7th World Congress for Hair Research
4th-6th May 2013, Edinburgh, Scotland

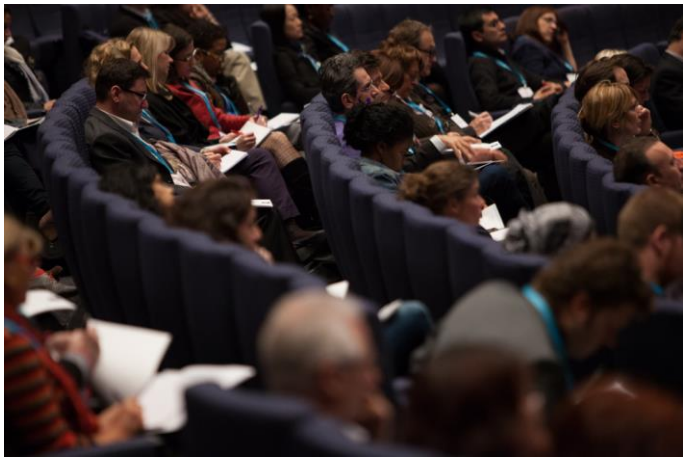
Meeting Report

By Yuval Ramot May 2013

Introduction

The 7th World Congress for Hair Research was held in Edinburgh, Scotland from May 4th to 6th. A total of 597 clinicians, investigators, surgeons, patient representatives and industry personnel from 47 countries gathered together to discuss recent innovations in the field of hair research. The meeting brought together researchers from a wide range of disciplines, highlighting the top scientific discoveries in the recent years in 10 concurrent sessions and three plenary symposia. This was a unique opportunity for young investigators to present their work together with the world's leading pioneers, stimulating vivid discussions that energized the hair research community.

Before the official start of the meeting, three science education sessions, and a pre-congress clinical course took place in the wonderful Edinburgh International Conference Centre, the venue for the whole meeting. In these sessions, leading experts gave educational talks on several fast-evolving fields in hair research. The "Genetics and Epigenetics: All you wanted to know but were afraid to ask" session was dedicated to the new techniques available today in genetic investigations, and how they can be harnessed for hair research. This session started by an edifying talk by Regina Betz (Bonn, Germany), who reviewed the old and new tools available today for genetic research. This was followed by several talks on cutting-edge scientific innovations, including the role of chromatin folding on gene expression (Wendy Bickmore, Edinburgh, UK) and the role of microRNA in hair follicle function (Natalia Botchkareva, Bradford, UK). The last talk in this session was given by Claire Higgins (New York, USA), and was dedicated to the fascinating finding of the potential to reprogram hair follicle cells to a pluripotent state. This finding opens a whole new horizon for the utilization of the hair follicle in regenerative medicine and many other uses.



The "What's new in hair follicle model systems?" session focused on the tools available for scientists today for studying hair follicles. An extensive review on the potential use of mouse models for the study of hair diseases was given by John Sundberg (Maine, USA), and this talk was followed by several lectures on the use of in vitro models which involve human material. The dermal papilla culture systems were presented by Young Kwan Sung (Daegu, Republic of Korea), who

gave a comprehensive overview of the development of these cultures and their potential uses. Michael Philpott (London, UK) showed how the human hair follicle culture model can be utilized for studying a plethora of parameters in the human hair follicle. In his talk the many advantages of this model were emphasized, but he also named the limitations of this model, and the importance of properly selecting the hair follicle samples for culture. Following his talk, Ben Miranda (Bradford, UK) suggested a new hair follicle culture system, which uses intermediate hair follicles instead of the more commonly used terminal hair follicles, thus proposing a new model system for experiments on hair diseases.

A special science education session was dedicated to the hair fiber, with a focus on curly hair. In this session, chaired by Gill Westgate (Bedford, UK) and John Gray (South Africa), the different theories concerning the formation of curly hair were discussed.

At the end of each session, a summary discussion was held, with active participation of the audience. These invigorating and thought-provoking discussions were the highlight of the session, allowing the participants to communicate with leading experts in the field.

The meeting officially started with welcome speeches by the 7th WCHR President, Andrew Messenger (Sheffield, UK) and President of the EHRS, Gill Westgate who welcomed each of the Hair Research Societies to Edinburgh and made a small presentation to each of a Quaich.

The opening lecture was given this year by Tayce Phillipson (Edinburgh, Scotland), who vividly reviewed the scientific and technologic contributions of Scotland, as appear in the National Museum of Scotland (penicillin and Dolly the sheep are only two examples). Following this talk, Jackie Tomlinson spoke on behalf of Alopecia UK, sharing with the audience the patient's view of alopecia areata. This heart-touching talk was an inspiration for all attendees, and emphasized the necessity for performing research in this field. After a cheerful Whisky tasting experience, the welcome reception took place in the historic Edinburgh Castle, accompanied by live Scottish pipe band music.

Keynote Lectures

Two luminaries of hair research delivered the conference's keynote addresses: Elaine Fuchs (New York, USA) pictured above, and Ulrike Blume-Peytavi (Berlin, Germany). Fuchs reviewed her fundamental work in exploring the regulatory mechanisms of the hair follicle stem cell functions, and especially the crosstalk between these cells and their microenvironment. Elaine Fuchs' work underlines the hair follicle as a perfect model for studying stem cells, being a self-regenerating mini-organ.

Elaine Fuchs showed how the fact that the murine hair cycles are synchronous can facilitate our understanding of stem cell regulation in health and disease.

This year the John Ebling Lecture, the highest award given by the EHRS, was given by Ulrike Blume-Peytavi (pictured below receiving the award from Prof Valerie Randall).

She reviewed her life-long journey for finding better therapies for hair diseases. Her talk emphasized how experimental research can lead to new therapies, and combined with new technologies and standards allow us to perform well-controlled clinical trials. The results of these clinical trials give us strong data, on which evidence-based trichology can be formed. The formation of evidence-based trichology can facilitate better consultation for patients with hair diseases.

Plenary Lectures

In accordance with the recent exciting advancements in stem cell research, the first plenary session was dedicated to an update on hair follicle stem cells. George Cotsarelis (Pennsylvania, USA) described his work in examining the different cell populations that reside in the bulge using different cell markers. Cotsarelis described how using these markers, it is possible to show that androgenetic alopecia may be attributed to a defect in the transformation of stem cells to progenitor cells. In other work, he demonstrated a hitherto unexpected role for prostaglandin D2 in inhibiting hair growth, and suggested that PGD2 inhibitors might be therapeutically useful in alopecia.

The topic of hair follicle aging is of great interest and a field of extensive research. Emi Nishimura (Tokyo, Japan) provided evidence, utilizing chronological analysis, that aging-associated hair graying and hair loss is attributable in part to defective renewal of the hair follicle melanocyte and hair follicle stem cells. Her work also provides us with the understanding of the underlying mechanisms of the hair follicle aging.

Valentina Greco (New Haven, USA) discussed a new in vivo imaging technique, which enables to visualize the cells residing in the bulge. This innovative method allows monitoring of the stem cells and their progeny during hair regeneration. Using genetic approaches, it is possible to dissect the role of different signaling pathways in this process.

Colin Jahoda (Durham, UK) presented his laboratory's work on establishing the characteristics of dermal sheath and dermal papilla cells, and their capacity to form skin-derived precursors. By developing three-dimensional skin models, Jahoda's group has also established the fact that cultured follicle dermal cells can elicit normal epidermal differentiation.

The second plenary session focused on progresses in clinical hair disorders. Angela Christiano (New York, USA) presented her monumental work on discovering the genetic basis for alopecia areata. Rooting from the extensive genome-wide microarray study reported in 2010 in Nature, several candidate genes have been discovered to be associated with alopecia areata, and of special importance was the finding that the NKG2D axis may be a prominent player in the pathogenesis of this

condition. Christiano also reviewed possible new therapeutic strategies for this condition, including abatacept, anti-IL15ra antibodies and topical JAK inhibitors, which all show potential benefit in mice models.

Pratima Karnik (Ohio, USA) spoke about the role of xenobiotic receptors in cicatricial alopecia, and specifically on the role of the aryl hydrocarbon receptor. To delineate the role of this receptor in the skin, Pratima Karnik developed a transgenic mouse model, which overexpresses the aryl hydrocarbon receptor in the skin. These mice developed clinical and histopathological phenotypes, which resemble scarring alopecia. In addition for suggesting a new model for investigating scarring alopecias, this study emphasizes the potential connection between the environment and the development of scarring alopecias.

Won-Soo Lee (Wonju, Republic of Korea) gave a comprehensive overview on the latest updates in management of pattern hair loss, with emphasize on the recent well-controlled clinical trials in this field. Lee presented the Basic and Specific classification, on its basis a new algorithmic evaluation of pattern hair loss has been developed.

It is known that cicatricial alopecias pose a special problem in regards to proper surgical management, pertaining mostly to the stability of the disorder before surgical intervention. Russell Knudsen (Double Bay, Australia) shared with the audience his experience in treating these conditions, summarizing that frontal fibrosing alopecia poses a special risk for re-activation, and therefore life-time treatment should be continued in these patients after surgery.

The concluding plenary session focused on the new discoveries in clinical and basic science aspects of hair research. Abraham Zlotogorski (Jerusalem, Israel) in a fascinating talk full with life and humour reviewed the new therapeutic options for hair diseases. Although new treatments still seem to emerge, most of them were not substantiated in well-controlled clinical trials. Zlotogorski concluded by emphasizing the need for such large-scale studies.

Sarah Millar (Pennsylvania, USA) reviewed the recent advancements in basic hair research, focusing on the molecular signaling pathways involved in hair follicle regulation. Millar demonstrated that the hair follicle development requires reciprocal signals between dermal and epithelial cells, with special emphasize on the WNT/beta-catenin signaling pathway. She also underlined the fact that it is known today that mouse models are relevant also for human hair follicle formation.

Concurrent Sessions

The burst of information in hair research that accumulated in the last year was exemplified by the large number of excellent studies and abstracts that were submitted to the meeting (242 in total). The highest scoring abstracts were presented in a total of 10 concurrent sessions, which were dedicated to the following subjects: alopecia areata (two sessions); tissue engineering and regeneration; stem cells and epigenetics; clinical cases; androgenetic alopecia and hair restoration; factors influencing hair growth; genetic hair disorders and hair fibre science; cicatricial alopecia; and hair follicle development, control of the hair cycle and pigmentation.

Highlights from these sessions include the talk by Lynn Petukhova (New York, USA), which awarded her the prestigious Jurgen Schweizer award, which is given annually to young promising scientists. Petukhova reviewed her work in further elucidating the role of the NKG2D axis in alopecia areata pathogenesis, following her previous findings from the large genome wide microarray study performed on a large cohort of alopecia areata patients. By performing additional genetic studies, including whole-exome and targeted sequencing, ULBP6 has emerged as an essential node in the genetic architecture of alopecia areata pathogenesis. This finding corroborates the previous findings of the genome-wide association study.

The high quality of alopecia areata research was mirrored by the fact that 3 more talks from the concurrent alopecia areata sessions received the high-scoring presentations award. Tom Lovewell (Sheffield, UK) presented data on polymorphisms in the AIRE gene, and their relation to alopecia areata induction. AIRE is essential for negative selection of T cells in the thymus, and was previously suggested to be associated with alopecia areata induction. Lovewell showed that polymorphisms in the AIRE promoter region may affect AIRE transcription, and therefore lead to an autoimmune response as evident in alopecia areata.

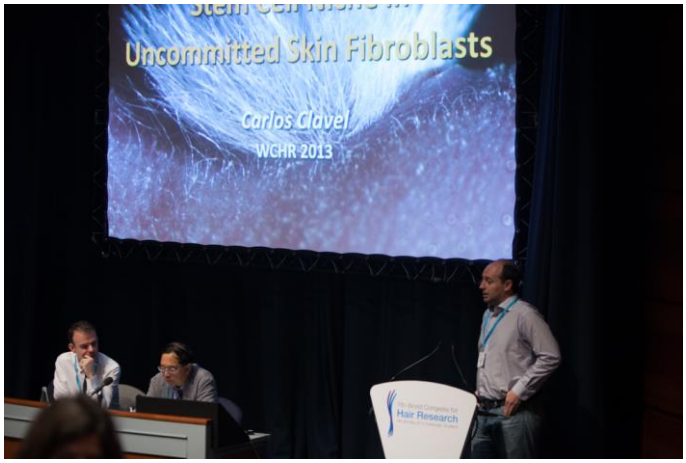
Annemieke de Jong (New York, USA) presented work utilizing next-generation T-cell receptor sequencing in humans, demonstrating expanded T-cell clones in lesional skin and blood of alopecia areata patients. Comparable findings were also evident in the C3H/Hej mouse model for alopecia areata. This finding raises the possibility to monitor autoimmune disease progression using T-cell receptor sequencing.

Although alopecia areata is considered to be an autoimmune disease, the exact autoantigen in this condition is yet to be revealed. Xiaojie Wang (Vancouver, Canada) described his study to elucidate potential epitopes in alopecia areata patients. By exploring a large array of potential epitopes in humans and mouse models, Wang concluded that trichohyalin, MART1 and K16 are potential causative antigens in this disease.

In a fascinating concurrent session on stem cells and epigenetics, Krzysztof Poterlowicz (Bradford, UK) focused on the role of Lhx2 in the hair follicle growth and stem cell maintenance. He presented evidence from mice studies for the existence of positive regulatory loops between Lhx2 and Sox9/Tcf4. Additionally, several additional gene groups were found to be regulated by Lhx2, which was suggested to function mostly as a transcriptional repressor.

In the same session, Takeshi Nakajima (Suita, Japan) reported on the role of MED1 in maintenance of normal hair follicle cycling and functions of stem cells. Takeshi Nakajima established keratinocyte-specific Med1-null mice, which showed marked epidermal and follicular phenotypes. These findings highlight the role of MED1 in maintaining quiescence of keratinocytes and follicular stem cells.

In the concurrent session entitled "Hair follicle development, control of the hair cycle and pigmentation", Carlos Clavel (New York, USA) presented fascinating work on skin fibroblasts.



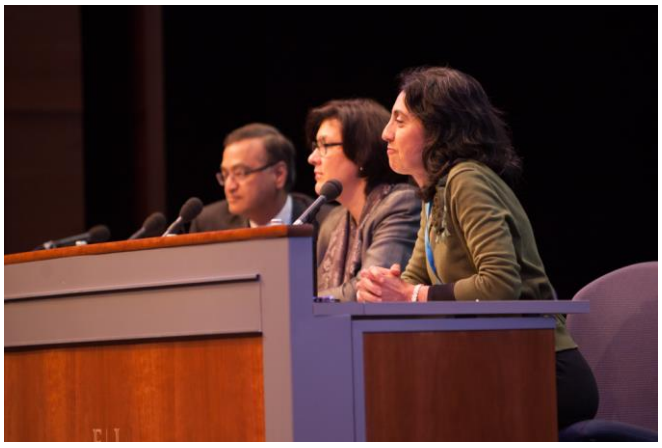
By overexpressing a combination of dermal papilla transcription factors in freshly isolated skin fibroblasts, Clavel could reprogram the cells into hair-inducing dermal papilla cells, which might be utilized in the future for hair restoration.

The tissue engineering and regeneration concurrent session provided several intriguing talks, and of special interest was Xunwei Wu's talk (Marietta, USA), which showed how to form skin which is able to grow hair using cultured human scalp dermal cells combined with neonatal foreskin keratinocytes. This reconstituted skin could retain human features for at least 1 year, therefore offering a new tool for studying skin disorders and potential clinical applications.

Seong Jin Jo (Seoul, Republic of Korea) presented in the androgenetic alopecia and hair restoration concurrent session his quest to find why androgenetic alopecia patients react differently to 5α-reductase inhibitors. To answer this question, he searched for exonic variants which might be associated with response to dutasteride. A total of three genes were found to be associated with response to dutasteride, including CYP51A1, DHRS9 and CYP4F11.

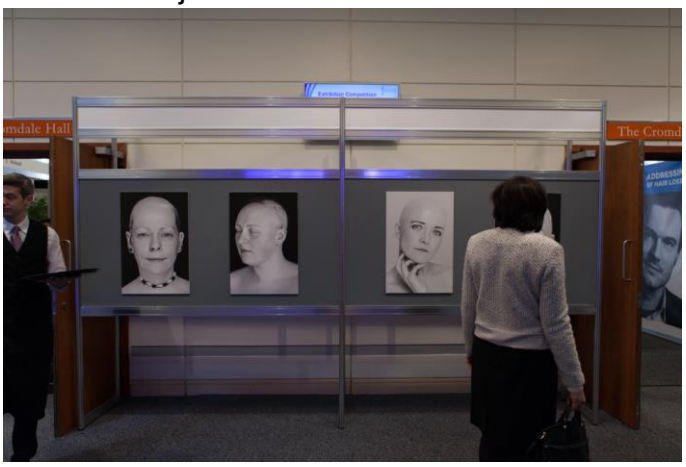
Sponsored Scientific Symposia

There were 5 sponsored science symposia from Kao, J&J, P&G (x2) and Unilever. Topics ranged from an update on Minoxidil in the J&J session in which Ulrike Blume-Peytavi and Paradi Mirmirani described recent clinical studies to further understand the mode of action of minoxidil. Hair fibre science featured in the session presented by Kao, with a special lecture by Prof George Rogers (Adelaide, Australia); in addition P&G organised an update on the causes of and repair solutions to hair damage and Unilever presented insights into the development of new technologies for Dove hair care products. P&G also presented a session on scalp health. The Hair Research Society of India also organized a workshop on aspects of hair trichology and restoration.



Alopecia UK and Art and Poetry exhibition

Daniel Regan, a photographer based in London, presented work from his Alopecia Project at the Congress in an Art and Poetry exhibition adjacent to the exhibition hall.



Alopecia UK brought Daniel to the Congress following his successful 'Uncovered' exhibition in London last year. Daniel was keen to present images of people with Alopecia to the scientists and clinicians at the congress to help delegates understand the effects that Alopecia has on body image.

Several Alopecia UK members with hair loss attended and were able to describe first hand their experiences of the condition in conversations with the delegates. In addition to the photographs a collection of poems written by Alopecians was displayed which explained how it felt to have Alopecia.

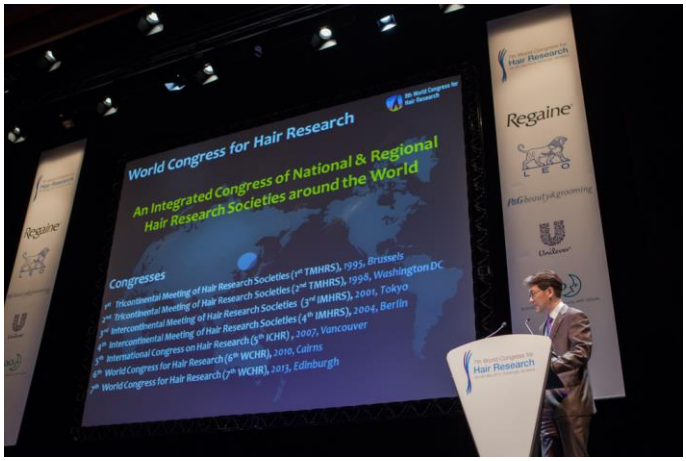
The exhibition and the involvement of those with Alopecia added a great deal to the congress and the experiences of the delegates.

Posters

For the first time, all accepted abstracts were presented as posters with 67 also presented during the concurrent sessions. This made for a very comprehensive poster session which was sited alongside the exhibitors who were show-casing their products and technologies to the delegates.

Future WCHR

During the closing ceremony, Won-Soo Lee warmly invited the attendees to come to the 8th World Congress for Hair Research, which will take place in Jeju Island, Republic of Korea, May 14-17, 2014. In addition to a very promising scientific program, Jeju Island offers wonderful sights and scenes, which will surely make this conference a great experience for all attendants.

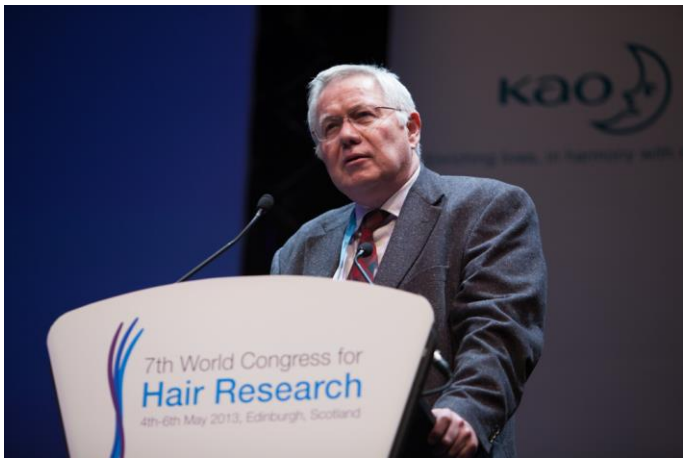


Social Events

In addition to the wonderful opening ceremony in the historic surroundings of Edinburgh Castle, the attendees were invited to the Congress Dinner, which took place in "Our Dynamic Earth", a place which takes you to a magnificent journey through the past, present and future of our planet. Dinner was followed by a traditional Scottish ceilidh, full with joy, music and dancing.

Summary

The meeting was concluded by Andrew Messenger, who thanked his enthusiastic team and especially Gill Westgate and Valerie Randall (the WCHR scientific chair), Meeting Makers and the organizing and international scientific committees. He further emphasized the importance of the sponsoring companies that contributed to the success of this meeting.



The data presented at the 7th World Congress for Hair Research highlighted the rapidly advancing field of hair research. Recent developments in genetic testing have led to a revolution in our understanding of hair diseases, and it would be interesting to see

how these genetic findings will be integrated diagnostically and therapeutically. The next WCHR meeting promises to galvanize the field once again and we are looking forward to meeting you in Jeju Island next year.

Publication of Abstracts

All abstracts presented in the 7th WCHR are available in the Journal of Investigative Dermatology, volume 133, issue number 5, pages 1391-1439.

Prize Winners

Jurgen Schweizer Award for best basic science presentation
Sponsored by L'Oreal UK
L Petukhova. Columbia University, New York, USA. *Functional genomics and targeted next generation sequencing points to ULBP6 as a critical node in the NKG2D axis in alopecia areata.*

Oral and Poster prizes
Prizes kindly sponsored by Leo Pharma

Best Presentations
K Poterlowicz, Centre for Skin Sciences, University of Bradford, UK. *Global genome analysis of Lhx2 target genes in hair follicle stem cells and their progenies reveals the non-random distribution and topological associations with functionally related gene loci*

C Clavel. Developmental & Regeneration Biology, Mount Sinai School of Medicine, New York, USA *Reprogramming regular skin fibroblasts into hair inducing dermal papilla cells*

Poster Prizes

T Nakajima, Osaka University, Suita, Japan. *Roles of MED1 in quiescence of hair follicle stem cells and maintenance of normal hair cycling*

EH Wang, Dermatology and Skin Science, University of British Columbia, Vancouver, Canada *Identification of autoantigen epitopes in alopecia areata*

K Matsushima, Saravio Central Inst., Saravio Cosmetics Ltd., Beppu, Japan. *Primary cilia–mediated cellular signaling in dermal papilla cells*

A de Jong, Dermatology, Columbia University, New York, United States. *Next generation T cell receptor sequencing for the identification and monitoring of pathogenic T cells in Alopecia Areata*

T Lovewell, Infection and Immunity, University of Sheffield, Sheffield, United Kingdom. T*he effect of AIRE -207 polymorphism on AIRE transcriptional activity highlights the potential role of AIRE in the pathogenesis of alopecia areata*

SJ Jo, Department of Dermatology, Seoul National University College of Medicine, Seoul, Korea. *Genetic variations associated with efficacy of dutasteride, the dual 5a-reductase inhibitor in the treatment of male pattern hair loss.*

X Wu, Aderans Research Institute, Inc., Marietta, United States. *Full-thickness skin with mature and cycling hair follicles using tissue culture expanded human cells*

Congratulations to all the winners.