Hexis Lab

E: info@hexislab.com **T:** +44 0139 482 5487 **W:** hexislab.com
www.linkedin.com/company/hexis-lab-limited twitter.com/hexislabs

Skin deep: the future of personalised dermatology

Research Objectives

Understanding the genetic factors that influence skin health and ageing, toward the development of personalised skincare products.

Detail

Address
The Catalyst
National Center for Innovation and Ageing
Newcastle Helix
Newcastle Upon Tyne
NE4 5TG

Bio
Dr Ewa Markiewicz is a molecular dermatologist at Hexis Lab, interested in plant cell biotechnology and phytochemicals. She has long-standing experience in human cell biology, genetic and stress-induced ageing, and tissue regeneration.

Dr Olusola Idowu is a complex system scientist with expertise in -omic data analysis for identification of biomarkers and development of new ingredients for cosmetics, personal care, and pharmaceuticals.

References

Markiewicz, E, Idowu, O, (2020) Melanogenic Difference Consideration in Ethnic Skin Type: A Balance Approach Between Skin Brightening Applications and Beneficial Sun Exposure. *Clinical, Cosmetic and Investigational Dermatology*, 13, 215–232. doi.org/10.2147/CCID.S245043

Markiewicz, E, Idowu, O, (2018) Personalized skincare: from molecular basis to clinical and commercial applications. *Clinical, Cosmetic and Investigational Dermatology*, 11, 161–171. doi.org/10.2147/CCID.S163799

Personal Response

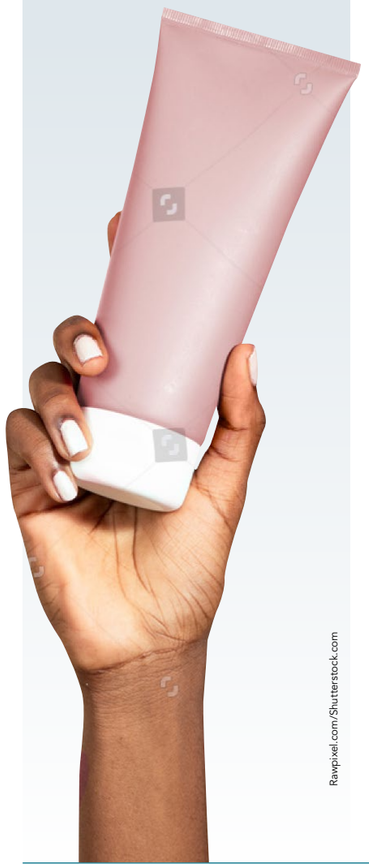
What is the next step in your research in this area? Will you be involved in controlled trials of personalised skincare, for example?

"In this work we highlighted a panel of the genes affected by small nucleotide polymorphisms (SNPs) in four major skin types. We demonstrated that in-silico analysis of the interactive network between the biomarkers reveals functional clusters and synergistic patterns with relevance to the biological activities of the skin. In future work, we would be providing evidence in in-vitro 3D skin models, of how different ethnic skin types age and respond to different skincare formulations."

Skin deep

The future of personalised dermatology

How our skin ages and resists damage is largely determined by its melanin (pigment) content, which varies according to skin type and is controlled through genetic single nucleotide polymorphisms (SNPs). Research by scientists at Hexis Lab, based in Newcastle, UK, explores the SNPs behind changes to pigmentation, as well as elasticity and hydration as our skin ages. Their insights offer the potential for highly personalised approaches to preventative measures and cosmetic products appropriate to all skin types.



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Everyone's skin is different, but the range of cosmetics and skin treatments available today falls far short of providing suitable products for everyone. New products aren't consistently designed and tested for different skin types – mostly because it's time-consuming and expensive to address.

Scientists at Hexis Lab, UK, believe the answer lies in our genes. Dr Olusola Idowu and Dr Ewa Markiewicz have examined the complex biology of four different skin types, revealing the molecular and clinical effects of environmental stresses that cause changes in the pigmentation, elasticity, and moisture of our skin as we age – factors that are strongly dependent on skin type. Importantly, they translate this knowledge to suggest approaches to individualised skincare that could catalyse the development of affordable, personalised products.

THE ROLE OF MELANIN

The colour of our skin relies on the quantity and quality of the natural skin pigment melanin – the more melanin a person has in their skin, the darker their complexion. Melanin also protects us against UV damage from the sun: in lighter skins UV damage is the main cause of ageing.

Melanin production – melanogenesis – is a complex process involving a network of biochemical reactions. When you lie in the sun, your skin darkens first through the redistribution of existing melanin, then several hours or days later, your body produces new melanin. Melanogenesis is controlled in different ethnic skin types through differences in DNA building blocks, known as small nucleotide polymorphism (SNP). Increased SNP is usually associated with decreased activity in the genes responsible for melanogenesis, resulting in lighter skin variants. There are significant variations in SNP pigmentation genes between European, East Asian, South-West Asian, and African populations. Idowu and Markiewicz believe this could be the key to breaking out of the one-size-fits-all approach to skin treatments. 'Biology is complex', they explain, 'and there's lots of evidence showing that darker skin tones are ignored in developing new products'.

ETHNICITY AND SKIN STRUCTURAL DIFFERENCES

Previous studies have shown that, after UV exposure, dark-pigmented skin suffers less DNA damage in the deepest skin layer, the lower epidermis, a redistribution of melanin from the lower to the middle epidermis, and an increase in apoptosis (programmed cell death). This may be because darker skins filters UV and remove damaged cells more efficiently. However, environmental factors may also be at play, by affecting the genes involved in melanin production.

Melanosomes – the cellular components that produce and store melanin – are more dispersed in darker skin, larger, break down more easily, and contain more melanin. This is consistent with their higher tyrosinase activity (an enzyme involved in pigment production) and slower breakdown of melanosomes in the epidermis. Conversely, melanosomes in lighter skin are closer together, smaller, and contain less melanin, due to a slower rate of synthesis and faster breakdown.

African skin has a thicker outer layer, or stratum corneum, than Caucasian skin, with more keratinous layers and higher lipid content. With a more acidified outer epidermis and fast recovery when damaged, this may be why African skin has stronger microbial resistance. African skin also has more (and larger) connective tissue cells, or fibroblasts, and more macrophages – the white blood cells involved in immune function. Furthermore, it has stronger collagen in the dermis, which it retains despite ageing and sun damage. However, darker skin is more susceptible to pigmentation abnormalities.

Different ethnic skin types also respond differently to environmental factors. For example, Caucasian skin is more susceptible to inflammatory lesions while African skin more regularly experiences raised scarring.

UV EXPOSURE – RISKS AND BENEFITS

Being out in the sun makes most of us feel happier and healthier, but UVR exposure causes hyper-pigmentation such as freckles and age spots, and skin cancers. Aside from avoiding exposure altogether, our best defence is to use sun creams. But evidence now suggests that sunscreen can reduce our vitamin D intake by up to 95%, a deficiency which is even more problematic for Indian and African skin types which need more sun exposure to produce this essential vitamin.

Could a more personalised approach to our use of sun protection products help us prevent the ageing and damaging effects of UV exposure, while still allowing us to reap the benefits of vitamin D? Idowu and Markiewicz believe that new treatments for hyper-pigmentation could be personalised around the differences in the melanogenic genes of different skin types. For example, a sun cream for lighter skins could target facultative pigmentation (caused by sun exposure) while still allowing synthesis of vitamin D; or treatments for darker skin types that focus on constitutive pigmentation (the pigmentation we're born with) while enhancing the potential for vitamin D synthesis – personalised skincare that would enable everyone to enjoy the sun safely and beneficially.

ETHNIC SKIN TYPES AND AGEING

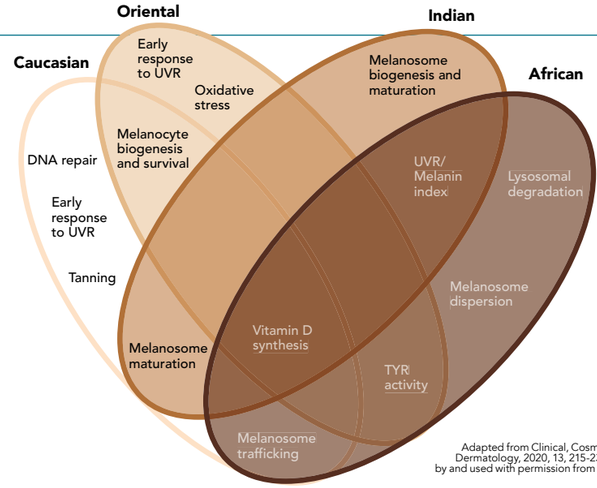
As our skin ages, pigmentation isn't the only thing that changes – our skin becomes drier and less elastic. Ethnic skin type may also influence differences in skin hydration and resistance to damage, as well as different reactions to chemicals – for example, how well we absorb transdermal drugs. While Caucasian skin is more resistant to stratum corneum damage, African skin doesn't so readily absorb applied substances. Meanwhile all ethnic skin types are subject to transepidermal water loss (TEWL) and reductions in skin-surface moisture with age. Changes in the epidermis also depend on the rate at which the outer layer of the skin is shed, something that increases with age causing skin dryness, and is more often experienced by people with African skin.

The future of clinical and pharmacological interventions, explain the researchers, is projected to focus on genetic variations that make each individual unique – aligning with the increasingly favoured ethos of treating the person rather than the disease. For example, African skin could benefit from moisturising products that specifically support skin-barrier renewal and prevent TEWL.

GENE-BASED SKINCARE

Idowu and Markiewicz's work demonstrates the importance of understanding the biology of individual skin types to advance the design of novel pharmaceuticals to regulate biological processes. Dermatology researchers can now use advanced statistical modelling tools to obtain information about skin biology and the ageing process. Applying integrative biology to genetic data – so considering every level from genome, through organism, to population – can help to elucidate how genes collaborate to perform a particular cellular function – known as the gene regulatory network.

Scientists at Hexis Lab are now using artificial intelligence and genomic data to challenge the one-size-fits-all approach, revealing the individual factors that will enable skincare companies to quickly develop new, affordable products for everyone.



Proposed functional cluster targets for enhancement of skin tone and prevention of pigmentation problems in four skin types, while retaining the capacity for vitamin D synthesis and defence against molecular damage caused by UVR.

Adapted from Clinical, Cosmetic and Investigational Dermatology, 2020, 13, 215-232. Originally published by and used with permission from Dove Medical Press Ltd

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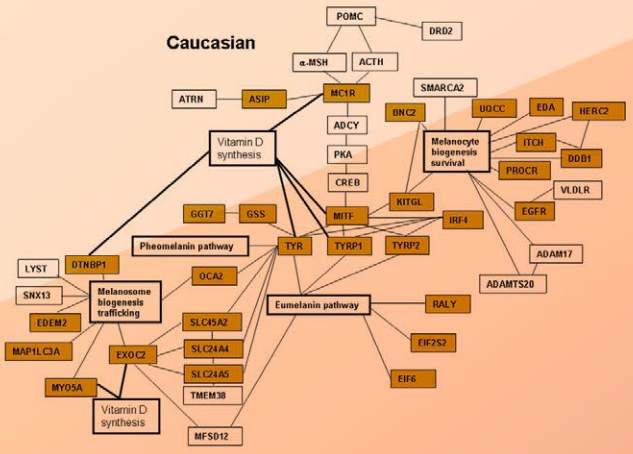
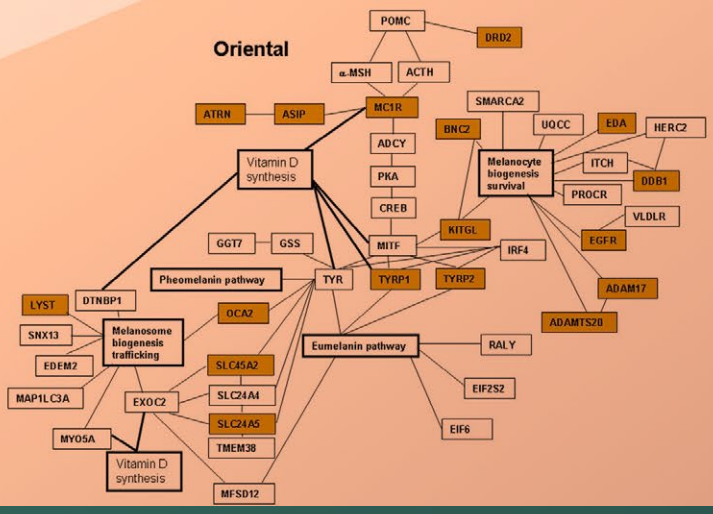
DISCOVERY WITHHEXIS LAB PRO.X®

Our in-sillico screening platform is built on proprietary deep-learning algorithms. These capabilities enable us to quickly and cost-effectively design, validate, and virtually prototype new bio-based products for different applications. Ingredients are systematically screened against the library of known materials in our integrated -omic databases for known bioactivities and predicted activity using machine learning. The platform is used to:

- identify new biological targets from -omic data
- assess the polypharmacology and interactions of new compounds/ materials across biological networks
- mine biomedical literature, patents, and public databases to discover new properties of ingredients for optimal formulations.





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Partnership enquiries: simon@researchoutreach.org