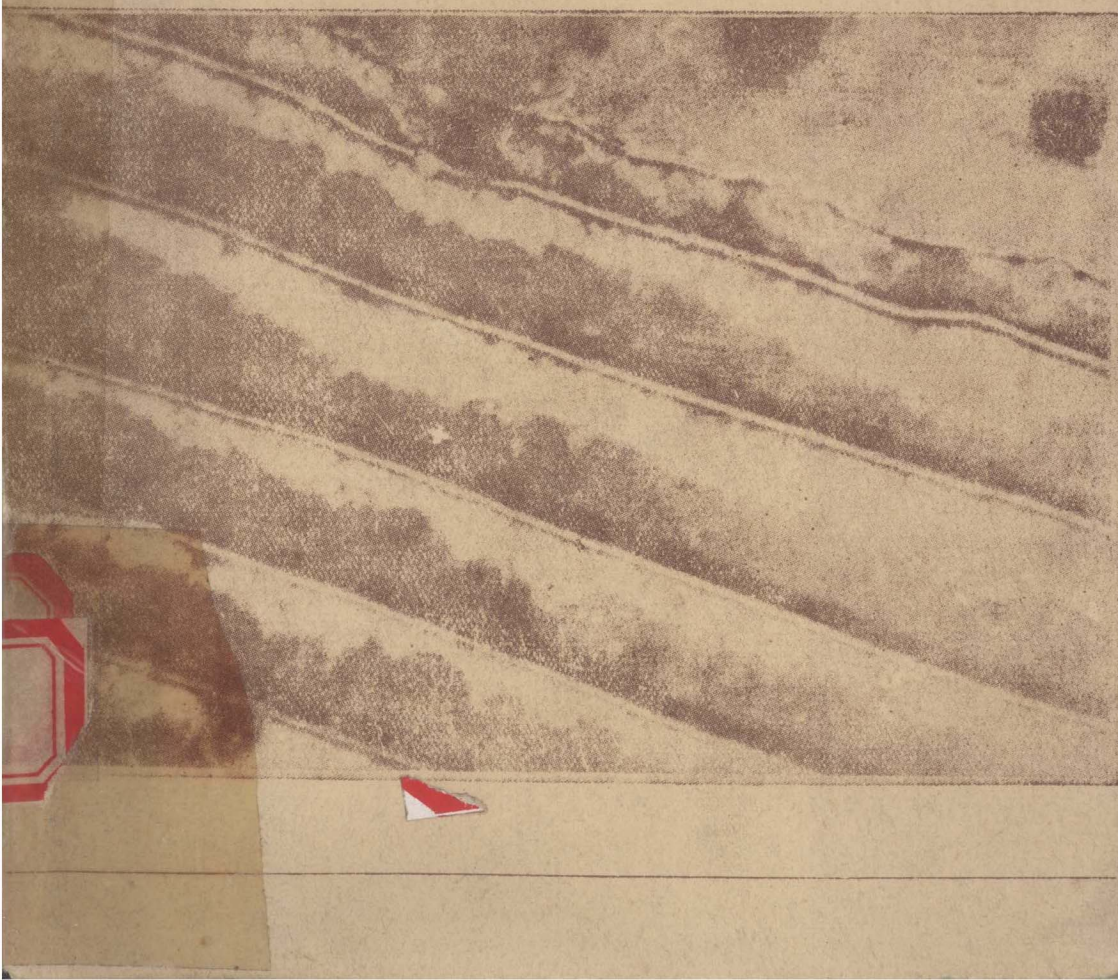


The Physiology and Pathophysiology of the Skin

Volume 4 edited by A. Jarrett



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Volume 4

The Hair Follicle

Edited by

A. JARRETT.

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VOLUME 4 The Hair Follicle

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Preface

The preface written for the three previous volumes applies equally well to this volume on the Hair Follicle. The vast amount of information available concerning mammalian hair follicles and their function is unfortunately limited to specialized aspects of hair growth and coloration, and is restricted to a few species. For example, biologists and geneticists have studied the inheritance of coat colour in the house mouse in great detail, and an immense amount of work has been undertaken on the physico-chemical nature of wool, and also on the production of this commodity because of its great commercial value. This makes the selection of material to be included in a work of this type difficult. Information has been selected that is hopefully of value both to the general biologist interested in hair and to those involved in wool research. The needs of the dermatologist have been rather more difficult to satisfy because man has been neglected in the study of normal hair growth. This is doubtless due to the difficulty of obtaining sufficient suitable material from the scalp for a full investigation of the many and varying functions of the human hair follicle. Nevertheless, recently some advances have been made in relation to disorders of the human follicle: for example, the recognition that acrodermatitis enteropathica is a zinc deficiency disease, and the value of the enzymology of plucked hairs to study the carrier state in sex-linked inborn disorders of metabolism. Most of the disorders of human hair growth are inherited defects but it is far too early to hope that genetic manipulation will be able to help this group of diseases: research in this field has to be carefully monitored for environmental and ethical reasons.

There are some areas of overlap in the subject material covered by the two main contributors but this has been approached from different aspects by the two writers. However, Chapter 37 by Dr Johnson carries, in the main, the same information as Chapter 38 written by Dr Spearman: the former could be considered as an introduction to the following chapter which has more detailed information of interest to the biologist. Chapter 37 may be sufficient on its own for the needs of the clinical dermatologist. It is hoped that the information in this

volume will give an adequate background to the clinician on which he can base new knowledge as it becomes available and which may be of direct value to him in the treatment of his patients.

A. JARRETT

March 1977

Acknowledgements

Again the authors are indebted to their colleagues at home and abroad who have discussed their work, provided illustrations and given permission to use published material. It is sincerely hoped that all these have been acknowledged in the text and legends.

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A. JARRETT

March 1977

E. JOHNSON

R. I. C. SPEARMAN

Contents of Volume 1 The Epidermis

A The Normal Epidermis A. JARRETT

- 1 The Epidermis and its Relation with the Dermis
- 2 The Biochemistry of the Epidermis
- 3 Epidermal Kinetics
- 4 Comparative and Experimental Keratinization
- 5 The Chemistry of Keratin
- 6 Normal Epidermal Keratinization

B Pathophysiology of the Epidermis A. JARRETT

- 7 Disorders of Keratinization : Psoriasis and Ichthyosis
- 8 Disorders Affecting the Dermo-Epidermal Junction
- 9 The Acantholytic Disorders
- 10 The Eczematous Reaction

AUTHOR INDEX

SUBJECT INDEX

Contents of Volume 2

The Nerves and Blood Vessels

PREFACE

A The Nerves of the Skin D. SINCLAIR

- 11 Normal Anatomy of Sensory Nerves and Receptors
- 12 Electrophysiology of Cutaneous Sensation
- 13 Psychophysiology of Cutaneous Sensation
- 14 Motor Nerves and Reflexes
- 15 Pathophysiology of Cutaneous Nerves

B The Blood Vessels of the Skin T. J. RYAN

- 16 Structure, Pattern and Shape of the Blood Vessels of the Skin
- 17 Measurement of Blood Flow and Other Properties of the Vessels of the Skin
- 18 Permeability and Responses of Blood Vessels in Skin
- 19 Blood Flow
- 20 Inflammation, Fibrin and Fibrinolysis
- 21 Factors Influencing Growth of Vascular Endothelium in the Skin

AUTHOR INDEX

SUBJECT INDEX

Contents of Volume 3

The Dermis and the Dendrocytes

PREFACE

IA The Physiology of the Dermis A. JARRETT, R. I. C. SPEARMAN

- 22 The Chemistry and Molecular Biology of Collagen
- 23 The Elastic Tissue of the Dermis
- 24 The Physical Nature of the Dermis in Living Skin
- 25 The Comparative Biology of Collagenous Tissues
- 26 Ageing of the Dermis

IB The Pathophysiology of the Dermis A. JARRETT, T. J. RYAN

- 27 The Collagenoses
- 28 Cutaneous Elastoses
- 29 Vasculitis
- 30 Dermal Cell Populations and their Pathological Responses

II The Dendritic Cell Population of the Epidermis P. A. RILEY

- 31 Melanin and Melanocytes
- 32 Embryonic Origin and Abnormalities of Melanocytes
- 33 The Biochemistry of Pigment Formation
- 34 Pathological Disturbances of Pigmentation
- 35 The Langerhans Cell
- 36 Melanoma

AUTHOR INDEX

SUBJECT INDEX

Contents

CONTRIBUTORS	vii
------------------------	-----

PREFACE	ix
-------------------	----

37 Cycles and Patterns of Hair Growth

ELIZABETH JOHNSON

I. Introduction	1237
II. Body patterns of hair growth in man	1238
III. The hair cycle	1241
IV. Regional differences in hair growth	1248
V. Patterns of hair growth and replacement	1249

38 Hair Follicle Development, Cyclical Changes and Hair Form

R. I. C. SPEARMAN

I. Introduction	1255
II. Phylogeny of the hair follicle	1257
A. Thermoregulation	1261
III. The evolution of keratin	1265
IV. Development of hair follicles	1268
V. Stages of follicular development	1273
VI. The development of new follicles in adult skin	1277
VII. Hair growth	1279
VIII. Types of hair in man and other mammals	1288

39 The Structure and Function of the Fully Developed Follicle

R. I. C. SPEARMAN

I. The transient portion of the follicle	1294
II. The permanent portion of the follicle	1299
III. The follicular blood supply	1302
IV. Innervation of the follicle	1304
V. The striated muscles in skin	1306

VI. Structures associated with the hair follicle	1307
VII. Physiology of the arrector pili muscles	1309
VIII. Functional zones of follicular growth	1312
IX. Keratinization of the inner root-sheath	1325
X. The completed hair	1327
XI. Pigmentation of the hair	1539
XII. Dynamics of hair growth	1341
XIII. Dermal and epidermal factors in control of hair growth and development	1346

40 The Control of Hair Growth

ELIZABETH JOHNSON

I. Determination of hair types	1351
II. Rhythms of activity	1354
III. Metabolism of hair follicles in relation to mitotic activity	1358
IV. Control of mitotic activity in the hair follicle	1360
V. Systemic factors	1364
VI. Hormonal effects on hair growth in man	1373
VII. Mechanism of androgenic action at cellular levels	1380
VIII. Male pattern baldness	1385
IX. Cellular metabolism of other steroids	1386

41 Environmental Effects on the Hair Follicle

ELIZABETH JOHNSON

I. Nutritional aspects of hair growth	1389
II. Effects of carcinogens on the follicles	1395
III. Effects of photoperiod on hair growth	1396
IV. Effects of temperature on the hair follicles	1399
V. Seasonal adaptive coat changes	1402

42 The Biochemistry of Hair Formation and the Chemistry of Hair Keratins

R. I. C. SPEARMAN

I. Protein biosynthesis	1418
II. The chemical composition of hair	1426
III. The keratin complex	1428
IV. Biophysical analysis	1434
V. Component keratins of the hair	1435

VI.	The chemical and molecular structure of hair	1438
VII.	The epicuticle	1442
VIII.	Medullary proteins	1442
IX.	Ortho- and para-cortical cells	1443
X.	Cuticular keratins	1445
XI.	Cortical keratins	1447
XII.	Molecular structure of the fibrous component of hair keratins	1450

43 The Genetics of Hair Growth and Coloration

R. I. C. SPEARMAN

I.	Introduction	1458
II.	Population gene statistics	1460
III.	Types of genetic variation	1461
IV.	Hair coloration	1463
V.	Mode of action of hair colour genes	1467
VI.	Allelic colour genes	1471
VII.	Colour patterning of the coat	1478
VIII.	Changes in hair growth and texture	1482
IX.	Effects of genes on hair structure	1487

44 The Physical Properties of Hair

R. I. C. SPEARMAN

I.	Introduction	1495
II.	Relationship of molecular structure to the mechanical properties of keratin	1496
III.	Non-keratin constituents	1497
IV.	Elastic properties of the hair fibre	1498
V.	Effect of water on the keratin complex	1510
VI.	Electrical properties of hair	1513

45 Abnormal Hair Growth in Man

A. JARRETT, ELIZABETH JOHNSON and R. I. C. SPEARMAN

I.	Introduction	1516
II.	Hypotrichosis and the alopecias	1517
III.	Metabolic disorders	1518
IV.	Ectodermal dysplasia	1520
V.	Hair defects associated with rare congenital syndromes	1521

VI. Abnormalities of the hair shaft	1522
VII. Alopecia areata	1530
VIII. Telogen effluvium	1534
IX. Acrodermatitis enteropathica	1535
X. Chemical agents inducing hair breaks or alopecia	1536
XI. Physical agents causing hair fracture or alopecia	1538
XII. Hirsutism	1538

AUTHOR INDEX	I4i
------------------------	-----

SUBJECT INDEX	I4xi
-------------------------	------

Cycles and Patterns of Hair Growth

ELIZABETH JOHNSON

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England*

I. Introduction	1237
II. Body patterns of hair growth in man	1238
III. The hair cycle	1241
IV. Regional differences in hair growth	1248
V. Patterns of hair growth and replacement	1249

I. INTRODUCTION

Mammals are unique in their covering of hair, and as in the case of bird feathers, without such keratinous coverings for the conservation of heat it is unlikely that homeothermy could have evolved in higher animals. Certainly with the exception of man, hair is an important thermoregulatory device, and adaptive changes in the length or density of the pelage related to seasonal variation are common features. Effective insulation can only be achieved if the hair is kept dry, and waterproofing is provided by the oily secretions from the sebaceous glands, associated with every hair follicle.

The hair of wild animals is coloured for camouflage;¹ for example in the cat family the pattern and colour of the coat is related to habit and environment. Thus the lion which lives mainly on sandy plains has a uniformly buff coat, and the vertical tawny-orange and black stripes of the tiger blend with the grass stems and reeds of the swamps and grassy plains of its habitat. The arboreal jaguar has a spotted coat which merges with the forest foliage.

1. Cott, H. B. (1940). 'Adaptive Coloration in Animals'. Methuen and Co. Ltd., London.

There may also be seasonal adaptive colour changes from the brown-to-grey summer coat to a white winter coat in a number of northern and Arctic species such as the weasel,¹ the varying hare² and the stoat.³ A similar adaptive function is the assumption of a dappled summer coat by European fallow deer which provides effective camouflage amongst the trees in summer.

There are a few examples of hair being used as a signal rather than for concealment. Such signals are usually sexual, and include the mane of the lion and mandrill, and the beard of man.

Because each hair follicle has nerve fibres around its base, hair is very important in receiving tactile stimuli, and this is true of all hair as well as the extra-sensitive specialized vibrissae (see Vol. 2, p. 415).

Man is peculiar in having a very restricted distribution of hair. It is generally agreed that naked man probably arose as a mutant, and in common with other naked mutants man possesses hair follicles all over the body surface. Indeed, human skin has more follicles per unit area than the chimpanzee,⁴ but over most of the body surface they only produce minute vellus hairs which function solely as tactile organs. The terminal hair that remains in man seems to serve either protective or sexual functions. Hair of the scalp not only provides physical protection from trauma, but also protection from ultra-violet and infra-red radiation. The eyebrows protect the delicate area around the eyes as well as serving to divert sweat. The pubic and axillary hair are partly protective in preventing direct contact between skin surfaces, but also, in less deodorized societies, served a sexual function in promoting the dispersal of apocrine secretions. Finally, the hair of the beard, chest and abdomen are truly secondary sexual characteristics, although it is entirely absent from these regions in some races.

II. BODY PATTERNS OF HAIR GROWTH IN MAN

Hair follicles in man are formed between the second and fifth month of foetal life and the number is the same in both sexes, and all races. The absolute number of follicles is also similar in different regions of the body but the density per unit area varies enormously due to differential

1. Wright, P. L. (1942). A correlation between spring molt and spring changes in the sexual cycle of the weasel. *J. exp. Zool.* **91**, 103.
2. Lyman, C. P. (1943). Control of coat color in the varying hare, *Lepus americanus*. *Bull. Mus. comp. Zool. Harv.* **93**, 393.
3. Rothschild, M. (1942). Change of pelage in the stoat. *Nature, Lond.* **149**, 78.
4. Schultz, A. M. (1931). The density of hair in primates. *Human Biol.* **3**, 303.

growth of the body surface.¹ For example, the follicle density is four to six times greater on the cheek and forehead than on the trunk and extremities.

The degree of hairiness of an individual depends upon the development of coarse, terminal hairs (see p. 1244). In some regions, such as the pubis, there is an abrupt transition from the fine postnatal vellus hair to coarse terminal hair. In other areas, such as the scalp, there is a more gradual transition with an intermediate type of hair during early

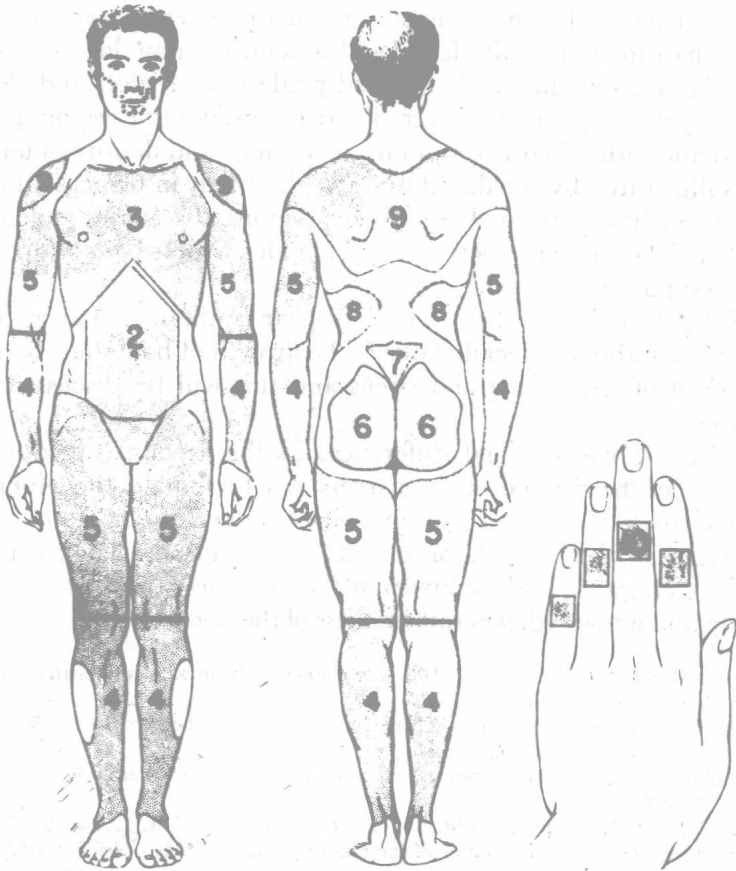


Fig. 1. Body regions in man which may develop terminal hair: 1. beard; 2. hypogastric; 3. thoracic; 4. lower arm and leg; 5. upper arm and leg; 6. gluteal; 7. lumbo sacral; 8. lower back; 9. upper back; 10. mid-phalangeal. From Garn, S. M. (1951). *Annl. N.Y. Acad. Sci.* 53, 502.

1. Szabo, G. (1958). The regional frequency and distribution of hair follicles in human skin. In 'The Biology of Hair Growth'. (Eds Montagna, W. and Ellis R. A.), pp. 33-39. Academic Press, New York and London.