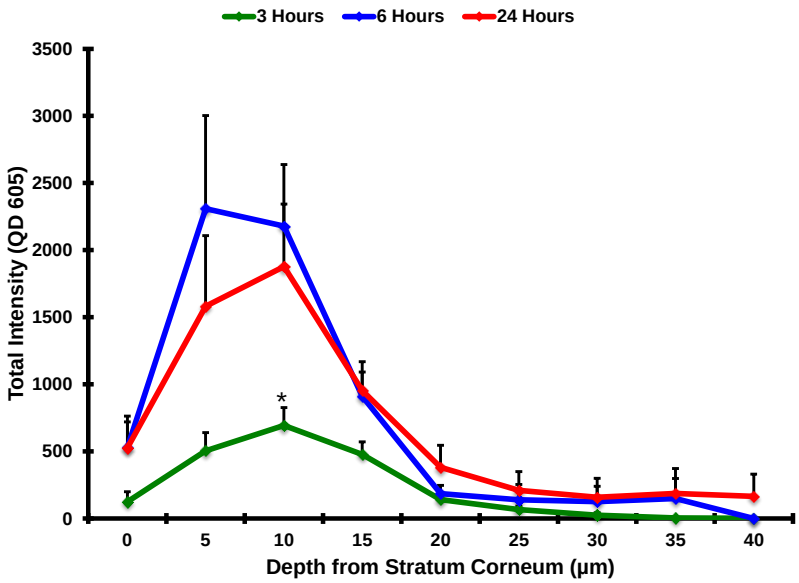

Figure S6. Less QD presence is observed in the *ex vivo* mouse skin treated using the petri dish protocol at 3 h compared to a 6 and 24 h exposure. Significantly lower QD presence was observed in mouse skin treated for 3 h compared to 24 h. There were no significant differences between the 6 and 24 h exposure group; Means ± SEM ($N = 4$, $n = 3$). * $p < 0.05$ *vs.* 24 h time point.

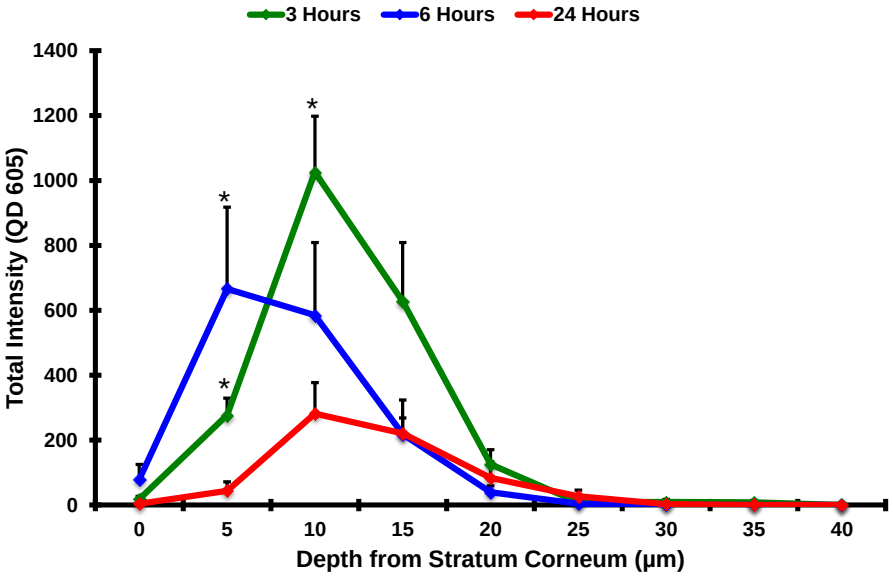

Figure S7. Less QD presence is observed in the *ex vivo* mouse skin treated using the Franz diffusion cell at 24 hours compared to a 3 and 6 h exposure. Significantly higher QD presence was observed in mouse skin treated for 3 and 6 h compared to 24 h. There were no significant differences between the 3 and 6 hour exposure group; Means ± SEM ($N = 4$, $n = 3$). * $p < 0.05$ *vs.* 24 h time point.

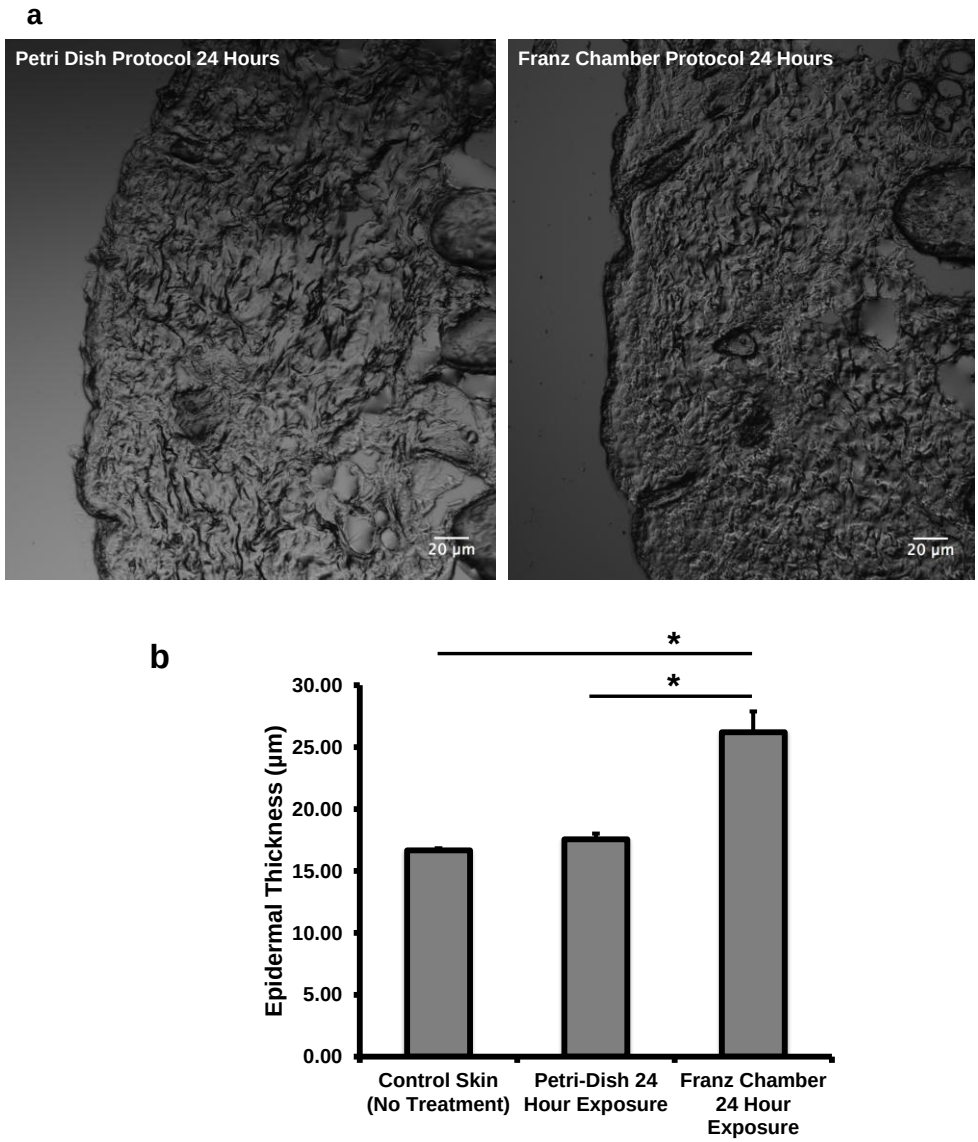

Figure S8. Quantification of epidermal thickness of mouse skin using ImageJ. (**a**) Mouse skin was exposed to the vehicle Eucerin Smoothing lotion and GSH QDs using the Petri dish protocol and Franz diffusion chamber. 24 h after exposure the vehicle was wiped off and the skin was cryosectioned. Brightfield images obtained at 20× magnification were used to quantify the epidermal thickness in the two exposure protocols. (**b**) The epidermal thickness of skin exposed to the vehicle using the petri dish protocol was significantly lower than the skin exposed to the lotion using the Franz diffusion chamber and was of similar thickness to control skin—measured immediately post-euthanasia—no treatment. * $p < 0.05$, 2-talied *t*-Test, unpaired with unequal variances. Means ± SEM ($N = 3$, $n = 3$).

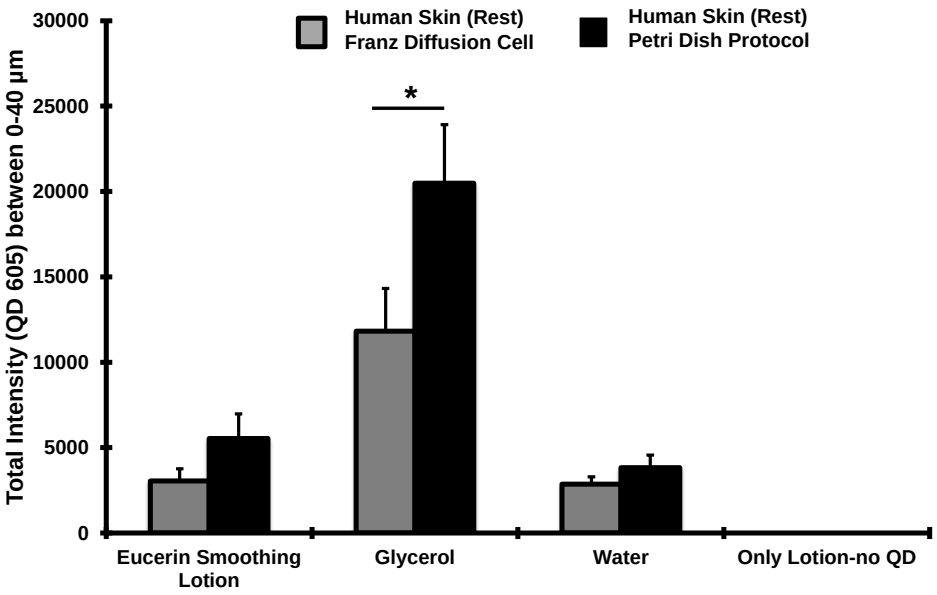

Figure S9. Comparable QD presence was observed in *ex vivo* human skin (rest $t = 24$ h) in the Eucerin smoothing lotion and water test groups treated using the Franz diffusion cell and petri dish protocol. No significant differences were observed in the two treatment protocols in the Eucerin smoothing lotion and water test groups. A significantly higher QD presence (1.7 fold) was observed in skin treated using the petri dish protocol compared to the Franz diffusion cell in the glycerol treatment group; Means ± SEM ($N = 4$, $n = 3$). * $p < 0.05$.