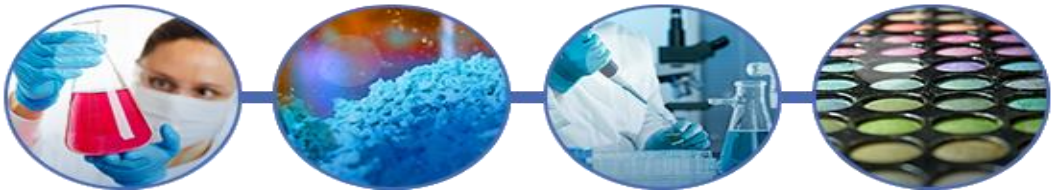


The Southwest Connection

SOUTHWEST SOCIETY OF COSMETIC CHEMISTS NEWS AND ANNOUNCEMENTS

Southwest Society of Cosmetic Chemists SCC

WHAT'S HAPPENING

CONTEST!

Page 3 for details

EVENT CALENDER

Page 4 – Check out our monthly chapter meeting schedule and special events.

www.swscc.org/events

SCIENCE CORNER

JOURNAL OF COSMETIC SCIENCE

See Page 6 for more info

Publishes papers concerned with cosmetics, cosmetic products, fragrances, their formulation and their effects in skin care.

NEWSLETTER / EVENT SPONSOR

WE NEED YOU

Page 9 - sponsorship opportunities newsletter

Event sponsorships also available.

https://swscc.org/events/events/133-swscc-newsletter-sponsorship

Southwest Society of Cosmetic Chemists SCC

Comments from your SWCC Chair:

Every moment of every day is an opportunity for change. As we are approaching the half-year mark, I would like to say that in the last four months, SWSCC has accomplished many things. In January, we created multiple new Committees, held educational meetings in each month outside of April. Had our golf tournament, and even had an Outreach educational panel for High School and college students. As we approach mid of Q2, we look forward to continuing our services in Houston and volunteering event work in June!

Events translate to work, and the work here is done by the numerous Committee Chairs and volunteers of our organization. Without the service of the many volunteers, none of these events can ever take place. Please take a moment to thank those, who you know, are volunteering with SWSCC, because their time is valuable and their efforts and energies are ever more crucial to any organization! I am proud to be a part of something good!

Yours truly,

Quyen

Southwest Society of Cosmetic Chemists SCC

Do you want to win an Amazon GIFTCARD? Be on the lookout for this picture within this newsletter! The first person to correctly reply with where they saw it will WIN!!

We will announce the winner in the next newsletter

1st winner was Karina Sanchez @ Merle Norman

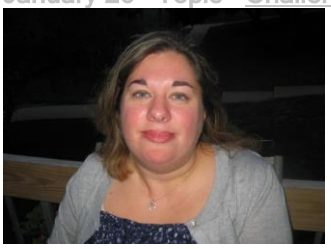
Email guess to Kimberly.wandell@omya.com

Southwest Society of Cosmetic Chemists SCC

Monthly Chapter Meeting Schedule – Check the website for more detailed info

2023 Schedule

January 26 – Topic - Challenges in Formulating Effective Sunscreens – presented by Susan Sperring @ Symrise.



Thank you Susan for presenting @ our January meeting!

Feb 23 Topic: Plant Doctors for Cosmetics, from Snake Oil to 21st Century Technologies

Thank you, Joseph Dallal for speaking @ our February Meeting

March 23rd – Topic - The Convergence & Divergence between MoCRA AND CSAR

Thank you, Dr. Zhi Li for speaking @ our march Meeting

April 5th – Golf Tournament – pictures posted on social media pages

May 25th – Houston Education meeting – More details soon

June 22nd – Social. Volunteer with another non-profit
July 27th – No meeting
August – Austin Educational Meeting
Sept 28th – Educational Seminar Day (all-day)
Oct – Social. Trunk or Treat
Nov 16th – Educational lunch
Dec 8th – Dinner Dance

To register for the above events please visit our web site. https://swscc.org/events

Southwest Society of Cosmetic Chemists SCC

THANK YOU TO OUR OF OUR GOLF HOLE SPONSORS!

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All your wonderful pictures have been uploaded to all of our social media platforms. Thank you to those who submitted pictures.






Southwest Society of Cosmetic Chemists SCC

SCIENCE CORNER

The JOURNAL OF COSMETIC SCIENCE (JCS) publishes papers concerned with cosmetics, cosmetic products, fragrances, their formulation and their effects in skin care or in overall consumer well-being, as well as papers relating to the sciences underlying cosmetics, such as human skin physiology, color physics, physical chemistry of colloids and emulsions, or psychological effects of olfaction in humans. Papers of interest to the cosmetic industry and to the understanding of the cosmetic markets are also welcome for publication. Issues are published online bi-monthly, for a total of 6 issues a year. There are no submission fees to publish a paper in JCS.

https://library.scconline.org/recent-issues

SCC Members receive a complimentary subscription to JCS. Nonmembers can purchase individual issues/articles on the issue's page. If you wish to receive complimentary access to the Journal, Join SCC or click here to subscribe.

Southwest Society of Cosmetic Chemists SCC

EDUCATIONAL PANEL:

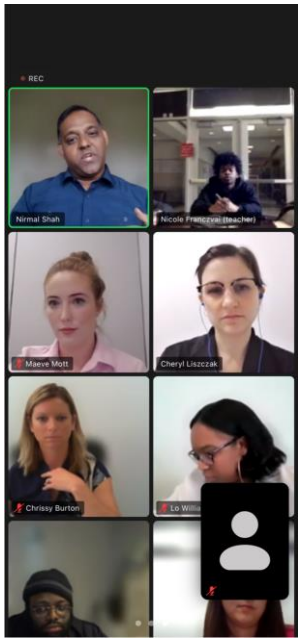
The SWSCC was pleased to have the opportunity this month to present an educational panel to local high school students about the R&D process of developing a cosmetic product.

Lewisville ISD teacher, Nicole Franczvai, reached out to the SWSCC for guidance when her students wanted to develop a cosmetic product for her "Shark Tank" style entrepreneurial class. Like many others outside of the cosmetic industry, Nicole was unsure on how to guide her students on the process of developing a formula to sell. To help her students understand some of the considerations, the SWSCC compiled a panel of speakers to educate the students on the many different facets of cosmetic R&D development. This panel, hosted and moderated by Cheryl Liszczak, included Nirmal Shah speaking on raw material characterization and clinicals, Zyanya Snook speaking on regulatory considerations, Chrissy Burton and Tyrick Allen both speaking on formulation practices, Anna Sandoval speaking on stability studies and analytical testing and Maeve Mott speaking on package engineering. With this breadth of expertise, the panel was able to give the students a comprehensive idea of all the work that goes into developing a cosmetic and all the many detailed parts that need to come together to create a quality, compliant product.

The students were very appreciative of the information we were able to provide and immediately sought further resources from their library to learn more about the topics we touched upon.

The SWSCC would like to thank all the panelists as well as Quyen Tra and Rhonda Solberg for introducing the SWSCC during the panel, and Lo Williams for expanding our audience by inviting interested Louisiana-based university students to attend the presentation.

If you are interested in organizing or participating in student outreach events such as this one, the Student Outreach Committee would love to have you on board! Email Cheryl Liszczak at Cheryl.liszczak@marykay.com to join!



Southwest Society of Cosmetic Chemists SCC

SPOTLIGHT ON CHERYL:

Cheryl Liszczak (pronounced Lish-chak) began her career in the personal care industry almost 5 years ago and she was confused! The media was so full of information about cosmetic ingredients but what information was real and backed by scientific evidence? What information was part of a marketing story to sell a product? What information was misinformation that had infiltrated popular opinion and had gotten out of hand? In a quest to find answers and to educate others she began working in student outreach with the SWSCC in 2021.

When asked why she chairs the student outreach committee, Cheryl said "I figured if I have all these questions and misunderstandings, surely others do too! It's so hard to separate fact from fiction using online searches, so I wanted to bring reliable information to students by utilizing the resources of the SWSCC and learn more myself along the way."

Prior to her current role as a Senior Scientist I in Product Integrity at Mary Kay, Cheryl worked as a scientist for a major pharmaceutical company developing quality control test methods for biologic drugs. She received her BS in Chemistry from Kent State University and her PhD in Biochemistry from the University of Pennsylvania. In her spare time Cheryl enjoys pretending to be a rhinoceros with her husband and two young children (ages 3 and 6 months) and watching reality TV.

In the future Cheryl aspires to continue to learn more about the cosmetic industry and cosmetic ingredients and to grow the student education platform of the SWSCC. She hopes to work towards dispelling misinformation that has negatively impacted the industry and consumers alike and to build excitement around the opportunities in cosmetic chemistry for the next generation.

Southwest Society of Cosmetic Chemists SCC

THIS YEAR WE WILL BE TAKING NEWSLETTER SPONSORSHIP PAYMENTS ON THE WEB SITE SO YOU CAN PAY BY CREDIT CARD. IF YOU STILL WISH TO PAY BY CHECK PLEASE LET ME KNOW

www.swscc.org/events

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2 X 4 - $380/YR
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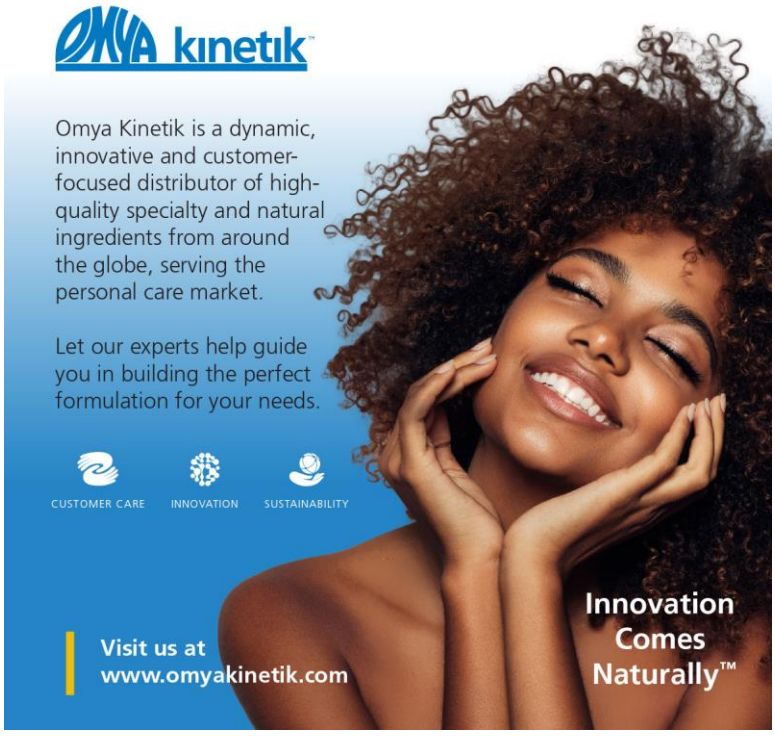
½ PAGE - $620/YR
FULL PAGE - $1000/YR

THANK YOU TO EVERYONE WHO HAVE ALREADY GIVEN US YOUR ADS FOR 2023! YOU WILL BE SEEING YOUR INVOICES SHORTLY.

EVENT SPONSORS:

WE WILL BE ASKING FOR EVENT SPONSORS SOON. BE ON THE LOOK OUT FOR EMAILS AND IN FUTURE NEWS LETTERS



Southwest Society of Cosmetic Chemists SCC

Whats new in 2023!

The Executive Board is working hard on forming committees for 2023 and beyond. Below is our committee lists. Your board will be reaching out to people who we think might be good for each of these. Also, if you would like to join a committee PLEASE let us know.

Committee Chairs

- Newsletter Chair – Kim Wandell – Omya
- Webmaster Chair – Kim Wandell – Omya
- Social Media Chair – McKenzie Shaytar – Botanical Science
- ByLaws Chair – Robert Vetkoetter – Emultec
- Dinner Dance Chair – Carrissa Dowdy – Mary Kay
- Golf Tournament Chair – Jeff Barcafar – Barentz
- Event Planning Chair – Stan Djurich – IMCD
- Historian - Barbara Durkee – Mary Kay
- Educational Chair – Michelle Hines – Mary Kay
- Suppliers Day Chair – Chrissy Burton – Botanical Science
- Student Outreach Chair – Cheryl Liszczak – Mary Kay
- Past Chair – Chrissy Burton – Botanical Science
- Editorial Chair – Melanie Timms
- Membership Chair – Rhonda Solberg @ Mary Kay

Southwest Society of Cosmetic Chemists SCC

It's that time again and we couldn't be happier to announce that we are now accepting abstracts for the **Society of Cosmetic Chemists' 77th Annual Scientific Meeting & Showcase (SCC77)**, convening December 11-13, 2023 at the Sheraton New York Times Square, NY.

All scientists, academicians, students, policy makers and other stakeholders in the cosmetic and personal care community are invited to submit an abstract of original work, lab demonstration or case study for consideration to present as a podium lecturer.

The SCC is looking for submissions covering:

- **Skin Care**
- **Hair Care**
- **Color Cosmetics**
- **Fragrance**
- **New or Novel Ingredient, Process, and Formulation Technologies**
- **Diversity and Inclusion in Beauty**
- **Sustainability**
- **Claims & Regulatory**
- **Photoprotection**
- **AI & Machine Learning**
- **Biotechnology**

Accepted speakers shall receive one (1) complimentary single day access registration to the annual meeting for use by the speaker, the day of their presentation. A full access registration upgrade for speakers is available at a discount if they wish to attend the entire meeting. Additional registrations may be purchased at the then-current rate.

ABSTRACT SUBMISSION DEADLINE: MAY 15, 2023 (11:59 PM EDT)

PLEASE NOTE: Any abstract not selected for a podium presentation will be eligible as a poster/tabletop in the exciting and ever-growing Exhibitor Showcase.

Click here to submit

Southwest Society of Cosmetic Chemists SCC

KNOW A STUDENT PURSUING A CAREER IN COSMETIC SCIENCE?

ENCOURAGE THEM TO APPLY FOR THE SCC MADAM C.J. WALKER SCHOLARSHIP TODAY!

APPLICATION COMPLETION DEADLINE IS MAY 19, 2023.

The Society of Cosmetic Chemists (SCC) **Madam C.J. Walker Scholarship**, *generously sponsored by* ***Mary Kay***, signifies SCC's support of under-represented minorities (Black/Brown/African American, Native/American Indian/Indigenous Peoples, or Hispanic/Latin American) of any gender identity pursuing higher education in STEM disciplines related to the cosmetics and personal care industry. **Encourage a student you know pursuing a career in cosmetic science to apply today**. Click here for **full program details, eligibility, and application requirements**.

Two (2) scholarships, in the amount of **$5,000 USD** each (sponsored by Mary Kay), will be awarded to eligible students pursuing an undergraduate or post-graduate Degree in chemical, physical, medical, pharmaceutical, biological or related sciences and technology ***relative to the cosmetics and personal care industry.***

In addition, winners will be provided with:

- A complimentary Full Access Registration to attend the SCC 77th Annual Meeting & Showcase in New York, NY, December 11-13, 2023
- An invitation to accept a ceremonial award at the SCC Awards Breakfast on December 13, 2023
- A complimentary student poster at the SCC77 Showcase December 12-13, 2023
- A $350 travel voucher to offset travel costs to NYC
- Two (2) nights complimentary accommodation at the Sheraton NY Times Square December 11 & December 12, 2023

Selected finalists may be provided with:

- A complimentary Full Access Registration to attend the SCC 77th Annual Meeting & Showcase in New York, NY, December 11-13, 2023
- An invitation to be recognized at the SCC Awards Breakfast on December 13, 2023
- A complimentary student poster at the SCC77 Showcase December 12-13, 2023
- A $350 travel voucher to offset travel costs to NYC
- One (1) night complimentary accommodation at the Sheraton NY Times Square December 12, 2023

Click here for **full program details, eligibility, and application requirements.**

Application deadline is 11:59pm EDT Friday, May 19, 2023!

Click here to submit

Southwest Society of Cosmetic Chemists SCC

Southwest Society of Cosmetic Chemists SCC

Advantages of Membership

Membership with the Society of Cosmetic Chemists (SCC) connects you with professionals who undoubtedly understand the challenges and opportunities of the industry. Our benefits can be categorized into three major reasons why professionals in the cosmetic and personal care industry make the decision to join the SCC.

Education

- Free and/or discounted access to content on the SCC Media Library and Resource Center, the go-to digital platform for journal issues, webinars, annual meeting content, and other resources.
- Complimentary digital subscription to the Journal of Cosmetic Science, our flagship technical publication. The Journal aims to provide readers with high quality, peer-reviewed technical articles covering basic and applied research in cosmetic science, as well as advances in technology and product innovation for cosmetics and personal care.
- Discounted and/or free registration for Continuing Education in various formats such as live webinars, classroom lectures, hands-on lab instruction, and more.

Networking

- ***Exclusive*** access to the online Membership Directory, the up-to-date guide of nearly 6,000 contacts - the who's who in the Society.
- Opportunities to participate in a wide range of education and networking events at 19 Affiliated Chapters across Greater North America.

Events

- Discounted registration to the Annual Scientific Meeting & Showcase, the Society's hallmark event. Drawing more than 1,200 cosmetic and personal care community members and partners each December, highlights include: two full days of education on the latest industry innovations and research; a Showcase featuring more than 100 exhibitors and scientific posters; and multiple opportunities to expand your professional network and connect with cosmetic chemistry experts.
- Complimentary Membership in the International Federation of the Societies of Cosmetic Chemists (IFSCC) - a worldwide federation dedicated to international cooperation in cosmetic science. As a member of IFSCC, you will enjoy discounts to international events and receive access to both the IFSCC Magazine and KOSMET (housing over 84,000 international abstracts).

Southwest Society of Cosmetic Chemists
SCC

Southwest Society of Cosmetic Chemists SCC

The below article was found by Melanie Timms – SWSCC Editorial Chair

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Gunn David (Orcid ID: 0000-0001-9866-3221)

REVISION TO ICS-2022-4092

RESEARCH COMMUNICATION

Scalp hair loss is not random across follicular units: a new insight into human hair aging

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c. Unilever R&D, Colworth Science Park, Sharnbrook, Bedfordshire, UK, MK44 1LQ

d. State Key Laboratory of Genetic Engineering and Ministry of Education, Key Laboratory of Contemporary Anthropology, Collaborative Innovation Center for Genetics and Development, School of Life Sciences, Fudan University, Shanghai 200438, China

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This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/ics.12851

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i. Center for Excellence in Animal Evolution and Genetics, Chinese Academy of Sciences, Kunming 650223 China

Short Title: Scalp hair loss and follicular units

Corresponding Authors:

Professor Sijia Wang (wangsijia@picb.ac.cn) and Dr David Andrew Gunn (david.gunn@unilever.com)

Number of Tables: 1

Number of Figures: 2

Word count: 1917

Keywords: Hair growth, Hair treatment, Computer modelling

Conflict of Interest Statement

Authors I.A., R.B., P.M., M.R., X.G. and D.A.G. are Unilever employees and had a role in data analysis and the manuscript. Although no products were tested, this manuscript could promote the use of anti-ageing products and services leading to financial gain for Unilever.

REVISION TO ICS-2022-4092

Abstract

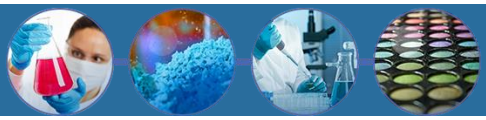
Southwest Society of Cosmetic Chemists SCC

Objectives: Scalp hair has the greatest number of hairs (typically 1-5) per follicular unit but is also the most susceptible body site to hair loss with age. Hence, we set-out to determine the degree to which scalp hair parameters change with age in women and men, any sex differences thereof and whether hair loss is random across follicular units.

Methods: A retrospective cross-sectional study of 200 Chinese men and 200 Chinese women (30-69 years). Image analysis and manual counting methods were used to measure occipital located hair parameters from 6x8 mm shaved scalp photographs and plucked hair microscopy images.

Results: Of 5 hair parameters, the number of hairs per follicular unit had the greatest (negative) correlation with age in both men and women. Men had a greater number of hairs and follicular units than women on average but had a greater decrease in number of hairs per follicular unit with age, particularly for the loss of multi-hair (3+) follicular units. The loss of hairs with age was significantly different to that expected by a random loss of hairs across follicular units, and better described by a model of increased hair loss risk the greater number of hairs per follicular unit.

Conclusions: We have found evidence of hair loss preferentially occurring in multi-hair follicular units which was more pronounced in men. This data suggests that part of the reason scalp hair is more susceptible to hair loss than on other body sites is due to the greater presence of multi-hair follicular units on the scalp.



Southwest Society of Cosmetic Chemists SCC

Introduction

Balding in men follows a notable and specific pattern of hair loss - a receding temporal hairline from the forehead and balding on the vertex/calvaria (1). In women, scalp hair loss more commonly occurs without hair recession from the forehead or balding at the vertex and is termed female pattern hair loss (FPHL). There is evidence that, although women suffer from a milder version of male pattern baldness (MPB), FPHL is a different phenotype with a stronger environmental influence(2). However, the underlying physiological differences in the way hair follicles are lost on the scalp between men and women are relatively unknown.

Despite genetic studies linking many genes to balding on the scalp(3), the physiological mechanisms driving hair loss with age are poorly understood as is why the scalp remains an area of particularly high risk of hair loss. Hairs on the scalp occur within follicular units, typically containing 1-5 hair fibres, with multi-hair follicular units much more prevalent on the scalp than other body sites (4). Only one study to date, in Japanese women, has investigated hair loss within follicular units with age and found there tends to be a loss of multi-hair follicular units but not single hair follicular units(5). Whether this pattern of hair loss within follicular units relates to a random loss across the scalp (as loss of hairs in multi-hair follicular units with age creates single hair follicular units) or reflects a bias for increased hair loss within multi-hair follicular units is unknown. In addition, how hair parameters change with age in men and women are lacking, particularly in east Asian populations.

Here, we investigated how hair parameters change with age in both Chinese men and women. In addition, we modelled the rate of hair loss with age to determine whether the observed pattern fitted a random pattern of hair loss.

Materials and Methods

Subject selection

Scalp images from 200 female and 200 male subjects were selected from a 2014 collection in the Taizhou Longitudinal Study (TZL) cohort (n=2964) (6). All image IDs from the dataset were divided into age groups (30-39, 40-49, 50-69 and 60-69) and sex. We randomly selected IDs from each group and sex, until 50 females and 50 males were selected for each age group. There were 8 men with MPB and no woman graded as having baldness. All volunteers were Han Chinese and lived in Taizhou, Jiangsu Province, China; the Taizhou economy is at a medium level of affluency among Chinese cities. The volunteers were from different jobs and more details are described in Wang et al (6). Ethical approval was given by the Ethics Committee of Fudan University (Ethics Research Approval Number 85), and all subjects were in good health and gave informed written consent.

Measurement of hair parameters

One hair from each subject was plucked from the occipital (mid back) area of the head. An optical microscope was used to take three 50X photographs of the hair fibre closest to the root (within 3cm) alongside a measurement scale so that hair thickness could calculated by a Canny edge detector (also see Fig. S1B).

Hair density, follicular unit density and hair density / follicular density ratio were measured from a photograph taken from a 6mm by 8mm shaved area on the occipital part of the scalp (example given in Supplementary Material Fig. S1). Hair and follicular unit counts were measured by a convolutional neural network (CNN) trained using 2,400 sample images, and validated using 565 sample images (Supplementary Material Fig. S1A); all these images were from a separate collection to the 400 subject test images used for further analyses in this study. First, the 2965 images were manually counted by three persons for hair and follicular unit number, and the average between the 3 assessors used as the final human measurement. After, a 16-layer CNN (VGG16), written in Python 3.6 and PyTorch 1.0.0 (also see Gallucci et al(7) for a similar approach), was trained on the training set, and then run on the validation set; the CNN data gave correlations of r=0.94 for hair counts

(RMSE 3.9) and 0.86 for follicular units (RMSE 2.6) with the manual counting data. The CNN was then used to automatically estimate hair density, follicular unit density and their ratio on the 400 test images. In addition, we also manually measured the number of follicle units containing 1, 2, 3, 4 or 5 hairs per image/subject on the 400 test images to determine the distribution of hairs per follicle unit for each image, not just the average.

Electronic microscopy was used to take 800X photos to measure hair scale pattern which is a marker of damage to the hair cuticle. Due to the labour-intensive nature of this method, we randomly selected hairs from 50 females and 50 males from the different age groups for measurement. Scale pattern was estimated by an algorithm based on the contrast component of Tamura texture features (Fig. S1C). Tamura texture was defined to quantify visual patterns of object surfaces based on psychological experiments and has been widely used (8-10). To evaluate the algorithm, 100 samples (not used in this study) were estimated manually by a classification system for hair damage (Fig. S2)(11). We found a lower contrast value of Tamura texture indicated fewer regular overlaid cuticles and a higher degree of hair damage by comparing it to manual judgement (rho=0.71).

Data analyses

Hair parameters: Hair fibre thickness and hair density were transformed to more normal distributions by using the square-root of the measures. A log transformation was used for hair-follicular unit density (base-e log). Correlation analysis was used to investigate the relationship between different parameters. Shapiro-Wilk normality tests were used to determine if parameters were normally distributed or not, and the Wilcoxon rank sum test to estimate differences between sexes. Correlation analysis was used to investigate the relationship between different parameters and age.

Modelling loss of hair fibres

To assess the credibility of two hair fibre loss models, 1000 bootstrap samples were simulated from the original data for each age and gender group in each case. The models applied were: Hair loss at random from 30-39-year olds to 60-69-year-olds was computed separately for both males and females but at a constant rate irrespective of hairs per follicular unit (probability of a hair being lost between the two age groups ~0.17 and ~0.13 males and females respectively). The higher rate of hair loss the more hairs per follicular unit, but different rates for each gender: Rate of loss = 1 -p^n, where n is the number of hairs in the follicle and p is increased hair-loss risk effect within a follicular unit, estimated as 0.09 for Males and 0.05 for Females.

The percentage of follicles with three or more hairs was determined for each 60-69 subject, and then the average equivalent percentage was computed for each simulated set. Follicles with 0 hairs were excluded from the calculation as no such observations were possible. To test the null hypothesis that hair loss reflected the approach being assessed, the proportion of these bootstrap statistics (percentages) that was more extreme than the actual percentage was used, i.e. in this case, the p-value is the proportion of simulated values that are lower than the observed value. This test was performed once to assess each approach.

Results

Hair parameters and sex differences

Table I shows the distributions of hair parameter values across sexes and additionally with low, average and high representative values. Males had a significantly higher hair density and follicular unit density than females, but similar fibre thickness and number of hairs per follicular unit (i.e. ratio of hair density /follicular unit density).

Hair parameter changes with age

The hair number per follicular unit had the greatest negative correlation with age (r=-0.58 and r=-0.48 in males and females respectively) whereas the density of follicular units more weakly changed with age (r=0.24 and r=-0.26 for males and females respectively); see Fig. S4 Supplementary Material for visualisations and relationships with age for the parameters.

Hairs per follicle unit and their change with age

There was a small decrease in 2 hair follicular units and a marked decrease in 3 or more hairs per follicular units with age; in contrast, there was an increase with age in 1 hair follicular units, Fig. 1A and 1B, and was more notable in the men. Indeed, there was a greater difference in the ratio of 3+ hair follicular units over 1 hair follicular units between men and women at 60-69 than at 30-39 year olds although the sex difference in the 60-69 group was outside significance, Table I p=0.08.

Finally, we modelled the likelihood of losing the number of hairs per follicular unit based on random loss as well as an increased likelihood of hair loss the more hairs per follicular unit. When examining the change in the proportion of 3 or more hair follicular units with age, the observed data was significantly different to the random model, but no significant difference was evident between the observed data and the model predicting increased risk of loss for every extra hair per follicle unit, Fig. 2A-D.

Discussion/Conclusion

Here, we found that men have a greater density of hairs as well as follicular units than women. However, the loss of multi-hair follicle units with age was greater for men leading to less 3+ hair follicle units on average for men than women in their 60s. Furthermore, the loss of hairs per follicular unit in men and women was more similar to a model of increased risk of hair loss the more hairs per follicular unit, which was particularly the case in men.

Recent advances in genomic studies, particularly the genome wide association study (GWAS), has helped identify genes underlying MPB (3). FPHL is less well explored with data indicating it has, at

least in part, a different aetiology(2). Although the change with age in the hair parameters found here were generally similar between men and women, men did lose more hairs per follicular unit with age faster than women giving a lower number of multi-hair follicular units relative to single hair follicular units by age 60-69. This effect could be the result of the greater genetic susceptibility to MPB in men. Investigations into how MPB linked DNA sequence variants drive loss of hairs within follicular units could give further insights into this phenomenon, such as if androgen receptor signalling interacts with and exacerbates such loss.

Only one study to-date has examined hair loss per follicular unit and found that one hair follicle units increased with age whereas there was a decrease in 3 or more hair follicular units(5). Here, we also observe a similar pattern and also demonstrate that the hair loss is unlikely due to random loss of hairs across follicular units. One explanation for this non-random pattern of hair loss is that there is a competition between hair bulbs within follicular units; for example, vascular supply of nutrients could diminish with age as capillaries that associate with vellus hairs (the precursors to hair loss) are smaller and less numerous(12). In support of this, minoxidil, which prevents hair loss, could be stimulating hair regrowth via improved blood supply to the hair follicle(13). However, it is not known if the reduced capillary supply is pre- or post-vellus hair formation, and minoxidil's exact mode of action is unclear(13). These data do, however, indicate that interventions that slow the loss of hairs within multi-hair follicular units should help reduce the amount of hair loss with age.

As a weakness to this study, the counting of hairs per follicular unit can be challenging if hairs overlap one another, although as the counting was done blind to age or sex of the subject this should have had an equal influence across images. In addition, the analysis assumes that the older groups are representative of what will happen to the younger groups when they age, which might not necessarily be the case. However, as there are 100 subjects per each 10 year age group, the results should be generally representative of the ageing effects on hair and are supported by a separate study showing a similar pattern of hair loss per follicular unit with age(5). Notwithstanding this,

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replication of these data is warranted, to determine whether such non-random loss of hairs is generalizable across populations.

In conclusion, we find evidence of preferential loss of hairs in multi-hair follicular units more than that expected by chance. As multi-hair follicular units are much more dominant on the scalp these findings could explain, at least in part, the notable susceptibility of the scalp to hair loss.

Statements

Statement of Ethics

All participants provided written informed consent, and all study protocols were approved by the institutional review boards of the pertinent research institutions. The research was approved by the Ethics Committee of Human Genetic Resources at the Shanghai institute of life Sciences, Chinese Academy of Sciences.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy restrictions and regulations in China.

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Figure Legends

Figure 1. The number of hairs per follicular unit across age groups. **A**) The average number of follicular units containing 1 (dark grey bars), 2 (medium grey bars) and 3 or more hairs (light grey bars) per subject image for each age group in men. **B**) The average number of follicular units containing 1 (dark grey bars), 2 (medium grey bars) and 3 or more hairs (light grey bars) per subject image for each age group in women. Errors bars depict standard error for each age group, with 50 men and 50 women per age group.

Figure 2. **A-D**: Depiction of the distribution of 1000 simulated hair loss iterations for the percent of follicles with 3 or more hairs. Simulations used the 30-39 age group hair numbers per follicular unit and simulated hair loss via two different methods to generate new counts of hairs per follicular unit, with a new reduced total hair count as found in the 60-69 age group. **A**) In men, random loss of hairs across follicular units **B**) In women, random loss of hairs across follicular units, **C**) In men, hair loss as per a higher chance of hair loss for every extra hair per follicle unit & **D**) In women, hair loss as per a higher chance of hair loss for every extra hair per follicle unit. The vertical line in each chart depicts actual percentage of follicular units in the 60-69 age group with three or more hairs. Same statistics was used to determine fit of simulations with observed and was $p<0.001$ for **A**, $p=0.008$ for **B**, $p=0.673$ for **C** and $p=0.363$ for **D**. In other words, it is unlikely hair loss follows a random loss across follicular units and more likely it preferentially occurs in follicular units with greater numbers of hairs.

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Table 1: Hair parameter characteristics by sex. A shapiro test for data normality and Wilcoxon rank sum test for sex differences were performed on the data. Males had greater hair density and follicular unit density but tended to have less multi-hair follicular units at 60-69 years. Example images of the differences between low (17th) and high (83rd percentile) values for hair thickness and hair density / follicular unit density ratio are given in Figure S3 Supplementary Material.

Parameters	Gender	Sample size	1st tertile/17th percentile	Median/50th percentile	3rd tertile/83rd percentile	Shapiro test (p value) for normality	Sex differences (Wilcoxon rank sum test p value)
Tamura texture (contrast)	Female	50	14.13	21.06	26.22	0.94	0.7
	Male	50	14.5	19.88	27.27	0.01	
	Combined	100	14.46	20.35	26.52	0.36	
Hair fibre thickness (μm)	Female	200	74.75	86.22	100.15	1.5×10^{-3}	0.69
	Male	200	72.43	85.69	100.45	0.7	
	Combined	400	73.47	86.04	100.23	9.8×10^{-3}	
Hair density (number/cm^2)	Female	200	80.95	97.62	118.39	0.01	3.21×10^{-4}
	Male	200	87.3	104.76	126.16	0.43	
	Combined	400	82.54	100.99	123.02	0.01	
Follicular unit density (number/cm^2)	Female	200	38.1	44.44	54.24	4.1×10^{-4}	1.82×10^{-4}
	Male	200	42.06	46.83	55.56	4.4×10^{-6}	
	Combined	400	39.68	46.03	55.56	1.9×10^{-7}	
Hair density / follicular unit density ratio	Female	200	1.87	2.18	2.54	0.98	0.87
	Male	200	1.91	2.21	2.49	3.7×10^{-3}	
	Combined	400	1.9	2.19	2.51	0.07	
	Female	200	4	9	14.17	4.9×10^{-4}	0.13

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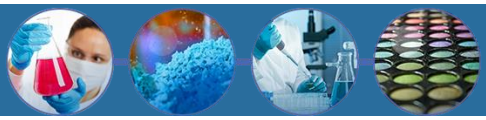
Number of 1 hair follicular units	Male	200	5	10	15	1.8×10^{-6}	
	Combined	400	5	9	15	6.1×10^{-8}	
Number of 2 hair follicular units	Female	200	10	14	17	0.15	0.37
	Male	200	10	14	18.17	1.8×10^{-2}	
	Combined	400	10	14	18	3.4×10^{-3}	
Number of 3+ hair follicular units	Female	200	2	4	8	4.1×10^{-8}	7.8×10^{-2}
	Male	200	2	5	9	1.7×10^{-4}	
	Combined	400	2	5	8	8.1×10^{-10}	
Ratio of 3+ hair follicular units over 1 hair follicular units in 30-39 year olds.	Female	50	0.21	0.73	1.7	3.9×10^{-11}	0.33
	Male	50	0.36	0.83	1.39	2.3×10^{-7}	
	Combined	100	0.27	0.8	1.51	1.8×10^{-15}	
Ratio of 3+ hair follicular units over 1 hair follicular units in 60-69 year olds.	Female	50	0.1	0.41	1.32	2.3×10^{-12}	0.08
	Male	50	0.02	0.21	1	5.0×10^{-9}	
	Combined	100	0.06	0.3	1.02	$<2.2\times10^{-16}$	



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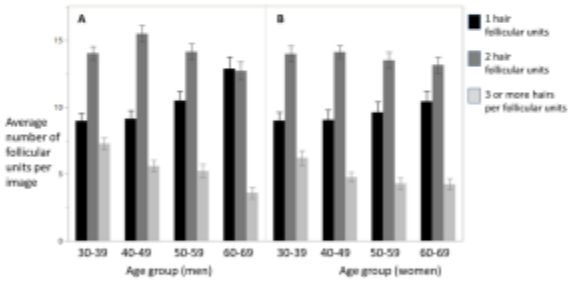

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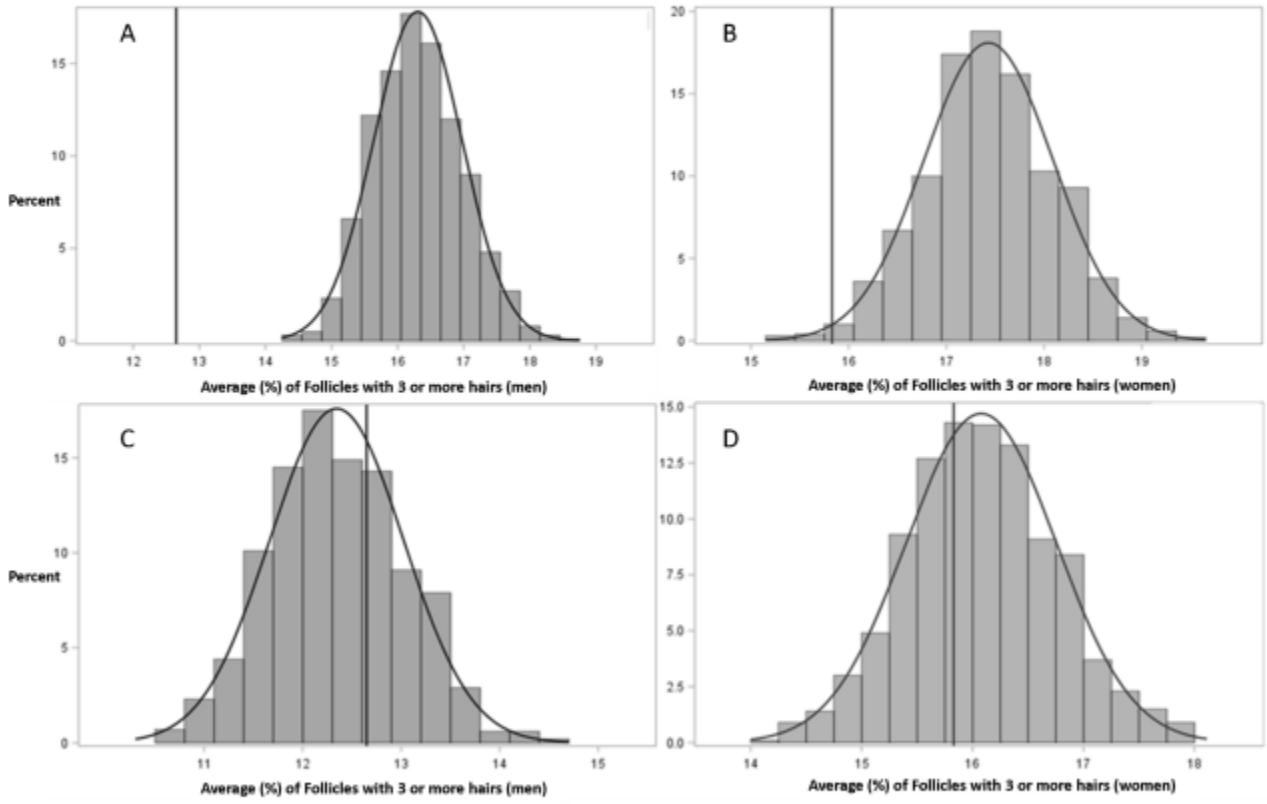

ICS_12851_Figure 2.tif

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Comments from the Editor:

I hope you have enjoyed this new addition of the newly named SWSCC Newsletter "THE SOUTHWEST CONNECTION." If you have questions or comments please reach out to me kimberly.wandell@omya.com

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-Kim Wandell 2023 SWSCC Secretary