Introduction
The 8th World Congress for Hair Research (WCHR2014), which took place in the beautiful International Conference Center in Jeju Island, Korea on 14-17 May, 2014, attracted an unprecedented number of 850 participants. The delegates came from more than 40 countries, representing all continents, and included physicians, scientists, industry personnel and medical and PhD students. The WCHR2014 organizing committee, headed by Prof. Won-Soo Lee (Wonju, Republic of Korea), produced a packed and varied program. Plenary sessions with keynote speakers (7 lectures) were combined with 10 symposiums, 6 free communications sessions and 5 workshops, providing a platform from laboratory science to clinical skills. Two hundred thirty seven abstracts were submitted to the conference, and were presented as posters or oral presentations. The poster sessions provided a stimulating ground for discussion and for forming a collaborative network among young investigators.

The WCHR2014 venue offered outstanding hospitality with social events in the beautiful landscape of Jeju Island. This report reviews the new scientific findings stemming from clinical and preclinical studies on hair research, and we hope that it will encourage you to attend the 9th World Congress of Hair Research, 18-21 November, 2015, in Miami, FL, USA.

Preceding the official start of the meeting, 4 pre-congress courses took place. These sessions included state-of-the-art lectures by leading experts. The scalp dermatosis course was dedicated to inflammatory and infectious diseases of the scalp. Yang Won Lee (Seoul, Republic of Korea) opened this course, by discussing novel methods to identify the Malassezia yeast, highlighting the restriction fragment length polymorphism as a rapid, precise and cost-effective method for rapid diagnosis and epidemiological
studies. Jianzhong Zhang (Beijing, China) reviewed the infectious diseases of the scalp, with special emphasis on bacterial infections and tinea capitis, providing tools for diagnosis and treatments. Joo-Heung Lee (Seoul, Republic of Korea) discussed the difficulties in the diagnosis and treatment of scalp psoriasis, and emphasized the under-estimated social burden that scalp psoriasis imposes on the patients. Gil Yosipovitch (Philadelphia, USA) presented burning scalp syndrome, a complex disease which although commonly encountered in clinical practice, is still not entirely understood and difficult to treat. John Gray (London, UK) closed the course by talking about dandruff and seborrheic dermatitis, focusing on the need for treatments that lead to overall normalization of the scalp, by targeting the three factors that contribute to this condition: sebum, microbial metabolism and individual susceptibility.

The hair transplantation pre-congress course started with an educational talk by Nilofer Farjo (Manchester, UK), who demonstrated how to prepare grafts for implantations and their proper placing methods. Jung Chul Kim (Daegu, Republic of Korea) detailed the advantages of the graft implanter for graft insertion and Jaeheon Jung (Seoul, Republic of Korea) shared his vast experience with the use of the total hairline correction technique. Akio Sato (Toyo, Japan) focused on androgenetic alopecia (AGA), and the treatment strategies that are utilized in Japan to address this condition. Dr. Sato stressed that in the future, hair follicle regeneration options should be considered for the treatment of AGA. Rattapon Thuangtong (Bangkok, Thailand) described the indications and proper administration of the scalp micropigmentation technique, and Kuniyoshi Yagyu (Tokyo, Japan) showed that high density transplantation can be a suitable strategy for secondary cicatricial alopecia.

Despite recent advances in our understanding of the genetic basis for alopecia areata (AA), the etiology is still not entirely known, and severe cases are still recalcitrant to treatment. Maria Hordinsky (Minneapolis, USA) presented results indicating that changes in the epidermal nerve density and neuropeptide expression can be observed in active AA, a fact which might shed light on the pathogenesis of AA. Xingqi Zhang (Guangzhou, China) presented an overview of the clues that point to allergy as an important contributor to AA by affecting the immune response, and Lidia Rudnicka (Warsaw, Poland) addressed the issue of possible
pitfalls in diagnosing AA using trichoscopy. Regina Betz (Bonn, Germany) presented an immunochip-based genetic analysis of AA patients which, in addition to confirming previously known loci, also revealed two new susceptibility loci, including HLA-C and TNFSF4. TNFSF4 encodes OX40L, a cytokine involved in additional autoimmune disorders, and can be a potential new therapeutic target in AA. Finally, Andrew McDonagh (Sheffield, UK) and Do-Won Kim (Daegu, Republic of Korea) gave an overview on the new treatment modalities available for AA, and discussed their pros and cons.

In accordance with the growing use of trichoscopy in the clinical practice of diagnosing and treating hair disorders, a pre-congress course was dedicated to this subject. Lidia Rudnicka opened the session with an educational talk on the basic findings in trichoscopy of the common hair diseases, such as AA and telogen effluvium and on the findings encountered in the different cicatricial alopecias. Shigeki Inui (Osaka, Japan) reviewed in two different talks ways to differentiate AGA and AA from other hair disorders by trichoscopy, with special emphasis on ways to differentiate these conditions from frontal fibrosing alopecia, which can sometimes be difficult for diagnosis. Moon-Bum Kim (Busan, Republic of Korea) presented several clinical cases, and demonstrated how the use of a trichoscopic algorithmic approach can aid in correct diagnosis and management of these cases. Xingqi Zhang showed which trichoscopic findings can help in arriving at the correct diagnosis, and to adequately evaluate disease activity of scarring and non-scarring alopecia. Gwang Seong Choi (Incheon, Republic of Korea) discussed the use of phototrichogram as a non-invasive method to quantitatively evaluate scalp and hair conditions, allowing to measure several factors such as hair count, hair diameter, amount of telogen hair and canities.

The meeting officially started with a wonderful performance of traditional Korean music, including an astonishing musical piece with the participation of 5 buks (Korean traditional drums), which spurred the audience to erupt in applause.

After opening remarks from Won-Soo Lee, the congress president, Do-Won Kim (Daegu, Republic of Korea), the KHRS president, Gill Westgate (Bradford, UK), the international board chair, Andrew Messenger (Sheffield, UK), the previous WCHR president and Donald Hyu, MSD president,
the keynote lecture was given by Sungnack Lee (Seoul, Republic of Korea). Dr. Lee is a man of many talents. In addition to being a distinguished dermatologist and researcher, he also serves as the chairman of the Korean Membership Society of the National Museum of Contemporary Art. He has demonstrated using examples from architectural designs and portraits the cultural differences between Korea, China and Japan. This talk was followed with welcome dinner with an astonishing view of the Pacific Ocean.

Plenary sessions

The first plenary session was led by Manabu Ohyama (Tokyo, Japan), who opened the lecture by discussing his laboratory’s recent work on human induced pluripotent stem cells (hiPSCs) and their potential use for human hair follicle regeneration. A major challenge in hair follicle bioengineering is to differentiate hiPSCs-derived mesenchymal stem cells to dermal papillae cells. Using special culture conditions, dermal papilla cell properties could be restored, and their interaction with keratinocytes could enhance both dermal papillae biomarkers and hair follicle gene expression in keratinocytes. Taking into consideration that melanocytes can also be generated from hiPSCs, it seems that it would be possible to form a three-dimensional hair follicle equivalent from hiPSCs.

Won-Soo Lee reviewed the current available information on the treatment of female pattern hair loss and AGA. He emphasized the importance of an algorithm-based approach, and highlighted the use of the Basic and Specific classification, which presents a classification system which is a validated, not gender-specific, and might be more applicable for daily use and clinical trials. Although much research has been invested in understanding the hair follicle, it seems that overall the arrector pili muscle, which attaches to the hair follicle in the level of the bulge, has not received the attention it deserves, being considered a mere bystander in hair follicle cycling and function.

Rodney Sinclair (Melbourne, Australia) has emerged in a quest to explore the role of the arrector pili muscle in normal and pathologic conditions. To achieve this, he used computer generated 3-D reconstructions of hair follicle units together with the arrector pili muscle. Using this method, he was able to show that attachment to the arrector pili muscle is probably crucial in maintaining the normal cycling of the hair follicle, and loss of this
attachment leads to miniaturization, which leads inevitably to AGA. In a lively talk, Ralf Paus (Muenster, Germany and Manchester, UK) discussed yet another unexplored topic in hair research, which is the energy metabolism properties of the hair follicle. Dr. Paus reviewed the available evidence for the importance of the mitochondria for normal hair follicle energy metabolism, and showed that the regulation of mitochondria function is dependent on the hypothalamus-pituitary-thyroid axis, which is known to be fully functional in the hair follicle. Such regulation might be exploited in the future as potential therapeutic target for regulating hair growth and ageing.

Jerry Shapiro (Vancouver, Canada and New York, USA) shared with the audience his approach to the diagnosis and treatment of female pattern hair loss. Dr. Shapiro emphasized the importance of taking proper history from the patient, and the use of diagnostic aids such as blood tests and the phototrichogram for both diagnosis and treatment follow-up. Dr. Shapiro presented his algorithmic approach for the treatment of female pattern hair loss, which is based on the extent of baldness and patient satisfaction from available treatments.

Scalp itch is a highly disturbing and difficult to treat condition, especially in the elderly. Gil Yosipovitch discussed the available literature on the suggested pathophysiology of this condition, which probably stems from neuropathy of the dense innervation of the hair follicle and dermal vessels which are abundant in the scalp. Dr. Yosipovitch presented his treatment ladder to manage this condition, aiming mainly at the neuropathy believed to be responsible for this condition.

The last plenary session was given by George Cotsarelis (Philadelphia, USA), who started his talk by reviewing his recent studies which suggest that in AGA CD200- and CD34-positive cells are diminished, while K15-positive cells are maintained in the balding scalp, thus supporting the hypothesis
that in AGA there is a defect in the conversion of stem cells to progenitor cells. Dr. Cotsarelis then continued and presented the recent work in his lab, which shows that prostaglandin D2 is a potent inhibitor of hair growth, both in vitro and in vivo, thus making prostaglandin D2 and its receptor a novel target for treating AGA.

**Concurrent sessions**
The large amount of exciting and new studies that continue to emerge in the field of hair research was mirrored by the large number of concurrent symposiums and free communications in the WCHR2014. A total of 6 free communications sessions and 10 concurrent symposiums took place during the meeting. The topics of the concurrent symposiums this year were androgen metabolism and pattern hair loss; cicatricial alopecia; stem cell, tissue engineering & regeneration; neurobiology of hair follicle; alopecia areata and immunobiology of hair; hair graying and pigmentation; hypertrichosis, hirsutism and hair removal; animal models and hair research; hair genetics and pediatric trichology and morphogenesis and hair cycle. Additionally, the audience could also enjoy 5 workshops, which this year covered the following topics: recent progress of hair transplantation; laser and instrumental devices; cross reaction of hair follicle and surrounding tissues; structure and biology of the hair shaft and hair care and hair cosmetics. These sessions included invited lectures from leading experts in the relevant fields, and also presentations selected from the 237 abstracts that were submitted to the meeting. Highlights from these sessions include the talk by Claire Higgins (Durham, UK and New York, USA), who reviewed her successful quest to restore the hair follicle induction properties of human dermal papilla cells by growing these cells in hanging drops. Indeed, spheroid dermal papilla cells could instruct hair neogenesis.

Aaron Gardner (Durham, UK) provided an update on the attempts to culture fully functional dermal papilla cells, efforts which were rewarded by being selected as the best research paper. Dr. Gardner showed that the coating of dermal papilla cells with keratinocytes could enhance the formation of stratified epithelium, enhanced the inductivity of the cells, and could lead to down-growth of epithelia, in a similar manner to hair follicle morphogenesis. The importance of establishing proper epithelial-mesenchymal interactions for human hair follicle bioengineering was also highlighted by Manabu
Ohyama, and the importance of the microenvironment for dermal papilla cell growth was presented by Mike Philpott (London, UK), who showed that oxidative stress can be detrimental to the cells.

Hair follicle neogenesis was also addressed by George Cotsarelis, in his lecture in the “Stem cell, tissue engineering & regeneration” symposium. Dr. Cotsarelis provided evidence from mice studies that hair follicle regeneration during wound healing is mediated by γδ T cells, which enhance hair follicle regeneration by secreting Fgf9. Unfortunately, human skin lacks robust γδ T cells, a fact which can possibly explain the inability to regenerate hair.

Enhanced ability to regenerate hair was also the topic of the lecture given by Kang-Yell Choi (Seoul, Republic of Korea), who showed that activators of the Wnt/β-catenin pathway can enhance stem cell markers. This talk was followed by Bruno Bernard (Paris, France), who highlighted the differences between the stem cell pool located in the upper outer root sheath and the one located in the lower outer root sheath. Dr. Bernard also emphasized the fact that the progenitor pool of the pigmentary unit of the hair follicle is subject to continuous depletion, which in the end leads to hair whitening.

Cicatricial alopecia is a frustrating condition, oftentimes resistant to treatment, which etiology is still unclear. Matthew Harris (Manchester, UK) shed some light on its pathogenesis, by providing evidence that lichen planopilaris stems from immune privilege collapse, but in contrast to AA, this collapse occurs in the hair follicle bulge, which leads to scarring alopecia. Jerry Shapiro has offered the audience his treatment algorithm for scarring alopecia, with special emphasize given to frontal fibrosoing alopecia, an emerging diagnosis, which was termed as epidemic by Dr. Shapiro. Ralph Trueeb (Zurich Wallisellen, Switzerland) has made a surprising connection between pattern hair loss and scarring alopecia, by showing that pattern hair loss is accompanied by microinflammation, a phenomenon which is not targeted by current treatment protocols.

Hair genetics experienced a real renaissance following the major advancements in genetic analysis methods, and the utilization of whole-exome sequencing. Regina Betz reviewed the recent findings in genetic disorders that lead to hypotrichosis, while Miao Sun (Sozhou, China) presented the new discoveries in the field of hypertrichoses.
Abraham Zlotogorski (Jerusalem, Israel) in a vivid presentation gave an update on new discoveries and trends in pediatric trichology, covering all fields of hair diseases, from androgenetic alopecia, via alopecia areata, trichotillomania and genetic diseases.

**Sponsored Scientific Symposia**

Several sponsored scientific symposia took place during the meeting. Johnson & Johnson arranged a special session on treatment of common hair loss conditions, with the participation of Jerry Shapiro, who gave treatment algorithms for pattern hair loss, and Ulrike Blume-Peytavi (Berlin, Germany) who presented en evidence-based approach to the treatment of pattern hair loss. The session was concluded with an uplifting Q & A session with these two luminaries of the hair field.

In Angfa’s symposium, Rei Ogawa (Tokyo, Japan) discussed the role of mechanical force in hair growth and regeneration, with special emphasize on its effects on dermal papilla cells. In Unilever/CLEAR symposium, scalp health was discussed, including lectures on the negative effects of dandruff on scalp self-confidence (Amanda Godbehere, Bebington, UK) and a lecture by Ralf Paus on the uniqueness of scalp skin biology. The aging scalp and hair was the topic of the Amore Pacific symposium. Desmond Tobin (Bradford, UK) gave an overview on the external and internal factors which can influence hair aging, and George Cotsarelis summarized his lab’s work to characterize the hair follicle stem cells. Ohsang Kwon (Seoul, Republic of Korea) presented data showing the differences in physical characteristics between hair from young and old Asian females, and presented the beneficial effects of ginsenosides on hair follicle growth.

Aderans symposium also addressed the issue of the aging hair, with a lecture by Emi Nishimura (Tokyo, Japan) who focused on the effects of aging on hair follicle stem cells. Another lecture in this symposium, given by Shigeki Inui (Osaka, Japan)
wad dedicated to the beneficial effects of wigs on quality of life and appearance satisfaction. MSD symposium was dedicated to male pattern hair loss, which included enlightening talks by Won-Soo Lee and Jerry Shapiro on the treatment of androgenetic alopecia. The topic of Unilever/Dove symposium was the damaged hair, with several lectures on how to characterize hair damage, and potential ways for improving and avoiding further hair damage. Andrew Messenger opened the Galderma symposium by providing evidence for the hypothesis that female pattern hair loss in not androgen-mediated, and emphasized the need for more studies, such as genetic experiments, to find other etiologies for this condition. Gwang Seong Choi closed this session by reviewing possible treatment options for female pattern hair loss.

Posters
The poster session this year was a great success, and attracted the attendants for inspiring discussions in the poster hall. The posters hall also hosted the large number of exhibitors, who presented new technologies and the new research on different commercial medications for hair loss. In addition to the best research paper given to Aaron Gardner, additional studies were selected from the presenting posters. Best Clinical Paper award was given to Emiko Watanabe-Okada (Keio, Japan) for her poster on “Histological investigation of clinically non-affected lesions in alopecia patients detected phenotypically undetectable pathologic abnormalities”. Amelie Rezza (New York, USA) received the Best Research Poster award for her poster on the “Role of mesenchymal PDGF receptors during hair follicle formation”, and Nicolas Perez-Mora (Madrid, Spain) received the Best Clinical Poster award for his poster on “Acute telogen effluvium in 503 female patients: the value of the triggering cause to predict female androgenetic alopecia (FAA) association”.

Closing ceremony
The closing ceremony was opened by a congress review by Won-Soo Lee, which was followed by a wonderful presentation of photos that were taken during the meeting and social events. Afterwards, farewell address was given by Do-Won Kim and Gill Westgate, and the Platinum sponsors, Yil-Seob Lee (from GSK) and Young Ho Park (from Amore Pacific) greeted the audience. After the awards ceremony which included 4 scientific awards, 41 travel grants and 3 lucky draw event, Maria Hordinsky introduced the 9th WCHR, under the
slogan “Reflect, Rejuvenate and Regenerate!”, which will take place in Miami, FL, USA between 18-21 November, 2015, and promises to be a memorable meeting.

**Social events**
Special social events held during the meeting included a welcome dinner and Makgeolli and Soju tasting experience, in the wonderful “Ocean View & Foyer”, which overlooked the Pacific Ocean, providing a fabulous atmosphere for renewing old friendships and creating new ones.

A picnic lunch was held the next day near the magnificent Jusangjeolli cliffs, which are composed of impressive pillar rock formations entering the sea, and the perfect weather allowed a relaxing stroll along these cliffs.

May 16 was a special day in the congress, as it provided a breathtaking break in the lectures to allow the participants to enjoy the wonders of nature in Jeju. The delegates could choose between three beautiful courses: Camellia Hill, Spirited Garden and Botanical Garden Yeomiji, which they could explore in a calm and relaxing atmosphere.

These tour breaks were followed by the Gala dinner, which was held on the sea side in the cliff garden of the Hyatt Regency Jeju, which in addition to delicious food, also provided special performance of female jazz band.

**Summary**
Much progress has been made in recent years in our understanding of many hair disorders, and especially of the genetic basis of AA and AGA. Additionally, new treatment modalities continue to emerge. It is to be believed that new technologies and novel in vitro and animal models will provide further important insights within the few next years. This dynamic
meeting has addressed many of these research advances, and covered the depth and breadth of hair biology.

Given the rapid advances in this field, we look forward to more revelations in the next exciting meeting, the 9th WCHR, 18 November 2015 to 21 November 2015 in Miami, FL, USA, which will be organized by Wilma Bergfeld, Angela Christiano and Maria Hordinsky.
All abstracts presented in the 8th WCHR are available in the Annals of Dermatology, volume 26, Suppl. 1, May 2014, pages 1-58.