ACROMEGALIC-GIGANTISM:

A

HYPOTHESIS

by

A. CAMPBELL GEDDES.

VOL.II.

CHAPTER XV.

GIANTS OF THE SECOND CLASS.

PATHOLOGICAL GIANTISM.
(continued)

SECTION I. THE GIANTISM OF NUTRITIVE OVERLOADING.

This class was made provisionally to include three hypothetically distinct groups of giants.

1. The giants of deficient exogenous metabolism--the deficient excretors.
2. The giants of excessive absorption--the more than sufficient absorbers.
3. The giants of excessive absorption, deficient excretion and consequent sexual failure combined.

In order to obtain a definite basis of information I quote the published records of ten cases of giantism which undoubtedly belong to this class.

RECORDS/

PLATE XXVI.

PLATE XXVI.

The Giant Constantin.

----After Woods Hutchinson.

RECORDS OF TEN CASES OF GIANTISM.

(1)
OBSERVATION I.

The Giant Constantin.

Scientifically accurate accounts of the hereditary and personal history of Constantin are not obtainable. It is known, however, that he was born in 1872 in Wurtemberg and that his parents and only brother were of ordinary stature. It is said that he had an uncle who stood 2m03 in his stocking soles. According to Constantin's show biography his stature at the age of 14 was 1m94, at the age of 26, 2m59, but it is necessary to receive these measurements with caution. His photograph shows two points of interest. First, his face is peculiar as the result of his heavy lower jaw; second, his great stature is obviously largely the result of the great length of the lower limb.

Mentally Constantin is said to have remained to the end of his life a perfect child: he lived almost entirely on cakes and sweets.

Towards the end of 1901, when on tour in Belgium,/

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(1). A.Dufranc, P.E.Launois et P.Roy. Bulletins et Mémoires de la Société, Méd.des Hôpitaux de Paris, séance du 8 Mai, 1903. (Summary.)

PLATE XXVII.

PLATE XXVII.

Fig. 1. Photograph of Constantin to show facial asymmetry.

---- After Launois and Roy.

Fig. 2. Photograph of Constantin taken some years earlier; the facial asymmetry is less marked and the great length of the lower limbs is well seen.

---- From Professor Cunningham's Collection.

Belgium he developed a symmetrical gangrene affecting both feet. He was admitted to the Hospital of Mons where Dr.Dufranc successfully amputated the right leg. By the 26th of February the stump was sufficiently healed to permit of an artificial limb being fitted. As soon as he began to go about, the left leg which had temporarily recovered became bad again.

At first the giant would not hear of another amputation, but as the gangrene got steadily worse he consented and on the 7th of March 1902 the left leg was removed by disarticulation at the knee. The result for the first few days was satisfactory, but he was a bad patient, continually knocking off the dressings, with the result that the wound went septic: septicaemia developed and he died on the 30th of March.

Post Mortem Examination.

The post-mortem examination showed the cause of death to have been pyaemia. The joint cavities, especially those of the wrist and left shoulder, were full of pus. The bases of the lungs were markedly congested and on section muco-pus was found in them; the apices were studded with tubercles, some of which were breaking down.

There was a most marked visceral giantism, the/

PLATE XXVIII.

PLATE XXVIII.

Photograph of the skull of Constantin to show the asymmetry of the nose, malar region and orbit and the great increase in the vertical diameter of the face.

---- After Launois and Roy.

PLATE XXIX.

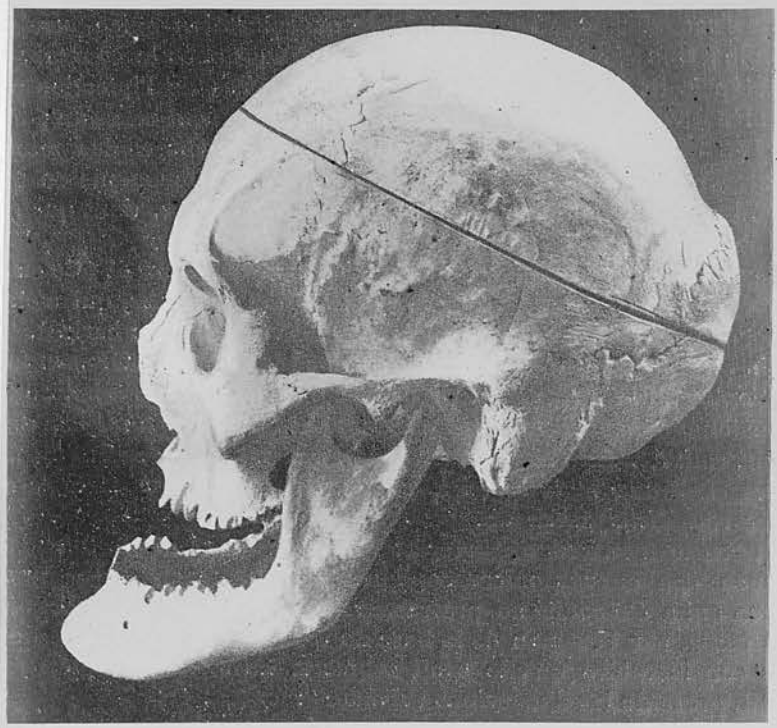

PLATE XXIX.

Skull of the giant Constantin to show the increase in the vertical diameter of the face, the high degree of mandibular progenism and the well marked occipital ressaut.

---- After Launois and Roy.

PLATE XXX.

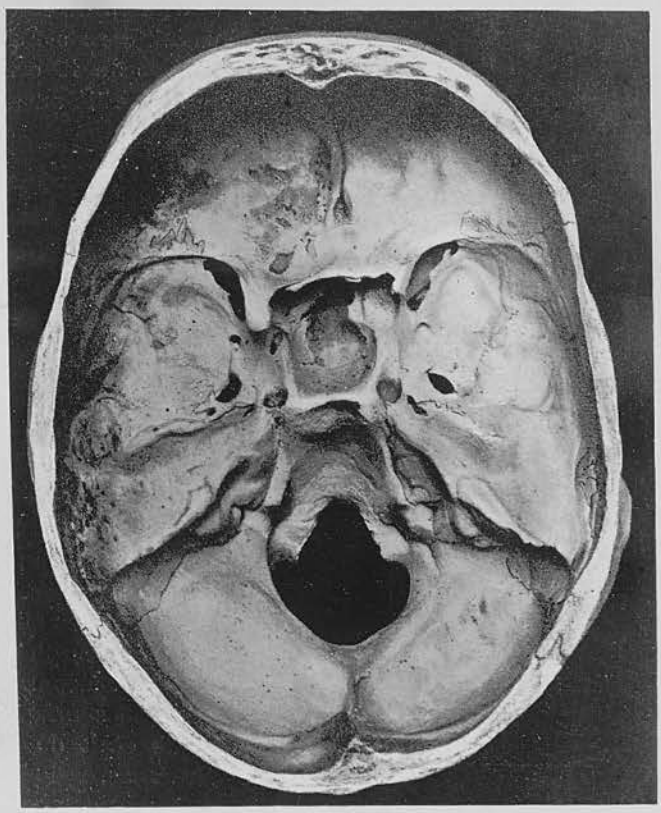

PLATE XXX.

Base of the skull of the giant Constantin to show the dilatation of the sella turcica and the asymmetry of the foramen magnum.

---- After Launois and Roy.

PLATE XXXI.

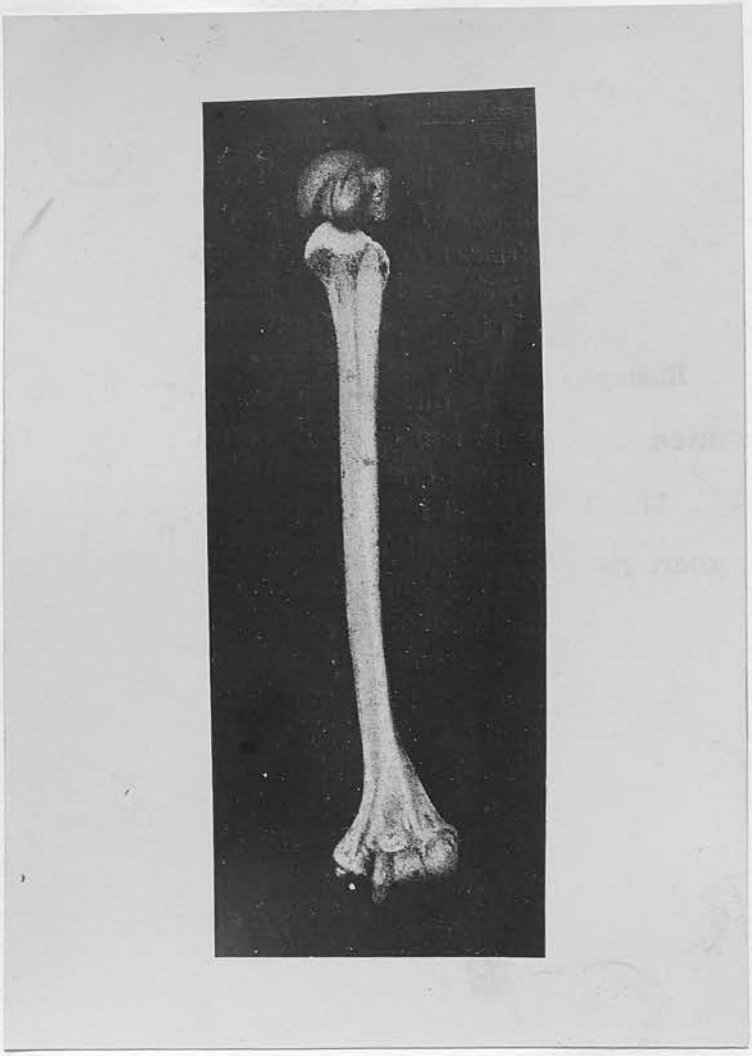

PLATE XXXI.

Humerus of the giant Constantin, to show the persistence of the epiphyseal cartilage at the upper end until the time of death. Constantin was nearly thirty when he died.

---- After Launois and Roy.

PLATE XXXII.

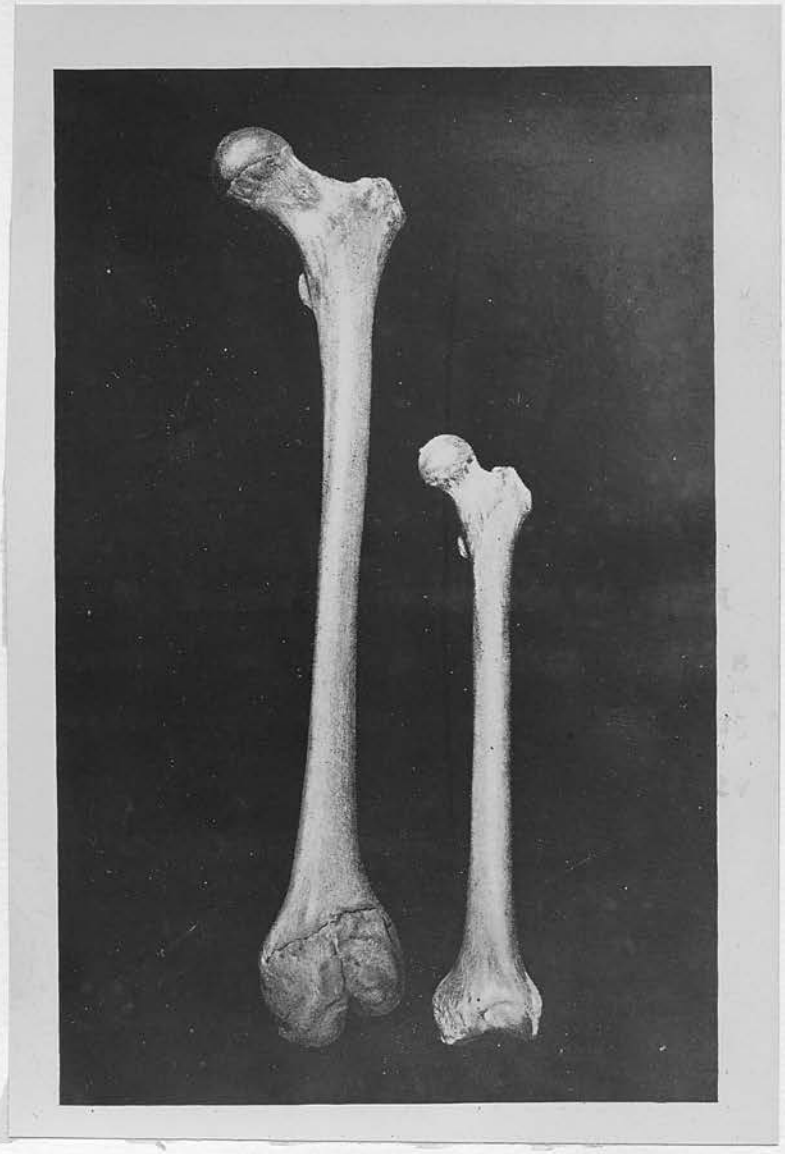

PLATE XXXII.

Femur of the giant Constantin compared to that of a normal adult. At the lower extremity the line of junction of the epiphysis and diaphysis is plainly visible.

---- After Launois and Roy.

the heart and liver being especially large: the testicles, on the other hand, were very small, being no larger than haricot beans. The pituitary was markedly enlarged (the size of a nut.) There are no measurements of the gland and no record of its structure, but the measurements of the sella turcica were:--

Antero-posterior diameter 30mm.
Transverse -- -- 36mm.
Depth -- -- 30mm.

The skull was remarkable in two other particulars:--

1. The malars were exceedingly prominent.

2. There was a marked projection of the lower jaw, this was so great that the lower alveolar margin was three fingers' breadth in front of the upper.

The skeleton was also remarkable,

1. because of the enormous length of the femora 760mm.

2. because of the persistence or the extremely recent union of the epiphyseal cartilages. In the femur, as is shown in Plate XXXII. the line of junction is readily apparent, although bony union has in part taken place. In the humerus the separation of the head is complete, as is shown in Plate XXXI.

Constantin/

Constantin was nearly 30 when he died.

(1)

OBSERVATION II.

THE GIANTESS ELLA EWING, AGE 23, REPUTED HEIGHT 8ft.3.

PROBABLE HEIGHT 7ft.6.

According to herself she did not begin to grow, beyond the normal rate, until she was about nine years of age, when she rapidly shot up to a great height. She is, however, still growing and has added an inch to her stature in the course of the present year. In the photograph the disproportionate length of both upper and lower limbs is so obviously abnormal as to require no support from measurements. This is fortunate as all requests for permission to make measurements were definitely refused. Her feet are of enormous size and of clumsy shape. In spite of the great length of her lower limb her hand descends beyond the mid-point of her thigh and this lends some colour to the statement that her span is 10 feet, 2 inches. The length of the hand from the bend of the wrist to the tip of the middle finger is 10 inches, an excess of nearly an inch above the normal proportion for her estimated stature./

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(1) Woods Hutchinson. New York Medical Journal, July 21st, 1900.

PLATE XXXIII.

PLATE XXXIII.

Miss Ella Ewing and her parents. The extraordinary height of the giantess's iliac crest is well seen: the length of her arms is also most remarkable.

---- After Woods Hutchinson.

stature. The circumference is no less than 10 inches and the fingers have a peculiar sausage-like appearance.

No measurements of the jaw or other parts of the face were permitted, but the impression given by inspection was that the lower jaw, the nose and the malar bones are distinctly excessive in their development in comparison with the forehead and cranium. This is shown sufficiently well in the photograph, I (W.H.) think, to justify the statement.

Miss Ewing was born in Missouri and is an only child. Her father is 6 feet 2 inches: her mother 5 feet 1½ inches. She has had the ordinary illnesses of childhood and her growth is said to have started shortly after an attack of measles. A point of some interest in her history is that two years ago she broke a tibia by jumping off a stump two feet high; repair was normal. Her speech is somewhat lisping and strongly suggestive of a tongue too large for her mouth, but no examination was permitted.

Her intelligence would be normal for a girl of thirteen or fourteen.

There is no disturbance of vision and no headache; she is, however, easily tired.

No kyphosis can be detected and the girl declares herself to be in perfect health in every way.

PLATE XXXIV.

PLATE XXXIV.

The giant Machnow with, at his side, Professor V.Luschan and the skeletons of a Patagonian and a Bushman. The asymmetry of the face and the great size of the hands and feet are well seen.

---- Journal des Voyages, 1903, p.416.

OBSERVATION III. (1)

THE GIANT MACHNOW.

The Giant Machnow was born at Witebsk in Russia, he belongs to a family all the members of which are of normal stature. Up to the age of four he himself was of ordinary size. No cause can be assigned, but immediately thereafter he began to grow rapidly. He slept a great deal, often for 24 hours consecutively. At the age of 15 he measured 1m57: now, at the age of twenty-two he is 2m38.

He is, therefore, one of the tallest giants known.

The following measurements are all that he would allow to be taken.

MEASUREMENTS OF THE HEAD.

Length of Head.	220mm.
Breadth " "	173
Length of base	135
Height	160
Minimum frontal diameter	128
Height of face (top of forehead to chin.)	222
Height of face (nasion to chin.)	154

Height/

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(1) Lissauer und v. Luschan Zeitschrift für Ethnologie 1903. Heft 2. (Summary)

MEASUREMENTS OF THE HEAD (continued)

Height of face (naso alveolar length)	99mm.
Length of nose	70
Breadth " "	50
Bizygomatic Breadth	167
Bigonial "	126
Distance between internal angles of the eyes	40
" external "	118
Breadth of the mouth	65
Height of the lips	27
Length of Ear	74
Breadth " "	44
Circumference of the head	620

MEASUREMENTS OF THE TRUNK.

Height seated	1130
Stature	2380
Epi-sternal notch to ground	2000
Shoulders to the ground	1980
Iliac crests " "	1450
Symphysis " "	1260
Lower border of patella (to the ground)	600
Circumference of the pelvis	1200

MEASUREMENTS/

MEASUREMENTS OF THE LIMBS.

Length of arm	1046mm.
" " forearm	640
" " hand	251
Breadth "	109
Length of middle finger (palmar)	107
Length of middle finger (dorsal)	157
Smallest circumference of the thigh	290
Largest " " " "	410
Length of foot	370
Breadth of foot	149

Supplementary Note.

Machnow's intelligence was very poor, he was described to me (A.C.G.) by a freak showman who knew him well as a "simple sort of fool" and "very stupid." He was a large eater and drinker. There is no record whether he was diabetic or not. (Since the facts given above were published Machnow has died: I do not know of any post-mortem record

OBSERVATION IV.(1)

THE GIANTESS LADY AAMA.

Lady/

(1). Woods Hutchinson, American Journal of Medical Sciences 110, 1895, p.190. (Summary.)

PLATE XXXV.

Lady Aama and her sisters.

---- Show card from Professor
Cunningham's collection.

PLATE XXXV.

Lady Aama (Emma Alline Batallaid) was born on the slopes of the Jura in France. Her age was variously stated by her sisters as 17 or 19.

Aama was reported and advertised to be over eight feet; after death her height was found to be 8ft. 7½ inches. She died in Iowa on the 27th of February 1893, and the cause of her death was certified as "quick consumption." On careful inquiry, however, it was found that she had been failing gradually for four or five years and had died quite suddenly. She was on exhibition to within three days of her death, but for weeks before that her muscular weakness was so extreme that she was obliged to support herself by holding on to an upright rod fixed in the floor. Her death appeared due to a general collapse hastened by an acute coryza: the actual mechanism of death being syncope following a fit of coughing.

She was the fifteenth child of a poor labourer; all the others were of normal height. One of the sisters who accompanied her declared that she was growing up to the time of death.

Her intelligence was decidedly poor.

Description of the Body.

The body was extremely emaciated and the first thing/

PLATE XXXVI.

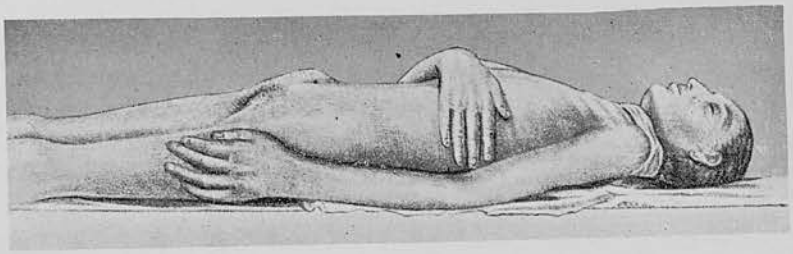

PLATE XXXVI.

Lady Aama upon the autopsy table. The thinness of the arms and chest and the enormous size of the hands are especially to be noted.

--- After Woods Hutchinson.

thing which arrested the attention was the extremely small size of the chest and of the trunk as a whole compared with the greatly elongated extremities. Measurements showed this impression to be correct and that the excessive length of the lower limb was responsible for three-fourths of the total excess of height.

The next striking feature with regard to the body was the disproportionate and peculiar shape of the hands and lower jaw. These are well seen in the accompanying figures. Measurements, again, supported the general impression. The hand instead of being about one-tenth of the body height in length, was nearly one-seventh; that is, instead of being about 7·9 or 8·inches it was actually 11·25. The fingers were of peculiar shape being long, of uniform thickness and square at the tips. The foot was also large 13·75 inches long instead of 12·6 inches which would be the proper proportion for an individual of her height.

The lower jaw measured $6\frac{1}{4}$ inches from angle to symphysis as against the $3\frac{3}{4}$ inches which is the average for adult males.

There was absolutely nothing in a view of the trunk above the symphysis pubis to indicate the sex; the /

the circumference of the chest was two inches less than that of the hips; the mammary glands were completely absent. The nipples were flat and small and upon dissection a mere trace of gland tissue and of a suspensory ligament could be made out.

The skin looked thick and earthy, but otherwise did not appear abnormal: the hair of the head was thin and sparse, but of about normal length.

REPORT ON THE VISCERA.

Heart	slightly above normal size; left ventricle enlarged, valves dilated. Pericardium normal.
Lungs	normal except in size which appeared below the average; light in colour and completely collapsed; no pleural adhesions.
Spleen	greatly enlarged (2 lbs;) pulp, grayish; capsule thin and surface lobulated.
Kidneys	normal, capsule non-adherent.
Liver	slightly enlarged, otherwise normal.
Supra-renals	enlarged.
Thyroid Gland	normal in size and appearance.

Brain/

Brain — Owing to the fact that the autopsy was not performed until a week after death it was impossible to remove it entire. The tip of the left temporal lobe came away as a putty-like mass: the pituitary, which was greatly enlarged, broke across on removal, its form and outline being completely destroyed. Its dimensions can be judged from the size of the fossa which measured 1¼ inches in its antero-posterior and 1½ inches in its transverse diameter.

After hardening in alcohol the brain weighed 36 ounces.

GENITAL ORGANS. The most striking abnormality was found in the genital organs. The mons veneris and labia majora were flat and poorly developed. The clitoris was nearly half an inch in diameter and extremely prominent and with large clitoridal folds presented no very fanciful resemblance to a small and imperfectly developed penis. This probably was the cause/

cause of the reports circulated in Aama's life-time that she was an hermaphrodite.

The vagina was small, straight and barely capable of admitting the forefinger.

The uterus was 1¼ inches long and two-thirds of an inch broad--about the size and shape of the last joint of the little finger and weighed two drachms.

The Fallopian tubes were barely recognisable and their abdominal extremities had only three or four rudimentary fimbriae, none of them being attached to the ovary.

The ovaries were small granular masses of the size of the finger nail adhering to the posterior surface of the broad ligament

SKELETON.

After the removal of the softer tissues the bones were macerated and cleaned in the hope of being able to mount them for the museum, but such was their spongy, crumbling condition that it seemed doubtful whether they were firm enough to support their own weight. The whole osseous system appeared to be in a condition of/

of osteoporosis; a touch dislodged the teeth from their sockets, the ribs and slighter bones snapped across at the lightest strain and the epiphyseal plates upon the bodies of the vertebrae could be lifted off with the finger.

The bones though much larger were very little heavier than normal, the radius, the scapula and the fibula, for instance, being found to exceed in weight the average of healthy bones by only ten per cent.

THE SKULL.

Circumference at level of glabella	21⅛	inches
Distance between ext. orbital processes	5⅛	"
Superciliary ridge to point of symphysis	6¾	"
Angle of inferior maxilla to symphysis	6¼	"
Length of nasal bone	1¼	"
Breadth of nasal bone	¾	"
Glabella to occipital point	7¾	"
Breadth index	74	"
Height index	76	"

A/

PLATE XXXVII

PLATE XXXVII.

Base of Lady Aama's skull. The enormous size of the frontal sinuses is well seen.

---- After Woods Hutchinson.

A most striking illustration of the highly rarefied, not to say cavernous, condition of the bones is seen in the condition of the frontal sinus and the thin paper-like condition of their bony walls. A similar condition was found in the maxillary antrum. The squamous temporal was so thin that the groove for the middle meningral actually caused, on the right side, a perforation half an inch long. The zygoma was reduced to the thickness of pasteboard.

PELVIS AND TRUNK.

Pelvis:--

Circumference around crest	38 inches
Transverse inter spinous	15 "
" inlet	6½ "
" outlet	6 "
Depth	7 "
Transverse diameter	6½ "
Antero-posterior diameter	7 "
Symphysis pubis to tuberosity of ischium	11 "
Anterior superior spine to posterior superior spine	8 "
Do. do. to posterior inferior spine	9½ "
Crest of ilium to sacro sciatic notch	7 "
Length of sacrum and coccyx(internal)	9½ "

Length/

PLATE XXXVIII.

PLATE XXXVIII.

Skull of Lady Aama, showing the great size of the mandible and of the nasal bones which have been outlined in crayon.

---- After Woods Hutchinson.

Length of sacrum and coccyx (external)	$10\frac{1}{2}$ inches
Long diameter of sacro sciatic foramen	$2\frac{3}{4}$ "
Diameter of acetabula	$2\frac{1}{4}$ & $2\frac{1}{2}$ "
Depth " "	$1\frac{3}{4}$ & $1\frac{1}{2}$ "
Depth of pubis symphysis	$2\frac{3}{4}$ "

Fourth Lumbar Vertebra:--

Tip to tip of transverse processes	$5\frac{3}{4}$ inches
Body	$2\frac{1}{4}$ x $2\frac{3}{4}$ "

Trunk:--

Spine; atlas vertebra to tip of coccyx following curves	42 inches
Clavicle length	7 "
Scapula (inferior angle to tip of acromion	$10\frac{3}{4}$ "
Sternum length	$8\frac{1}{4}$ "

The sternum presented a central round perforation one-third of an inch in diameter in the third piece of the gladiolus, and the fourth piece was cleft and broadened at its extremity. The acromial epiphysis was in two pieces.

Upper Extremity:--

Whole arm and hand	37 inches

Humerus/

Humerus	15¼ inches
Olecranon to tip of 2nd finger	23 "
Ulna	11¾ "
Radius	11⅛ "
Middle metacarpal and finger	9⅝ "
Metacarpal middle	3⅞ "
First phalanx	2⅝ "

Lower Extremity:--

Head of femur to os calcis	47½ inches
Femur head to internal condyle	23¼ "
Width at condyles	5½ "
Circumference of shaft (middle)	5½ "

Tibia:--

Length internal tuberosity to internal malleolus	18⅝ inches
Circumference	5⅜ "

Foot:--

Length	13¾ inches
Girth	10½ "
First metacarpal length	3 "

There was a distinct, bossy, velvety-looking elevation/

elevation of the postero-internal surfaces of both tibia in their middle third.

OBSERVATION V. (1)

THE GIANT GOLIATH, AGE 47.

Clinical Note. For some fifteen years Goliath's face has been remarkable for the heavy jaw, prominent cheekbones and large nose. The body is literally covered with xanthomatous tumours. He is diabetic; his sight is bad. In addition he is of enormous size.

Apparently, apart from the inconvenience attendant upon diabetes and the diminution of vision, Goliath is quite comfortable and does not complain of headache.

Death. Death was sudden and was the result of diabetic coma.

AUTOPSY.

Upon the post-mortem table the body measured 1m78; the trunk 0m95; the cranium 0m21 and 0m165.

On/

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(1). Dallemagne, Arch.de med. experim. 1893 obs.1.p.589. (Summary)

On opening the thoracic cavity no pleural effusion was found; on the left side there were no adhesions; on the right they were numerous and strong.

The right lung showed some hypostatic pneumonia at the base.

The left lung was in a state of red hepatisation, except at one or two points where the colour tended towards grey.

The heart was very large, weighed 885 grammes and measured 15,×18,×7 centimetres. The left ventricle was markedly hypertrophied, the wall being 3 centimetres thick. The mitral cusps were slightly thickened and adherent. The aortic valve and aorta were normal. The right heart was slightly hypertrophied, but much less than the left, microscopically the fibres appeared twice as large as normal.

The liver was enormous; it measured 39 x 55 x 11 centimetres, and weighed 5,900 grammes. Microscopic examination showed a slight selerosis with a little fatty infiltration.

The spleen measured 23 x 13 x 6 centimetres, and weighed 920 grammes; it was very firm; there was slight hypertrophy of the fibrous tissue.

The pancreas weighed 220 grammes.

The/

The kidneys were very large, the right weighed 550 grammes; the left 620. Histologically the cell outlines were difficult to determine owing to swelling; the lumen of the tubules was obliterated.

The brain weighed 1400 grammes. In the sella turcica there was a tumour the size of a pigeon's egg. There were several secondary nodules in the neighbourhood. The tumour and secondary nodules had pressed upon the optic chiasma and nerves which were markedly atrophied, and, as the result of pressure, pyramidal on section.

The brain appeared small, and the convolutions either undeveloped or atrophied; the fissures were numerous, but very shallow.

THE SKELETON.

THE SKULL.

The Cranium:--Cephalic index		75·3
	Frontal index	78·8
	Stephanic index	87·6

The skull bones were remarkable for their thickness. None of the principal sutures were ossified; they were peculiar for their lack of serrations. The styloid processes/

processes were 50mm. long. The frontal sinuses were enormous and passed half-way up into the squamous part of the frontal bone. The parietal at the level of the eminence is 6 to 9mm. thick.

The sella turcica was extraordinarily large, the antero-posterior diameter was 19mm.; the transverse diameter 25mm. the depth 15mm. the posterior wall was exceedingly thin and in part perforated. The rest of the skull gave the impression of being the seat of an intensely active bone formation.

The Face:--

The face, like the cranium, showed some peculiarities; some of its parts were considerably over developed. There was a marked maxillary prognathism; the lower jaw projected 16cm. beyond the plane of the nasion.

The hands and feet were large, but the increase was uniform. The hand measured 20 centimetres in length; the foot 24.

The crests upon the bones were rough and "mossy;" the fifth metatarsals were especially remarkable for these bony excrescences.

The/

The other bones, though they did not show characteristics comparable to the preceding, appeared to have developed unusually, their extremities resembled in appearance the bones of the hands and feet.

Microscopic Examination of the pituitary showed the mass to be very cellular, the cells being small and staining deeply. The whole gland appeared to be a sarcomatous mass surrounded by a strong fibrous capsule. Blood vessels were very plentiful.

Microscopically the thyroid was found to have undergone a colloid cystic degeneration. The cysts were about the size of a pin's head, and consisted of a fibrous membrane which enclosed the colloid material. In other parts it was possible to trace all intermediate stages between this and the normal.

The optic nerves were largely fibrous.

In the medulla some peculiar nodules were found. Spherical in shape and about one millimetre in diameter, they had the appearance of being formed of small masses of ependyma which had emigrated and become encysted.

PLATE XXXIX.

PLATE XXXIX.

The giant K. Drum-major of the 101st Regiment of Infantry of the Line of France.

---- After Launois and Roy.

OBSERVATION VI.[1]

DRUM-MAJOR K.

I. CLINICAL REPORT BY ACHARD AND LOEPER, 1900.

K., age 34, carpenter, was admitted on 14th of April, 1900, to the Hospital Tenon. His great stature immediately attracted attention, with bare feet he measured 2m12. It appears that he attained this stature about the age of 21. At the age of 18 he was 1m76, two years later, for no known reason and having had no acute disease in the interval, he was found to have grown 20mm. At the time of his conscription he was entered as being over two metres in height. He performed his military service and was appointed drum-major.

He comes of a family which is remarkable for the height of some of its members. His sister was 1m80; his father, who died at the age of 65 of some undetermined cause, was no less than 1m95; one of his paternal/

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(1). I quote this record from Launois and Roy's work "Géants." The clinical record is by Achard and Loeper; the post-mortem, by Launois and Roy. The whole report forms a most valuable addition to our knowledge of giantism.

paternal uncles was actually 2m10. The rest of his paternal uncles and aunts, to the number of eight, were of normal stature. His mother enjoys good health and is of normal stature; she has never had a miscarriage, nor have any of her children died in infancy. There is no evidence of hereditary syphilis.

In his personal antecedents it is only necessary to note a slight right sided otitis media which has existed for five years; there is occasionally a slight purulent excretion. He complains of pains in the legs; it is because of these that he has come to hospital for advice.

There, for the first time, the existence of diabetes was established; it is evidently of recent date.

Examination of his body form reveals a certain disproportion existing between its different parts.

I. THE HEAD

The face recalls in some measure the face of Punch; the nose is long, pointed, arched, and slightly curved in towards the upper lip. The chin is long and pointed and curved slightly upwards. Probably the most striking features are the temporal hollows and the great prominences/

prominences of the cheekbones.

The exact measurements are:—

Length of the head vertex to chin	270mm.
of which 110mm. are made up by the forehead. (60 to the hair line)	
80mm. by the nose.	
80mm. by the chin.	
Circumference of the head	620mm.
Frontal diameter	150
Bijugal "	180
Bizygomatic "	170
Antero-posterior diameter	250
Bi-temporal "	145
Bimastoid "	180

From these we can say that there is a very marked disproportion between the breadth of the forehead and that of the face. The rest of the cranium appears normal; the occipital protuberance, however, is very prominent and the posterior part of the occipital is almost at right angles to the neck. The ears are small in relation to the different parts of the face: their lobules are slightly elongated. The tongue is very much spread out and measures 65mm. from side to side.

II./

PLATE XL.

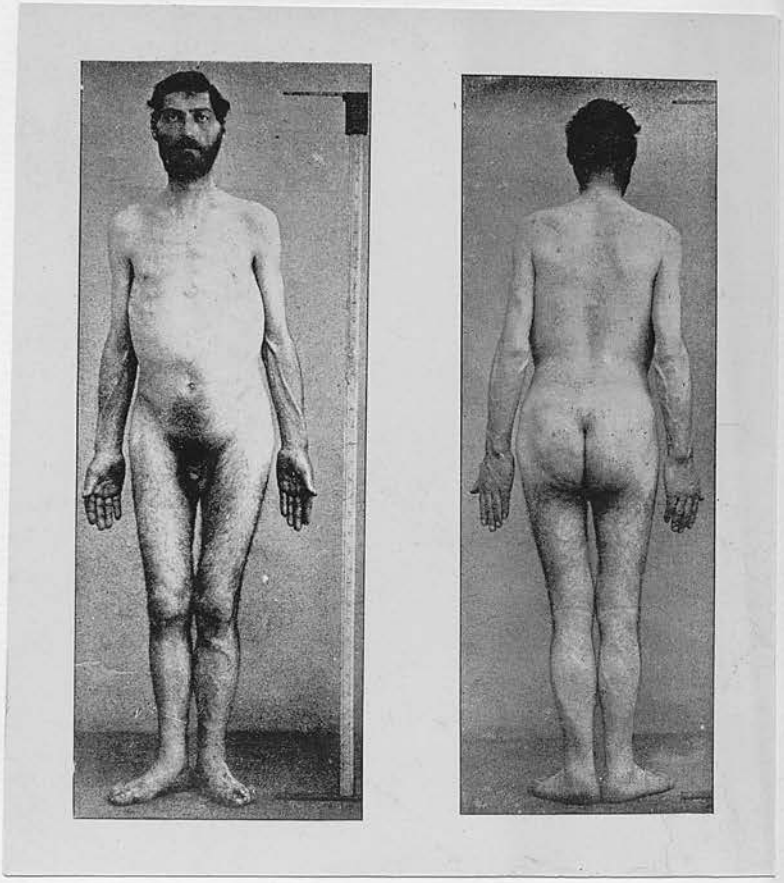

PLATE XL.

The giant K. in 1900.

---- After Launois and Roy.

II. THE NECK.

The circumference of the neck at its base is 500mm. The thyroid body causes no projection on the surface; the larynx is not unusually prominent. There is no curvature.

III. THE THORAX.

The thorax is barrel shaped. The junction of the body of the sternum and the xiphisternum and the junction of the second and the third pieces of the sternum are marked by prominences. There is no hyperostosis of the clavicles. The thorax appears to be unusually developed in proportion to the abdomen and the false ribs descend very low almost to the iliac crests.

Circumference just below axillae	1060mm.
" at the middle point	1110 "
" at the base	1180 "
Length of sternum	280 "
Abdomen (xiphoid to symphysis)	400 "

IV. THE LIMBS.

The proportions of the limbs are fairly normal, except for the hands which are of unusual size and more particularly for the fingers which are extraordinarily/

extraordinarily long and thick. In the lower limb the total length is in good proportion.

MEASUREMENTS.

Total length of upper limb	910mm.
Length of forearm	320
" " hand	240
" " middle finger	130
Breadth of hand	120
Total length of lower limb	1080
Length of thigh	570
Length of leg (knee to ground)	510
Length of foot	340
Length of great toe	100
Breadth of foot across the heads of the metatarsals	140
Circumference of ankle	290

The span measures 2m10 which, as in the normal individual, is almost exactly equal to the height.

The genital organs are normal and well formed.

Though the general giantism of this man commenced when he was from 16 to 20 the excessive giantism of the hands and face did not manifest itself until later, when he was about 28. At that age, he says, his/

his nose was not so coarse and was less prominent than it was two years later. The temples began to appear slightly hollow about that age, but this depression became much more marked later. The projection of the cheekbones was slight when he was 17, now it is considerable.

The chin about the same time got longer. It is unknown whether the growth of the fingers took place at the same time or whether it has been slowly progressing.

The diabetes of which he complains appears only to have been in existence for 9 weeks. At that time he commenced to pass large quantities of urine, 4 or 5 litres per day. For the last year, however, there has been a slight polyuria; his thirst is now intense and he drinks several litres of fluid daily. He has always been a large eater and his appetite does not appear to be more now than formerly; he has a particular fondness for bread and other starchy foods.

He has been losing flesh lately, his weight is now 110 kilogrammes 300.

As a result of the diabetes there is marked pruritus; shooting pains in the legs; a permanent sensation/

PLATE XLI.

PLATE XLI.

Fig. I. Giant K in 1900 to show the tongue.

Fig. II. Giant K in May 1902.

----After Launois and Roy.

sensation of sweetness in the mouth; a tendency for the gums to bleed and a loss of sexual appetite. He has been married for four years, but has no child. Headache is rare; there is no disturbance of vision; hearing is bad on the right side, doubtless the result of the otitis media. There are no disturbances of sensation; the plantar reflexes are normal.

There are varicose veins in both legs.

Examination of the viscera failed to show any abnormality.

The voice is peculiarly deep.

URINE, 14th APRIL:--

Total amount passed in 24 hours	6200cc.
Specific gravity - - - -	1033
Sugar total passed in 24 hours	386grms.

No albumen; no urobilin; traces of indican.

Under appropriate treatment he improved and left hospital on the 8th of May 1900.

On the 18th of May 1900 he returned complaining of pain in the legs and loins and of a general feeling of weariness. He had gone back to work, but found that he got tired quickly and was quite incapable of prolonged effort.

At this time the urine was less abundant, the amount of sugar was down to 21 grammes per day. There was/

PLATE XLII.

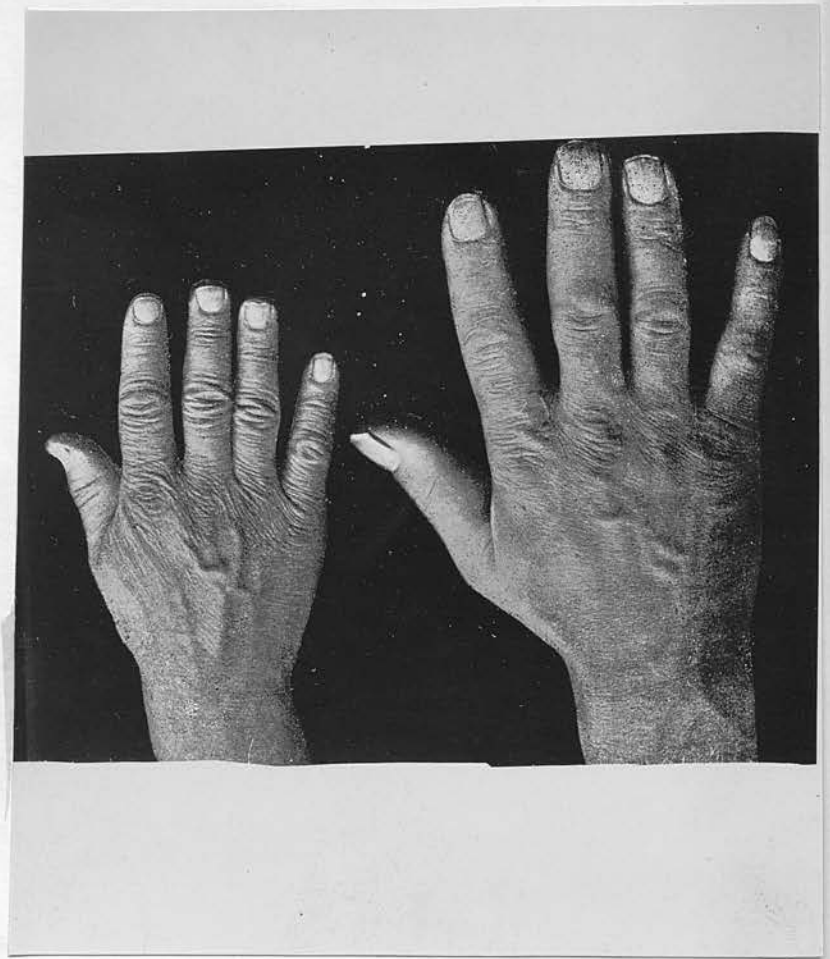

PLATE XLII.

Hand of the giant K compared to that of a normal adult.

----After Launois and Roy.

was, however, some disturbance of sensation in the legs. He was again measured and was found to be 2m10 in the mornings and 2m7 or 8 in the evenings. If the original measure 2m12 be correct he definitely lost height during the month.

Under appropriate treatment he again improved and left hospital on the 8th of June 1900.

From June 1900 until his death in May 1902 K.(1) circulated from one Parisian Hospital to another, getting steadily worse. He developed tuberculosis: he suffered from pains resembling those of angina pectoris, and his diabetes continued. He died on 29th May 1902 of coma following convulsions.

AUTOPSY performed by Launois and Roy.

The autopsy was performed 18 hours after death.

When the thorax and abdomen were opened, the extraordinary misproportion between them particularly attracted attention. If the abdomen was of approximately normal size, the thorax was far too large; the result was that the intestine, which was gigantic, was far too large for the abdomen. The different parts of/

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(1). In the Hôpital Necker he was examined by Render who pronounced his case to be one of "pure" giantism--physiological giantism. The sequel on the post-mortem table is interesting in this respect.

of the intestinal tube had lost their proper proportions to one another. The sigmoid was enormously dilated, 270mm. in circumference, and reached up to the liver, pushing back the stomach and transverse colon which was also enormous, 260mm. in circumference. The diaphragm was pushed up in an extraordinary way.

In spite of the great development of the thorax the lungs were small; both apices were riddled with tubercle.

The heart was large, cleared of its clots it weighed 510 grammes.

All the abdominal organs had undergone a truly gigantic development, there was no marked macroscopic change in any of them.

The liver weighed 4650 grammes.

The spleen - - 370 --

The right kidney - 390 --

- left - - 325 --

- pancreas - 250 --

The thyroid in life did not appear to be enlarged; post-mortem its enlargement was found to be extreme. It weighed 250 grammes, or no less than ten times the average weight for an adult. The lateral lobes surrounded the trachea.

In/

In the anterior mediastinum there were some cellular masses which were taken for remains of the thymus; subsequent microscopic examination did not support this view.

The removal of the skull cap was rendered exceedingly difficult by the great variations in the thickness of the skull, in places it amounted to as much as 20mm. The frontal sinuses were considerably enlarged.

The brain was not increased in size; the membranes were healthy.

On raising the frontal lobes a pedunculated tumour was found filling up the sella turcica. On removal it was found to be soft. The sella turcica was greatly enlarged, its transverse diameter being 40mm. The canal in the stalk of the pituitary measured 2mm. in diameter, the walls being enormously thickened. In front of the chiasma was a tumour mass, the size of the thumb which passed between the optic nerves without compressing them, into the great longitudinal fissure and thence into the frontal lobe.

The photograph of the vertical coronal section shows this process passing into the right lateral ventricle. In the centre of the mass is a cavity filled with/

PLATE XLIII.

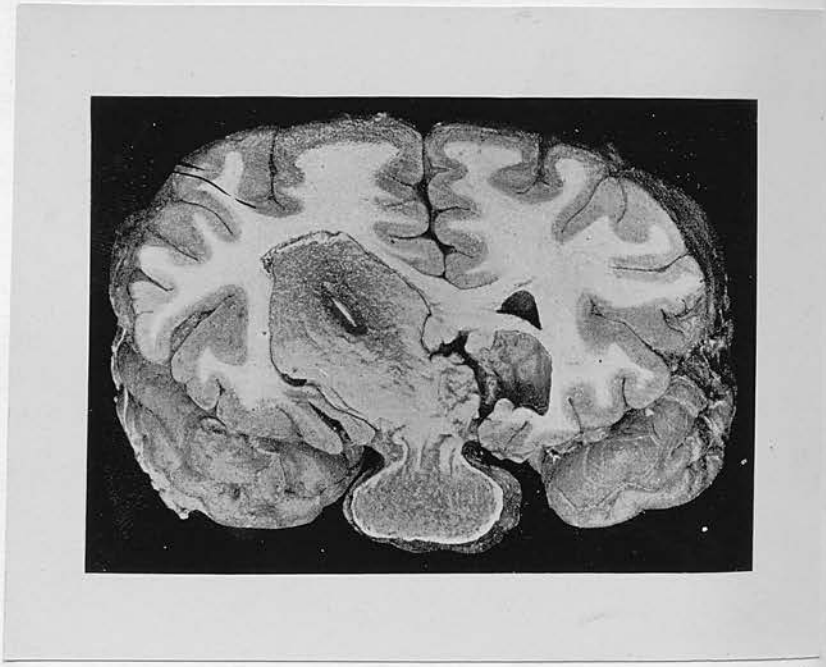


PLATE XLIII.

Photograph to show the position and relations of the pituitary tumour in the giant K.

with colloid or mucus.

MICROSCOPIC REPORT UPON THE VISCERA.

LIVER :-- There is no sclerosis properly so-called: the portal spaces show nothing abnormal: there is no arteritis.

At rare intervals there is some slight swelling of the endothelium of the capillaries which are slightly dilated and have in their walls occasional pigment granules.

The lobules are of unequal size some are large and clear and show chromatolysis. There is slight fatty degeneration in places and, in one place, granular pigmentation of the cell protoplasm.

KIDNEYS:-There is sclerosis both in the cortex and medulla, but more marked in the latter. The arteries seem healthy. The cells of the urinary tubulules are not normal,in some places the cell outline is lost, in others it is present; some of the cells are larger, others smaller than usual.

SUPRARENALS:--The capillaries are dilated and the connective tissue is increased in the cortex.

There/

There are islets of embryonic cells in the cortex. No other abnormalities are to be seen.

SPLEEN:--
The spleen is apparently normal.

PANCREAS:--The pancreas was not examined owing to an unfortunate slip in technique.

TESTICLE:--There is marked sclerosis. The cells of the seminiferous tubules are degenerated and show granular pigmentation of the protoplasm; some of the cells have two or three nuclei.

The epididymis appears normal.

THYROID:-The vesicles are large, unequal in size, and contain colloid. The cells show mucous degeneration and chromatolysis. There is pigment in the vesicles and interstitial tissue; some large bands of fibrous tissue traverse the gland.

THE NERVOUS SYSTEM.

The brain appears to be normal, although the pia shows numerous areas of thickening. In the/

PLATE XLIV.

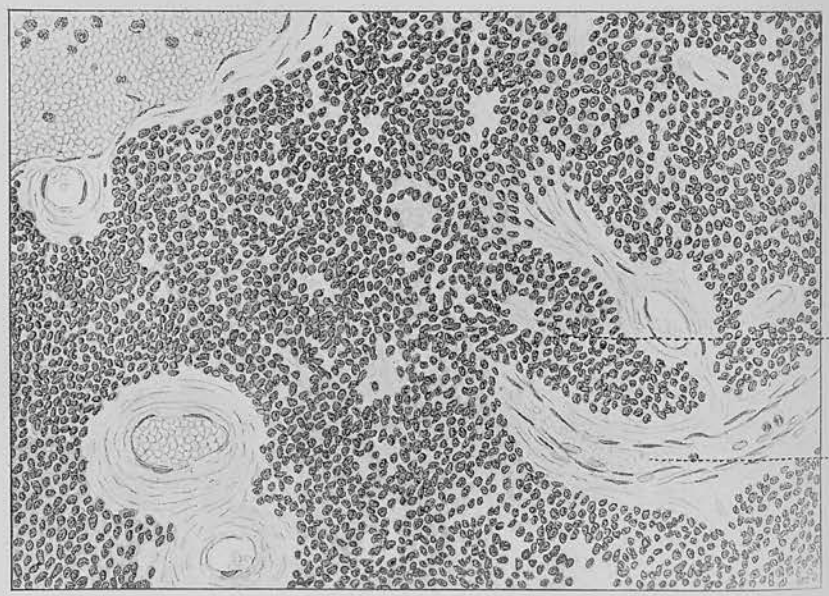


PLATE XLIV.

The pituitary tumour of the giant K.

----After Launois and Roy.

cord there is marked diminution in the number of the cells of the anterior cornu, especially in the dorsal region.

PITUITARY TUMOUR:--Microscopically the structure of the pituitary was at some places perfectly normal at others that of a commencing epithelioma.

OBSERVATION VII. (1)

SIMON BOTIS.

Simon Botis, aged 35, a Greek Catholic, unmarried and a swineherd, entered hospital upon 24th May 1894. All the members of his family are of ordinary stature. Both parents were alcoholic, but are dead. One brother and one sister died in infancy: one brother aged 25 is a domestic servant and is of ordinary stature.

Personal History.

He was a puny infant, but had nothing special the matter with him, and at 17 he was developed like a man of 20. At this time he abandoned himself to sexual excess, keeping two mistresses, and for the space of two years he copulated four to six times a night./

(1) Buday and Jancso, Ein Fall von pathologesehen Reisenwuchs Deutsches Archiv. für klin Med. 1898, p.385. (Summary.)

PLATE XLV.

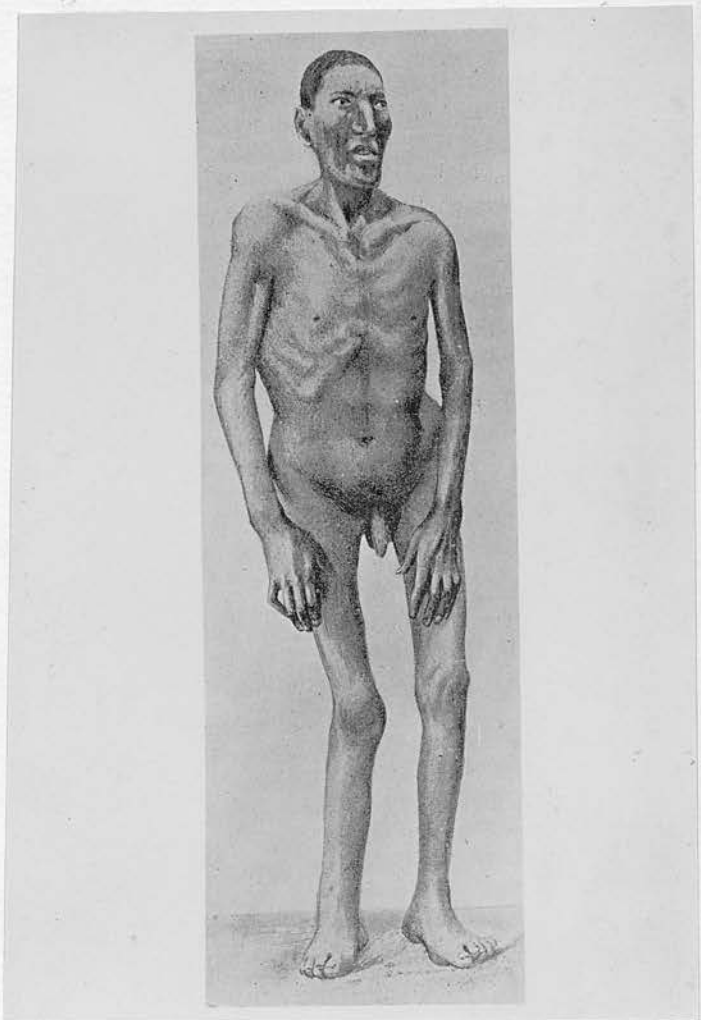


PLATE XLV.

Simon Botis.

----After Buday and Jancso.

night. Then various troubles began to show themselves: emission following immediately upon erection, he was no longer able to satisfy his mistresses; a little later he had erections, but no emissions. In 1879, when he was twenty years of age, he became completely impotent.

It was at this time that his abnormal growth started.

When he was 20 he appeared before the medical board for the inspection of conscripts, and the following measurements were recorded:—

Stature 1m63.

Chest measure 0m80.

Some time later a second medical board examined him and recorded the following measurements:—

Stature 1m69

Chest measure 0m86.

After a further interval he had to appear before another board which recorded still greater measurements:—

Stature 1m72.

Chest measure 0m91.

He was then declared unfit for military service because of knock-knee and caries of the right heel. It appears/

appears that he had had for 18 years oedema with suppuration and fistulae of the right foot, for which he was treated at the surgical clinic. In December, 1889, he came back for treatment for the same condition; necrosis of the right tibia was diagnosed and a sequestrum was removed. At this time he weighed 110 kilos, and was so tall that he could not sleep on an ordinary bed. He was dismissed cured, and retired to look after his pigs.

In April, 1894, there was a recrudescence of the old trouble and for this he was admitted to hospital.

Present State (24th May 1894.)

Simon Bottis is a man of gigantic stature, he is 1m94 in height and weighs 114 kilogrammes. At first view one is struck by the gigantic proportions of everything about him, both skeleton and musculature.

The skin is normal; the hair is black and short: the moustache is rather scanty, there is no beard. The axillary and pubis hair is well developed.

HEAD.

The cranium is larger than normal; the face is/

is markedly increased both in breadth and length: especially are the nose, the malar prominences, the superior maxilla, and the mandible enormous, in result the face is disagreeable and repugnant. The cranium is increased in breadth and length, the forehead is narrow. The increase of the upper part of the face is due:--

1st. To the enormous increase in the bony part of the nose.

2nd. To the marked projection of the malars. On the other hand the lengthening is especially the result of the growth of the maxillae, both superior and inferior.

As a result of the great width of the nose the eyes are set very far apart.
The bi-internal angular distance is 73mm. in place of the normal 59.
The mandible is truly gigantic, the lips are a little thicker than normal. The ears are small and of good shape.

TRUNK:--

The/

The thorax is increased in all its diameters; the upper part is flat; the lower part projects markedly in front and laterally.

The clavicles are thick, long, and strongly curved.

The ribs are broad and thick and are more markedly curved upon the right side than upon the left; the lower ribs and their cartilages are set at a right angle to one another and the costo-chondral junctions are marked by hard bony projections, perceptible to the touch.

The vertebral column in the dorsal region is curved towards the right.

The shoulders are square; the scapulae are winged.

UPPER LIMBS;--

The whole limb is longer than normal; the increase affecting all the segments, but more especially the hands, which are large, out of all proportion to the rest of the limb. The muscles are feeble and soft. On palpation all the bones seem to be increased not only in length, but in all their diameters, but the increase in length does not seem to have affected all the bones to the same extent, for the long axis of the/

the hand is bent towards the radial side as if the growth of the radius had lagged behind that of the ulna.

Both hands are very large and especially very long, but in spite of their enormous size they are well proportioned and even not without a certain elegance. The fingers are long; the joints are not thickened; the nails are normally formed.

LOWER LIMBS:--

The whole limb is increased, but the most striking feature is the great growth of the feet. There is a right sided genu valgum and there is a marked thickening of the lower half of the right tibia. The left leg is not deformed, it is longer and more slender than the right.

The intelligence is wonderfully good.

The special senses are normal; sensibility of all sorts is normal; reflexes are normal, muscular power is slightly diminished.

Heart and pulse normal, 72 per minute.

BLOOD:-- red and white corpuscles normal in number, form/

form and colour.

The bucco-pharyngeal cavity is very large; several teeth are wanting; the tonsils are rather big; the tongue is longer, broader and thicker than normal. The appetite is good, being slightly greater than that of a man of average size; thirst is not exaggerated.

URINE:

normal, specific gravity 1012,

no sugar, no albumen.

The genital organs are not large; the testicles are distinctly small.

The patient remained in hospital from 24th May, 1894, to his death on 25th September, 1896.

PROGRESS NOTES:--

31st May 1894. Two abscesses on the right leg burst; they healed rapidly.

August 1894. Adenoids and nasal polypi extirpated.

October 1894. First appearance of polydypsia (12 litres of water per day) and of polyuria (13 litres of clear urine per day, sp.gr. 1027; sugar present; polarimeter/

polarimeter reading 5%.

November 1894. Pneumonia of the base of the left lung developed; during its continuance the amount of urine fell to 3 or 4 litres and the sugar reading to between 1 and 2%.

March 1895. 9 to 16 litres of urine passed per day; sugar present.

August 1895. The patient has lost ground and is much thinner; weight 102 kilogrammes. Stature has increased by one centimetre (1m995.) The circumference of the thorax and of the limbs has diminished considerably. Cough and expectoration, anaemia and loss of muscular force are well marked.

January 1896. The patient is much thinner (weight, 96 kilogrammes.) The physical signs all point to tuberculous disease of both apices: no tubercle bacilli can be discovered in the expectorate. The sugar has disappeared from the urine and the quantity is now reduced to two or three litres per day. Treatment; 30 grains of thyroid per day were given without appreciable result. (Sugar did not again appear in the urine.)

March 1896. Temperature shows hectic swing: tubercle bacilli and elastic fibres found in the sputum. The/

The loss of flesh is rapid (weight, 70 kilogrammes.)

23rd September 1896. Death from tuberculosis.

AUTOPSY 24th SEPTEMBER 1896.

Length of body on post-mortem table 2m02, weight 74 kilogrammes.

Brain weight, including pituitary, 1613 grammes. A tumour rather larger than a hen's egg represented the pituitary; it was lodged partly in the sella turcica and lay partly upon the neighbouring parts of the sphenoid and frontal bones. It measured 70mm in length and 50mm in breadth. It pressed against the tip of the temporal lobe and the anterior part of the Pons Varolii. It was found to be made up of two parts, an anterior, smaller, and a posterior, larger. These were united by a middle softer portion along the side of which ran a groove which lodged the optic nerve. The optic nerves and chiasma, although adherent to the tumour and apparently pressed upon, were neither atrophied nor discoloured. The tumour did not penetrate into the ventricles; the anterior commissure was intact.

Normal pituitary structure was only found in the middle part. In the other parts there was a cell proliferation/

proliferation of the greatest intensity: the cell arrangements were orderless and the connective tissue stroma was thickened. The condition was, therefore, apparently not one of hypertrophy, but of true tumour growth, probably angio-sarcoma rather than adenoma or adeno-sarcoma.

There were a few vestiges of the thymus; but even after microscopic examination it was impossible to say whether this was to be regarded as normal or abnormal.

Lungs: advanced tuberculous changes.

Tongue: length, 110.5mm; breadth 80mm.

Thyroid cartilage: length 67mm.

Vocal chords: length 28mm.

Thyroid gland: weight 57gr05. On microscopic examination the structure appeared normal.

Pharynx: very large.

Spleen: 840 grammes: capsule thickened and connective tissue increased in amount.

Kidneys: very large; weight, right 298 grammes,
left 315 grammes.
Consistency harder than normal, microscopic examination showed traces of nephritis.

Suprarenals: not much increased: their structure was practically/

practically normal.

Liver: weight 2960 grammes, congested, slight fatty infiltration; miliary tubercles present.

Stomach and Intestines: increased in all their dimensions; length, small intestine 10m70, large intestine 3m80. Tuberculous lesions were present here and there in the small intestine and the colon and in the mesenteric glands.

Testicles: markedly diminished in size; right testicle weight 9gr5, left 12gr5. Atrophy without inflammation: no spermatozoa in the canals.

Prostate; small and pale.

Muscles: atrophied and pale, especially the gastrocnemius in which some trichinae were encapsulated.

Spinal Cord:- normal except for a hyperaemia of the lumbar enlargement with commencing sclerosis of the column of Goll and the lower part of the lateral columns.

Peripheral Nerves: some increase in the fibrous tissue and reduction in the number of the nerve fibres. There was neither degeneration nor atrophy of the optic nerves.

Joints: There were rheumatoid changes in the larger joints, especially at the hip. A loose body was found in the right hip. The synovial membranes in/

in the upper limb joints were villous and hypertrophied. In the right tibio tarsal joint the cartilages were thickened. In no joint was there any trace of active or healed tuberculous mischief.

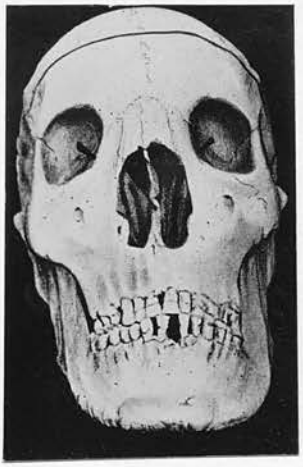
Skeleton: The diaphyses are large, but practically normal; there are no exostoses apart from some osteophytes on the right leg. The epiphyses are more unequal than the diaphyses; their vessels are larger. The muscular crests are sharp and outstanding, especially that marking the insertion of the biceps in the radius and the origin of the subclavius from the under surface of the clavicle. The bones are very light; the compact tissue is unusually thin and the medullary cavities are unusually large and extend into the epiphyses. The general osteoporosis is most remarkable, especially in the small bones and more especially in the tarsus where the compact layer is so thin that it can be depressed by the finger.

Skull: There is a disproportionate increase of the face in relation to the cranium, although it, too, is far from normal; thickness of the cranial vault 4 to 7mm.

In the interior the sella turcica is opened up and much enlarged.

Distance/

PLATE XLVI.



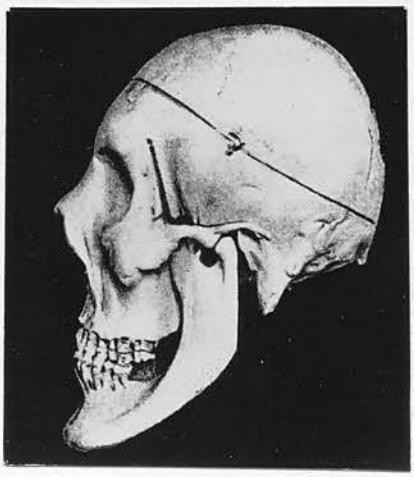


PLATE XLVI.

Face and profile views of the skull of Simon Botis.

----After Buday and Jansco.

Distance between optic foramina 36mm.
Do. do. anterior clinoid processes 43mm.
Do. do. foramina rotunda 51mm.

In the floor of the sella turcica the bone separating it from the sphenoidal sinus is extremely thin, but not perforated. The sella turcica forms a large depression continuous anteriorly with the floor of the anterior cranial fossa.

The foramen magnum looks very small; sagittal diameter, 31mm; coronal 32mm.

Face: The superior maxillae are very large; distance from nasal suture to alveolar border, 102mm. The nasal fossae are enlarged both in height and width to an almost unexampled degree. The nasal bones are twice the normal size; breadth, 15mm; length 42mm. Height of nose, 84mm. The body of the mandible is more increased than the rami.

Height of body 46mm.
Length of lower border 107mm.
Bigonial diameter 122mm.
Bicondyloid " 145mm.

The inferior border is thickened and projecting; the angle is more open than usual and measures 138° in place of the normal 120°.

Vertebral/

Vertebral Column: There is marked scoliosis with two curvatures, an upper cervico dorsal with its convexity to the left side, a lower, dorsal with its convexity to the right; there is no kyphosis. The bodies of the vertebrae are increased in size especially in the cervical region.

Thorax: The thorax is markedly increased in all its dimensions, especially in its antero-posterior diameter. There is a marked increase in the size of the ribs and clavicles.

Upper Limbs: In comparison with the other long bones both the humeri are short, especially the left which is hardly longer than an average bone. The right is 35mm longer than the left; the asymmetry is most striking. Unlike the arm, the forearm is of enormous length, but the bones are not thick. Contrary to the normal arrangement the ulnar styloid process extends further down than the radial; the ulna being longer than the radius, the hand is permanently radial flexed. The metacarpals and phalanges are very long, but their proportions to one another are scarcely modified at all.

Pelvis: The pelvis is increased in all its diameters, especially/

especially in the transverse, as the result of the great width of the sacrum and the great length of the horizontal ramus of the pubis.

Lower limbs: The length of the femora is greater than one would have anticipated from the stature. The left femur is 15mm longer than the right; the lower extremity of the right femur shows the modifications typical of genu valgum.

The legs are even more elongated than the thighs. There are well marked traces of caries on the right tibia. The feet are not lengthened in proportion to the limbs nor in proportion to the other parts of the body. The right foot shows equino varus. There are no osteophytes except on the ungual phalanges.

OBSERVATION VIII. (1)

THE SKELETON OF THE AMERICAN GIANT.

It is probable that the American Giant was twenty-two or twenty-four years old at the time of his death. The bones seem to have attained their full development/

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(1) Hinsdale, op. cit.

PLATE XLVII.

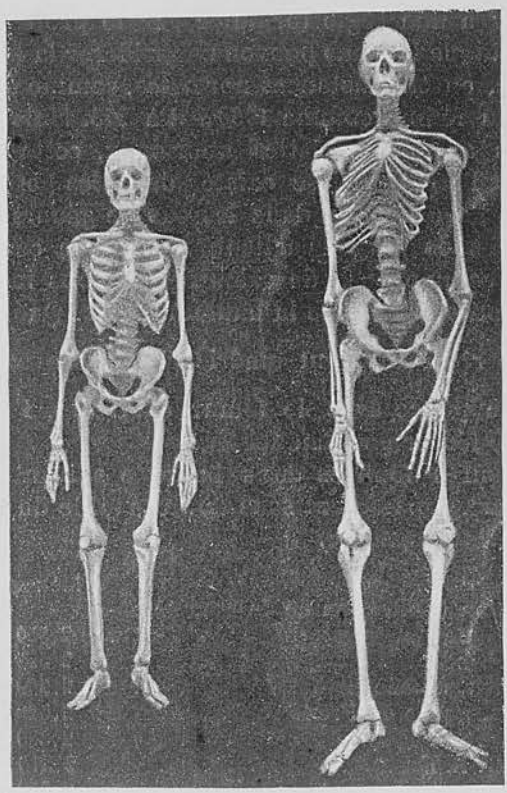


PLATE XLVII.

The skeleton of the American Giant compared to that of a normal adult.

----After Hinsdale.

development, although the epiphyseal junctions are everywhere plainly visible. The spine is both kyphotic and scoliotic; this detracts somewhat from the height, but taking the skeleton as it is, its greatest length is 7 feet, 6 inches.

THE SKELETON.

1. The Skull:--

The skull bears a fair proportion to the great size of the skeleton.

Measurements:--

Cubic Capacity	2320cc.
Length Glabella occipital	234mm.
" internal	195mm.
Height binaural over bregma	351mm.
Vertical index	78·3
Breadth maximum	145mm.
Horizontal circumference	640 "
Length of foramen magnum	51 "
Breadth " "	39 "
Interzygomatic breadth	147 "
Intermalar "	133 "

Internally; the pituitary fossa is very large; length/

PLATE XLVIII.

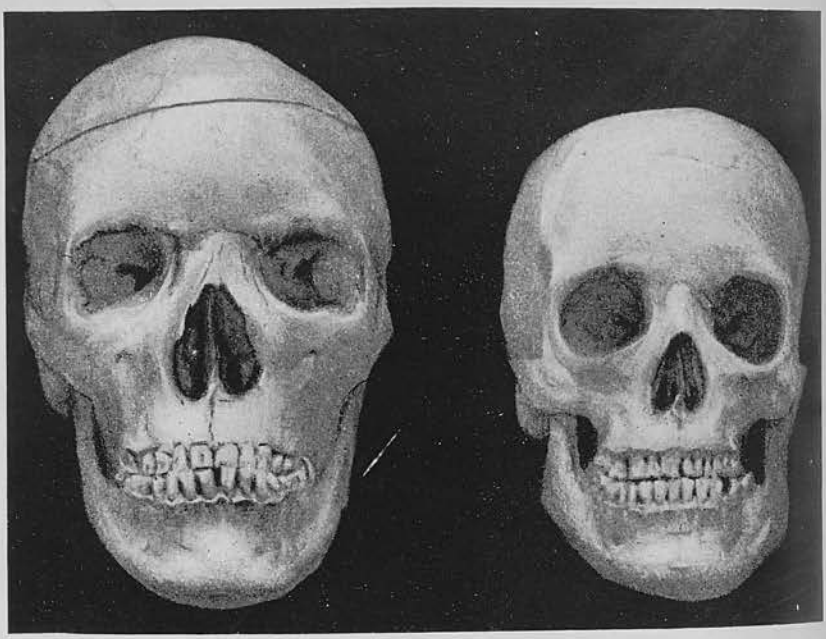


PLATE XLVIII.

Face view of the skull of the American Giant compared to that of a normal adult.

---- After Hinsdale.

length, 27mm; depth, 17mm; breadth 42mm.

2. The Face:--

The face is large even in proportion to the large cranium; the inferior maxilla is massive and slightly prognathous.

Length of face 148mm.

Face-stature index 6·48: normal, 7·01.

Naso-alveolar length 90.

Naso-alveolar stature index 3·93; normal, 4·26.

The measurements of the mandible are:--

Intercondyloid 141mm.

Intergonial 113 "

Mento alveolar 40 "

Angle of ramus 140°

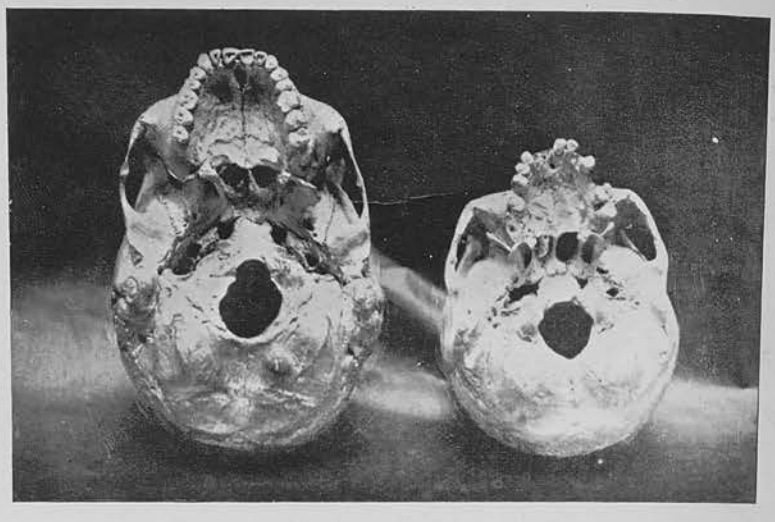
When the mandible is articulated the lower incisor teeth project in front of the upper incisors.

3. The Vertebral Column.

Viewed antero-posteriorly there is a sharp curve in the dorsal and lumbar region with its convexity to the right; viewed laterally the upper four thoracic spines are prominent on a kyphotic convexity. The lumbar vertebrae are massive.

The/

PLATE XLIX.



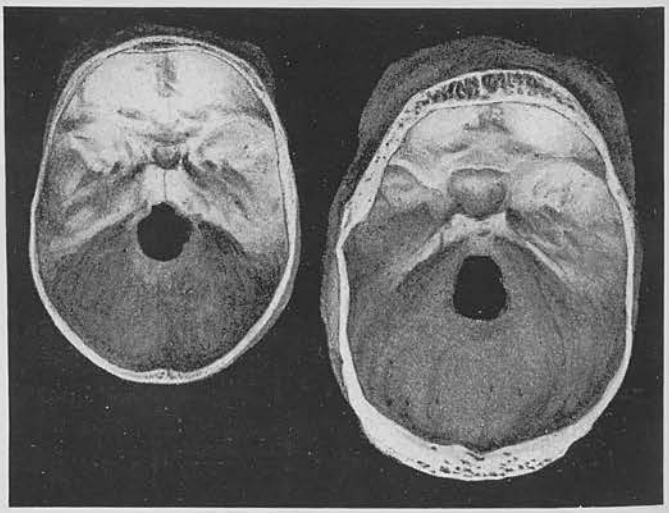


PLATE XLIX.

Internal and external views of the base of the skull of the American Giant compared to that of a normal adult.

------After Hinsdale.

The sacrum is composed of four pieces, its width is 160mm; its length 132. The coccyx consists of three pieces.

4. The Thorax:--

The ribs are long and narrow and relatively straight. The seventh and eighth right ribs, measured along the under border, are 450mm, and 435mm in length: the sixth rib on the left side is 435mm long; the seventh is 438.

The sternum has a total length of 235mm. It is a well-proportioned bone.

The thorax is large, but narrow in proportion to its depth; girth 1097mm; antero-posterior diameter 430mm; transverse 280mm.

5. The Pelvis:--

The pelvis is large and proportionate to the size of the skeleton. The bones are thickened at their borders and bear the marks of periosteal inflammation; especially is this noticeable in the iliac crests and above the acetabula which are evidently arthritic.

Measurements:--

Interspinous 355mm.

Intercristal/

Intercristal	335mm.
Between mid-points of ischia	155 "
Antero-posterior diam. of inlet	140 "

The cavity of the pelvis is considerably encroached upon by the convexities which mark the position of the acetabula, more particularly by that of the left side.

The acetabula are very deep and separated only by a thin layer of bone from the pelvic cavity.

6. Superior Extremities:--

Clavicles:	length	212mm.
Scapulae:	length	268 "
"	breadth	R.144. L.150.

Humeri: the right is 475mm long and has a circular perforation in the olecranon fossa 16mm in diameter.

Ulna:	length	R.378mm, L.375.
Radius:	"	R.354 " L.360.
Hand:	"	scaphoid to tip of middle finger 250mm.

7. Inferior Extremities:--

Femora:--The femora though slender in proportion/

proportion to the great size of the body are symmetrical; the shafts are well-formed and not unduly curved; length, R. 655mm, L. 666: circumference R. 84mm, L. 85: diameter R. and L. 20mm.

The hip joints are markedly arthritic, the femoral heads misshapen and the necks deformed. These instead of being circular on section are semi-lunar, the flat side being anterior, they are short and appear to be at right angles to the shaft.

The condyles are well-formed and in proper proportion. The compact tissue is very thin at the extremities, barely covering the cancellous tissue.

Tibiae and Fibulae:--The fibulae are very long and are curved so markedly backwards, that the perpendicular from the point of greatest convexity to the chord of the arc is no less than 47mm in length. The length of the tibiae is R. 55mm, L. 565: of the foot 306.

OBSERVATION IX. (1)

DESCRIPTION OF A SKELETON.

THE GIANT OF THE NATURAL HISTORY MUSEUM PARIS.

The/

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(1) R. Verneau; extracted from Launois and Roy, op. cit.

PLATE L.

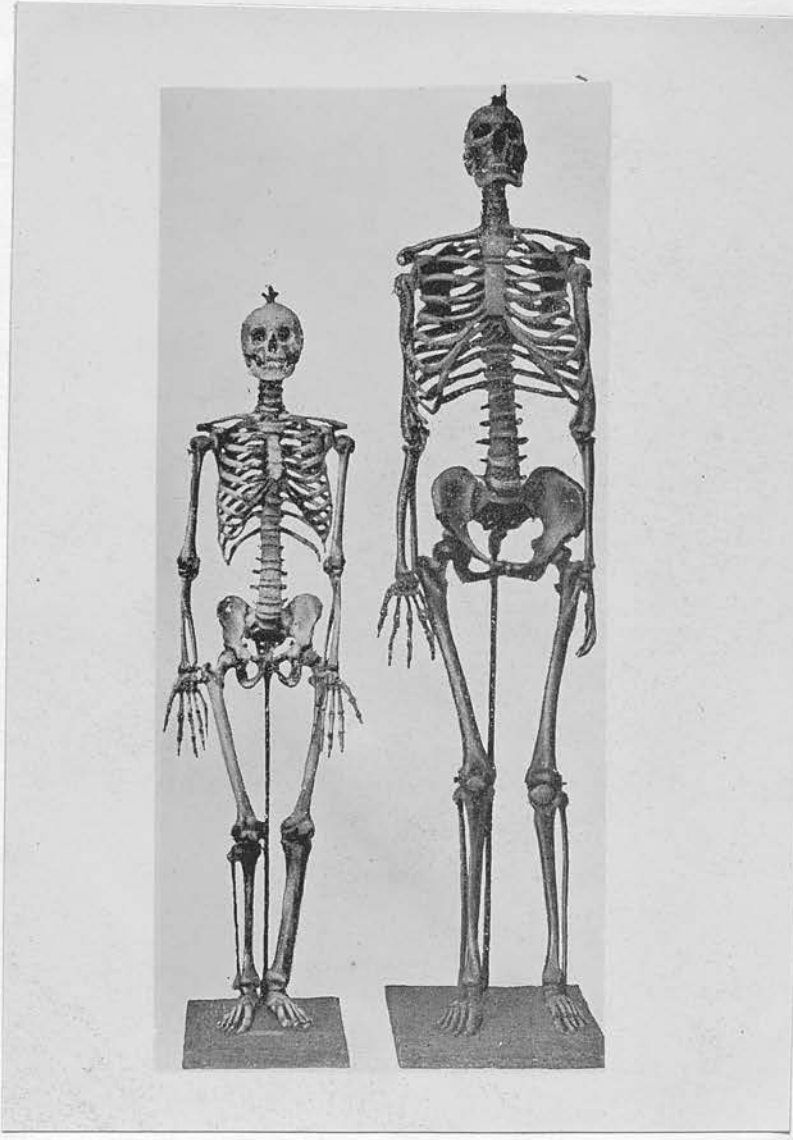

PLATE L.

Skeleton of the Giant of the Natural History Museum Paris compared to that of a normal adult.

----After Verneau

Published by Launois and Roy.

The following facts are known with regard to the individual whose skeleton is described:

He was born on 26th December 1847 in Anjou; he died on 21st January 1875. His age, therefore, was 27 years and one month.

As a young adult he was delicate and frequently was unable to work: in consequence he frequently had to go short of food. He suffered from boulimia and polydipsia: it is said that he could eat three quartern loaves of bread in a day and drink a litre at a draught. He toured as a freak for some time, but not liking the life gave it up. His intelligence was strictly limited, but he had a dog-like devotion to his parents.(1) He is said to have grown to within two years of his death.

THE SKELETON.

STATURE AND PROPORTIONS.

Stature 2m14.

The bones of the two sides are not symmetrical; the/

---

(1) Cf. Remarks on the Psychical Attributes of Eunuchs in Part I.of this Thesis.

the left side is considerably the larger.

	Right	Left	Difference in favour of left side.
Femur	566mm	574mm	8mm
Tibia	471 "	479 "	8 "
Fibula	480 "	486 "	6 "
Humerus	405 "	407 "	2 "
Ulna	339 "	345 "	6 "
Radius	317 "	317 "	0

The total length of the left lower limb is, therefore, 15mm more than that of the right. At the same time there is a well marked genu valgum of the right side: in life, therefore, there was an even greater reduction in the effective length of the right lower limb.

Size of Hands and Feet.

	Right.	Left.
Length of Hands	217	216
" " Feet	279	278

Measurements./

Measurements Illustrating lack of symmetry.

Humerus	Right.	Left.
Antero-posterior diameter at the level of the deltoid insertion.	49	35
Transverse diameter do.	36	36
Greatest breadth of lower extremity.	72	70
Greatest breadth of inferior articular surface	53	51
Femur.		
Maximum great trochanter to head.	116	113
Height of the head	57	59
Breadth do.	58	58
Antero-posterior diameter below lesser trochanter.	46	49
Transverse diameter do.	49	45
Index	93·8	108·9
Maximum Antero-posterior diameter of shaft	49	49
Maximum Antero-posterior diameter of shaft 40mm above the condyles.	37	36
Transverse diameter do.	49.5	48
Index	74.7	75
Maximum breadth of inferior extremity.	92	89
Tibia/		

Tibia.	Right.	Left.
Maximum breadth of superior extremity.	88	86
Antero-posterior diameter of the shaft at the level of the nutrient foramen.	46	46
Transverse do.	35	36
Index.	76.1	78.3
Scapula.		
Total length	212	210
Breadth (base of spine to glenoid.)	136	139
Height of infra-spinous fossa	171	168
Length of axillary border	178	177
" " spine and acromion	180	180
" " acromion	69	64
Breadth of "	38	40
Height of glenoid cavity	45	45
Maximum breadth	34	35
Scapular index	64.15	64.19
Infra-spinous index	79.55	82.74

The indices are interesting. The right approximates to the male standard; the left to the female.

Pelvis. (Verneau records a large number of measurements from which I select the following.)

Maximum/

Maximum Breadth	379mm.
Maximum intercristal	333 "
Inter-posterior superior spines	121 "
anterior superior	327 "
anterior inferior	256 "
Inlet antero-posterior diam.	140 " (?).
transverse " "	189 "
oblique " "	176 "
Sacro iliac artic. to symphysis	148 "
Subpubic angle	90°

Pelvic Indices

Horizontal (Diam. A.P.: Diam. Tr. Maximum.)	83 "
Transverse vertical (Max.height: Diam. Tr. Max.)	73 "
Inlet	74 "

The pelvis is, therefore, essentially feminine in type. In some respects it is infantile e.g. the epiphysis for the iliac crest is not yet joined to the rest of the bone in the posterior half and the cartilage between the ischial and pubic rami has only partly disappeared.

The Sternum.

Body:--Length 138mm.

Breadth/

Breadth	62mm.
Index	45 "

This high index is almost ultra feminine in type.

Manubrium:--

Height	68mm
Breadth	79 "

The Ribs.

The ribs on the two sides are not of equal length. On the right the 7th and 8th are about 492mm; on the left the seventh is the longest rib, measuring 485mm.

The Thorax as a Whole.

As a whole the thorax is very abnormal, being markedly flattened from before backwards.

Antero-posterior diameter	248mm
Transverse "	397 "
Thoracic Index	160 "

This index is sometimes approached by the negro, for a European it is ultra feminine.

The Head.

As/

PLATE LI.

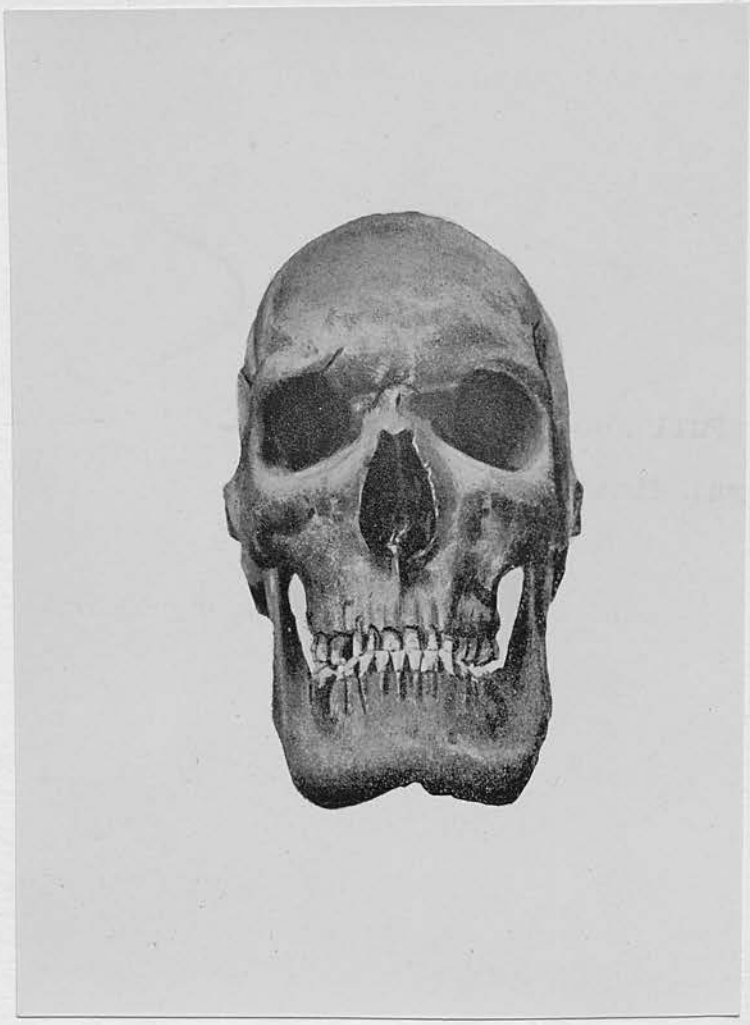

PLATE LI.

Full face view of the skull of the Giant of the Natural History Museum Paris.

----After Verneau.

Published by Launois and Roy.

As a whole the skull is dolichocephalic and the face is greatly exaggerated in height.

Cephalic index	70·53
Facial index	78·81

As the skull is intact it was impossible fully to examine the interior, but through the hole in the vault made for mounting the specimen it was possible to make out that the sella turcica is of unusual depth.

The mandible is peculiar: the accompanying photographs show its characteristics very well.

Measurements.

Cranium.

Cranial Capacity		1735
Projection anterior	total	115
	facial	41
Projection posterior		107

Diameters:--

Antero-posterior maximum	207
Transverse	146
Bitemporal	145
Biauricular	145
Bimastoid	110
Frontal maximum	120
" minimum	110

Occipital/

PLATE LII.

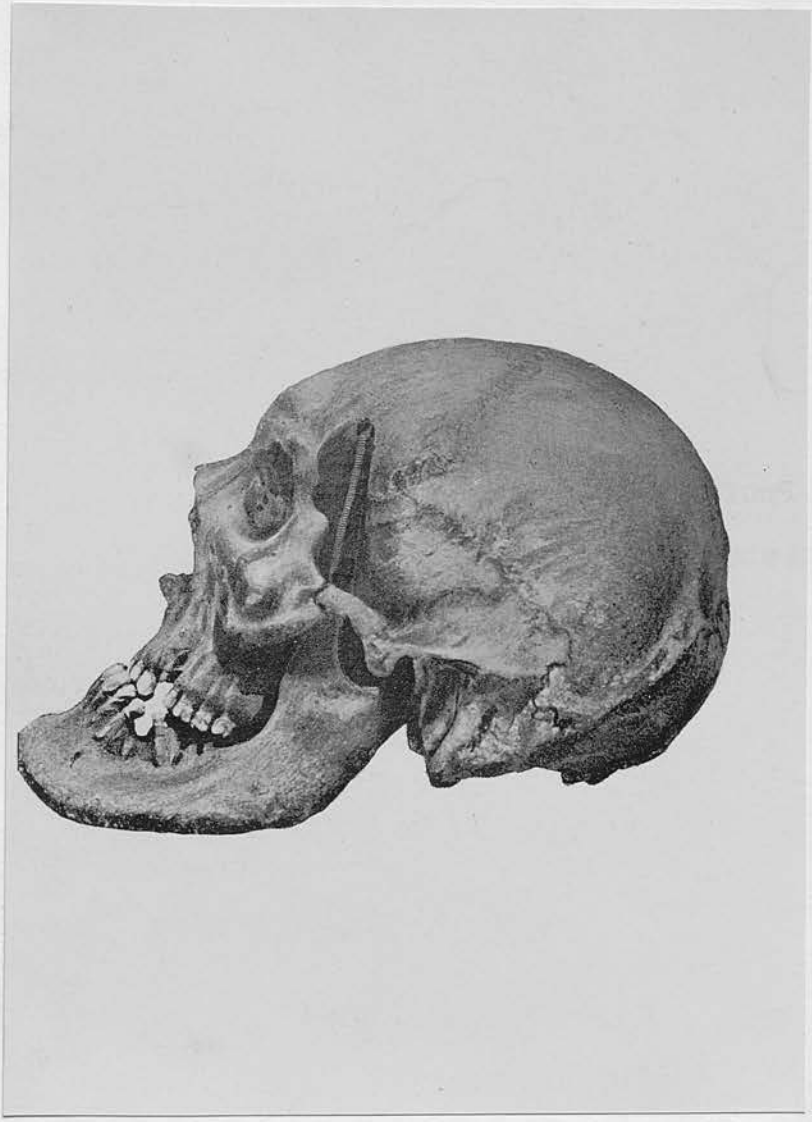

PLATE LII.

Profile view of the skull of the Giant of the Natural History Museum Paris

----After Verneau.

Published by Launois and Roy.

Occipital maximum	129
Vertical basi bregmatic	141
Length of foramen magnum	39
Breadth " "	30
Naso basilar	122
Indices.	
Cephalic	70·53
Vertical	68·08
Transverse-vertical	96·57
Fronto parietal	75·34
Facial Diameters.	
Biorbital ext.	125
Interorbital	51
Bizygomatic max.	151
Bimaxill. min.	78
Orbits	
Breadth	46
Height	35
Nose.	
Breadth of bones Sup.	17
Min.	13
Inf.	25
Max. breadth of opening	30
Total length	64

Heights:/

Heights.

Frontal sub-cerebral	22
Intermaxillary	35
Total of face	119
Malar prominence	37
Orbito-alveolar	65
Mastoid	57

Angles

Facial sub-nasal	67°
Alveolar	61°
Dental	52°

Indices.

Facial	78·81
Orbital	76·09
Nasal	46·87

Mandible.

Bigonial distance		107
Angulo-symphyseal		132
Height of ascending ramus		64
Breadth " " "	R.	36
	L.	39
Height at symphysis		44
Thickness of ascending ramus	R.	11
	L.	12

Thickness/

PLATE LIII.

PLATE LIII.

Cornelius Magrath.

From an old print or poster from the collection of Professor D.J.Cunningham.

Thickness of symphysis	16
Angles	
Mandibular	130°
Symphysis	31°

(1)
OBSERVATION X.

DESCRIPTION OF A SKELETON.

THE IRISH GIANT, CORNELIUS MAGRATH.

The age of Magrath at the time of his death was 23 years. In every bone of his skeleton there are present appearances which indicate that during life they were very vascular. The Haversian canals are dilated and their mouths are filled with foreign matter. This gives to the bone surfaces a punctated or dotted appearance. In the shafts of the long bones the nutrient canals have undergone a remarkable degree of expansion.

Again, at the articular ends of the bones, and in all other places where cancellous tissue is present in bulk, the surfaces of the bones are highly irregular, osteophytic growths forming warty or jagged prominences. The more evident impressions for the attachments of muscles/

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(1) Prof. D.J.Cunningham, The transactions of the Royal Irish Academy, Vol. XXIX, Part XVI. (Summary)

PLATE LIV.

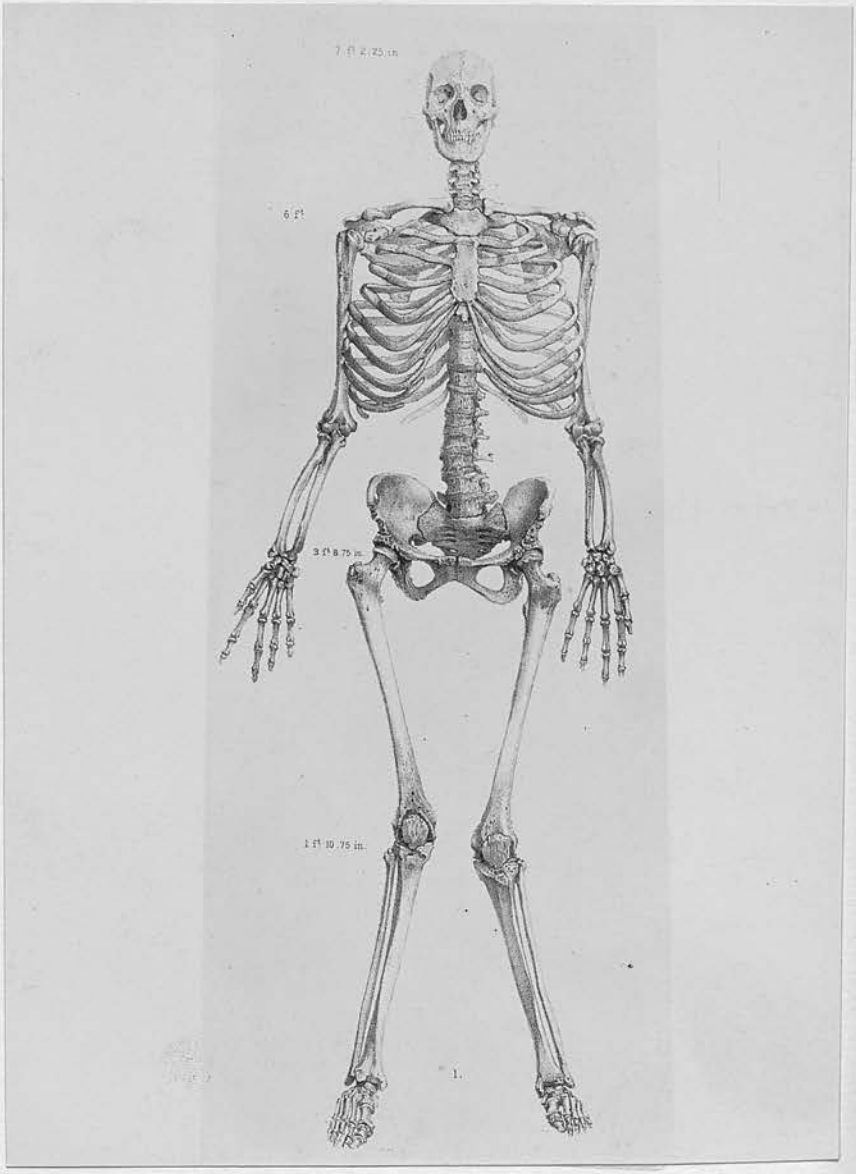


PLATE LIV.

Skeleton of Magrath.

----From the collection of Professor D.J. Cunningham.

muscles and ligaments exhibit that peculiar roughness and bony deposit which we know results from periostitis.

Stature estimated from femoral length 2m177.

THE SKULL.

The first point that strikes one on looking at the skull is the disproportion which exists between the size of the cranium and that of the face. The cranium is, if anything, small for a person of his gigantic stature: the face is out of proportion both to the cranium and the stature. The increase in the size of the face is due to a downward growth of the maxillary bones, together with a great enlargement of the lower jaw.

Measurements:—

Cubic capacity	1600
Glabello-occipital length	198
Basi-bregmatic height	139
Vertical Index	70·2
Minimum frontal diameter	109
Stephanic diameter	136
Asterionic diameter	144
Maximum breadth	155
Cephalic Index	78·3

Horizontal/

PLATE LV.

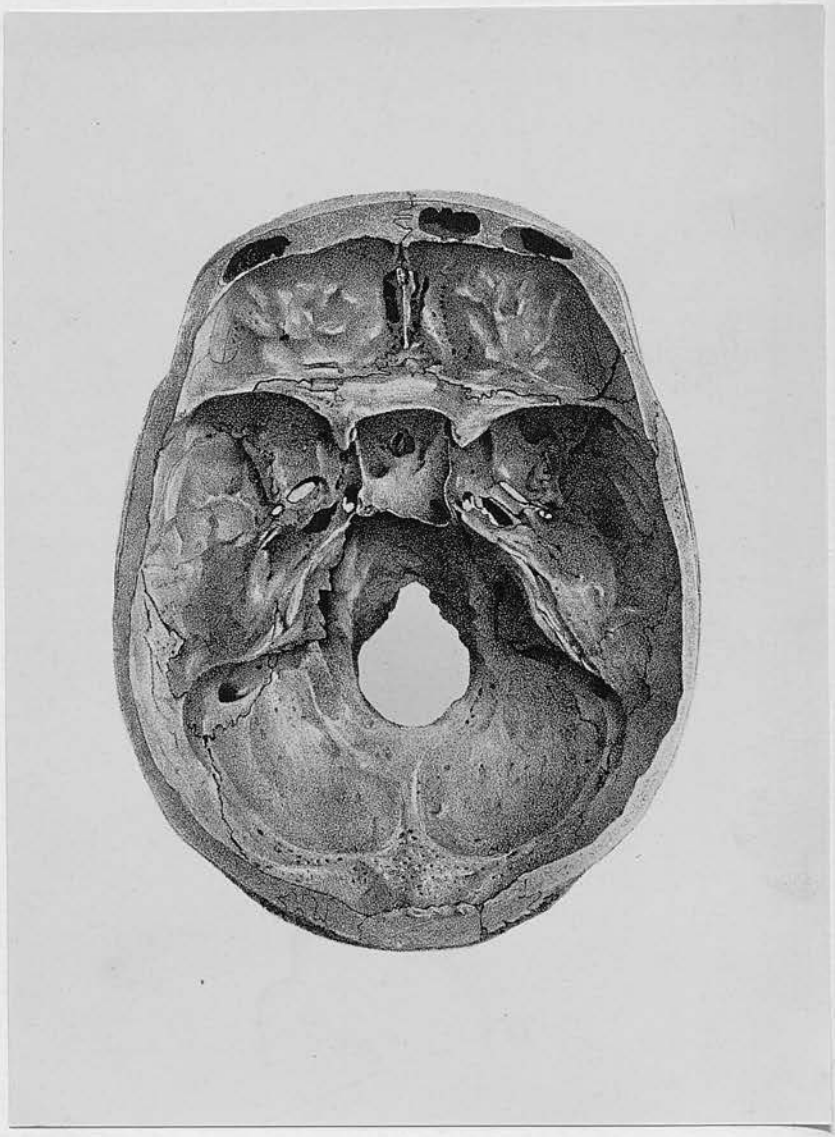


PLATE LVI.

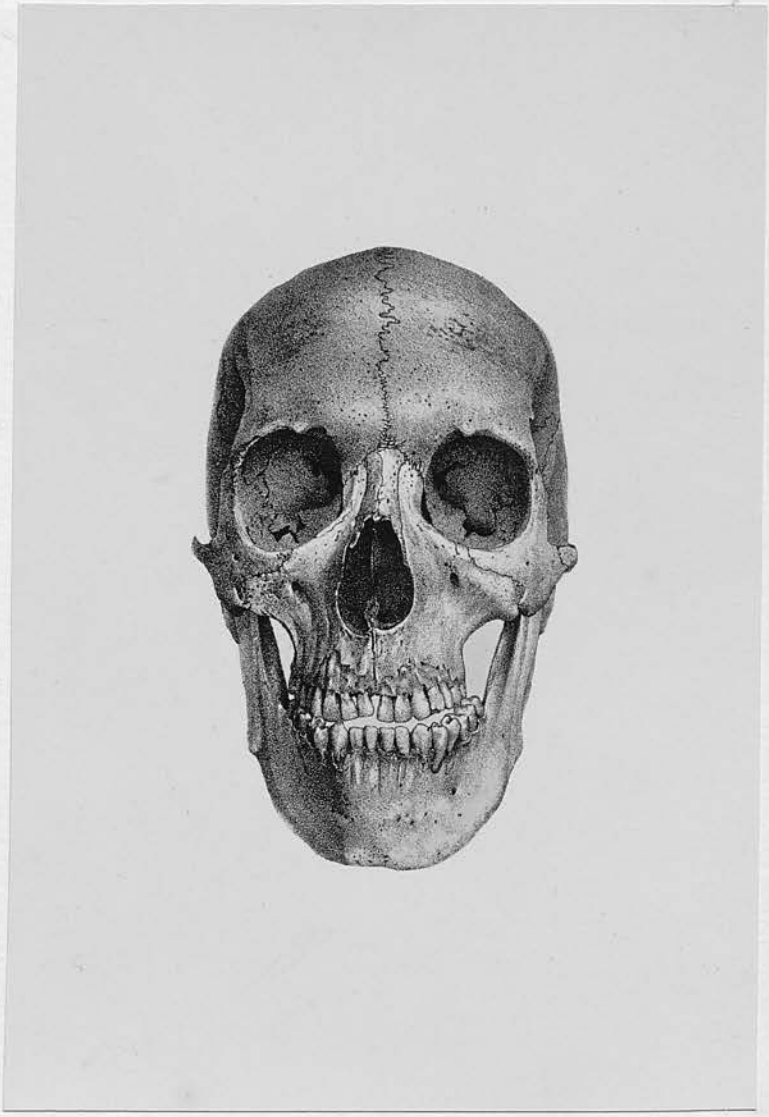
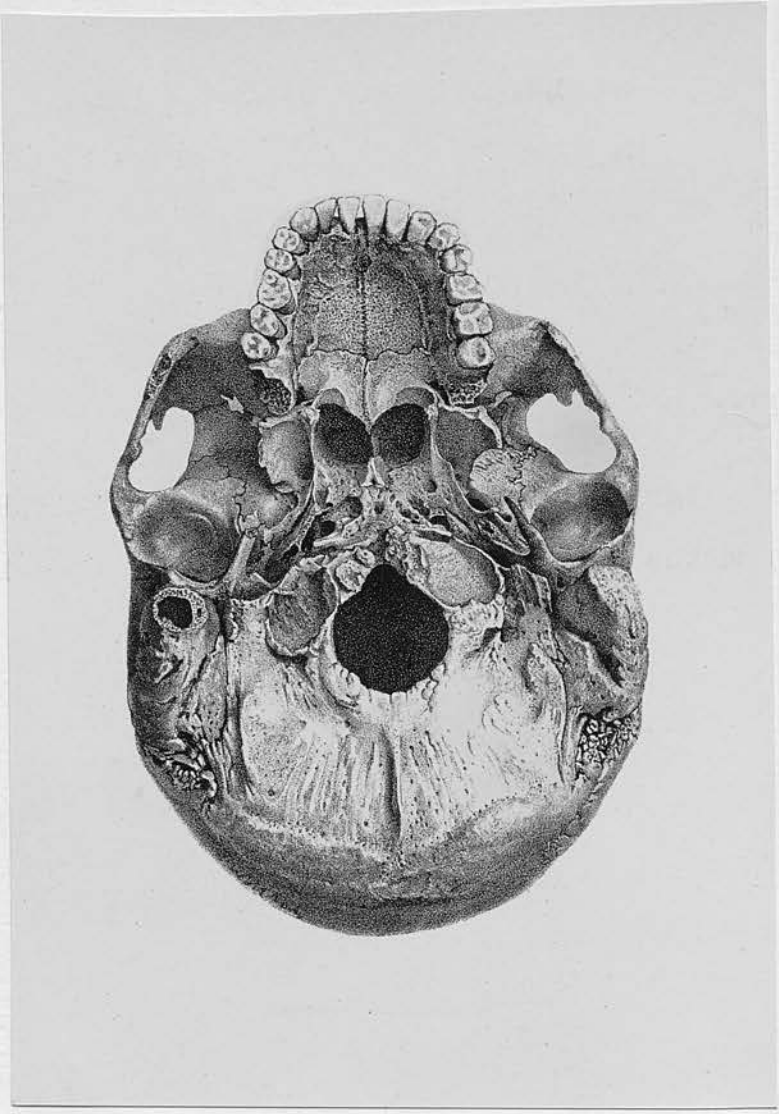


PLATE LVII.



PLATES

LV, LVI, AND LVII.

Various views of the skull of Cornelius Magrath.

----From the collection of Professor D.J.Cunningham.

Horizontal Circumference	568
Frontal longitudinal arc	139
Parietal do.	135
Occipital do.	120
Total	394
Vertical transverse arc	340
Length of foramen magnum	40
Basi-nasal length	105
Basi-alveolar length	107
Gnathic Index	101·9
Inter-zygomatic breadth	156
Intermalar breadth	127
Naso-alveolar length	96
Nasion to chin	156
Facial Index	61·5
Nasal height	72
Do. width	29
Nasal Index	40·2
Orbital height	44
Do. width	43
Orbital Index	97·7
Palato maxillary length	50
Do. do breadth	65
Palato maxillary Index	130

The/

The mandible:—

The mandible is of enormous size, being increased in all its dimensions except in the antero-posterior width of its ascending ramus. The base is exceedingly strong and the chin extremely prominent. But the growth is not confined to its basal part. The alveolar portion has also increased in height, whilst the dentary arcade has widened out to such an extent that the incisors of the lower range are placed fully half an inch in front of the corresponding teeth of the maxillary arcade.

The body meets the ramus at an angle of 127.°

Measurements

Symphysæal height	46
Coronoid height	98
Condyloid height	95
Gonio-mental length	113
Gonio-alveolar length	104
Intergonial width	113
Breadth of ascending Ramus	34

Viewed from the interior the floor of the cranium presents a coarse appearance from the strong manner in which all the natural prominences project into/

into the cavity. The vascular grooves are deep and the apertures for the emissary veins are large.

But the portion of the cranial floor which at once attracts the eye is the pituitary fossa which is enormously expanded. The floor of the fossa is at one point perforated; at others it exhibits a number of deep depressions separated from one another by salient smooth ridges. From this we may infer that the under surface of the greatly enlarged hypophysis was lobulated. The dorsum sellae is very nearly completely absorbed; only the basal part remains and this is reared erect and is as thin as paper. Not a trace is left of either of the posterior clinoid processes.

Dimensions:--

Length	38mm.
Depth	28

Vertebral Column:--

There are two lateral curvatures; one, in the dorsal region, with its convexity to the left; the other in the lumbar region with its convexity to the right. In connection with these a considerable amount of torsion has resulted.

In/

PLATE LVIII.

PLATE LVIII.

The cervical vertebrae, the astragulus, the scaphoid and internal cuneiform and the femora of Cornelius Magrath.

-----From the collection of Professor D.J.Cunningham.

In the cervical region the vertebrae have attained a great development, more especially the articular pillars which have grown to such an extent that they form on each side, when in apposition, two columns comparable with the central column formed by the bodies of the vertebrae. They project laterally beyond the transverse processes.

There is a peculiarity with regard to the proportionate length of the different segments of the column. This is brought out in the following table:--

Proportions of the different regions of the vertebral column.

Length of Spine = 100.

	Magrath.	Average of 6 Irish Spines.
Cervical Region	19·3	21·8
Dorsal Region	51	46·5
Lumbar "	29·7	31·7

In Magrath there is, therefore, apparently, a shortening of the cervical spine and a marked elongation of the dorsal.

THORAX:--

The/

The chest cavity is greatly expanded; at its widest part it presents a girth of no less than 1m323 (52⅛ inches).

The sternum is a large but well-proportioned bone.

Measurements.

Total length	270mm.
Breadth at junction of 1st costal cartilages	100
Manubrium length	74
Gladiolus	141
Ensiform process	55

The ribs are notable for:--

1. the boldness of their curvature.
2. the great depth and width of the subcostal grooves.

The Pelvis:--

The pelvis is of great size and its breadth is especially remarkable. The bones are coarsely modelled and the muscular impressions are conspicuous. The acetabula and ilia show arthritic changes. The excessive width is due to the great breadth of the sacrum and to the elongation of the pubic bones and the/

the spreading out of the pubic arch.

Measurements:—

Breadth	386
Height	274
Breadth Height Index	70·9
Between ant. sup. spines	365
Between post.sup. spines	192
Between ischial tubera	265
Greatest diam. of cotyloid cavity	74
Trans. diam. of obturator foram	67
Vertical diam. of do.	70
Obturator Index	98·5
Sub-pubic angle	88°
Trans. diam. of brim	217
Conjugate diam. of brim	112
Pelvic Index	51·6
Depth of Symphysis Pubis	57
Depth of Pelvic cavity	125
Length of Sacrum	112
Breadth of Sacrum	162
Sacral Index	144·6

Superior Extremity:—

In the bones of the upper limb there are also arthritic/

arthritic changes: these are especially noticeable in the elbow joint. Here the articular margins are lipped and the range of movement is very circumscribed. Complete extension is an impossibility: in life it was probably limited at an angle of 125°.

Shoulder Girdle:--

The left scapula is damaged: the right well preserved. In both the position of the coracoid is peculiar: it is bent so that its extremity looks more directly downward than in the normal bone.

Measurements:--

Length	197
Breadth	142
Scapular Index	72
Infra-Spinous length	151
Infra-Spinous Index	94

The scapular indices bring out well the most marked feature of the bone, viz. its great breadth.

The right clavicle is a long massive bone and presents a curious osteophytic outgrowth on its under surface which must have developed in connection with the insertion of the subclavius muscle. The left clavicle has been lost.

Humerus/

Humerus:--

On both sides the upper epiphysis of the Humerus is only partially ossified to the shaft. Its lower end is marked by arthritic changes: the upper end is comparatively free from this condition. In the shaft the only smooth surfaces are the floor of the musculo spiral groove and the areas covered by the brachialis anticus muscle and by the inner head of the triceps muscle. The nutrient foramina are of huge size.

Measurements:--

Length Right	431mm
" Left	433 "

Radius:--

In both radii the lower epiphysis is not completely ossified to the shaft.

Measurements:--

Length Right	331mm
" Left	338 "

The evidence of periostitis is not so marked as in the humerus.

Ulna:--

The shaft of the ulna is also tolerably free from/

from periostitic changes. In both bones the upper end is greatly expanded in an antero-posterior direction. On the surfaces to which the tendons of triceps and brachialis anticus are attached there are marked osteophytic growths. The most remarkable feature of the bone, however, is a curious outward bend of the shaft immediately above its lower half.

Measurements:--

Length Right	366mm
" Left	368 "

In both radius and ulna there is a marked expansion of the nutrient foramina.

The radio humeral index on the right side is 76·8; on the left 78.

The normal index. (Topinard.) is 73·4.

Hand:--

There is little trace of arthritic disease in the bones of the hands. The prominences of the carpus are exaggerated and the pisiform is remarkably large, but the articular ends of the metacarpal bones and phalanges are almost entirely free from projections of new bone.

The length of the middle column of the hand is 258mm. This is 11·8% of the calculated stature.

The/

The normal percentage, (Topinard.) is 11.7.

Inferior Extremity:--

Femora:--The femora are very far from being symmetrical. There is not only a difference in the length of the two bones, but also a decided difference in their configuration. The left femur is 21mm. longer than the right and deviates much more from the normal shape. This deviation is particularly noticeable in the upper and lower extremities. Thus, the neck is exceedingly slender, is longer than that of the right femur, and joins the shaft at a more open angle. On the right side the angle is 130°, on the left, 140°. In both bones a third trochanter is present, but it is much more marked in the right bone.

The shaft of the bone is in both cases clumsy, and exhibits a small degree of curvature. In its upper two thirds it is massive and strong, but in its lower third it becomes relatively slender and weak. The most notable feature is the linea aspera; in both bones this is enormously strong, projecting and thick. When the shaft is viewed in profile it descends vertically and thus obliterates the natural posterior concavity. The nutrient foramina are greatly expanded, and/

and along the lines of tendinous and ligamentous attachment there is distinct evidence of periostitic action.

The lower ends of both bones, but more especially of the left, show the condition which we associate with genu valgum. In the lower extremities of the femora the arthritic changes are more marked than in the upper; the articular surfaces are smooth, but their margins project in the form of high ridges.

Measurements:--

Length Right	603
" Left	624

Tibia and Fibula:--

The upper three-fourths of the shaft of the femur is of unusual strength; in the lower fourth it is decidedly weak and narrow. The fibula is weak throughout especially at the upper end. The fibula too has not kept pace with the growth of the tibia and on the right side the head does not reach the external tuberosity.

Measurements:--

Tibia length Right	506mm
" " Left	504 "
" Circumference at middle	120 "
Fibula length Right	485 "
" " Left	490 "

The/

The tibio-femoral index on the right side is 83.9; on the left 80.7.

The normal index,(Topinard,) is 80.5.

Foot:--

The bones of the feet are greatly altered: in this portion of the skeleton the arthritic disease has attained its maximum intensity.

The first metatarsal bone and its proximal phalanx are remarkable on account of their massive size and the great expansion of their extremities. Some of the bones as the os calcis, astragulus, scaphoid and internal cuneiform are disproportionately large whilst the others are relatively small.

The length of foot is 300mm. This is 13·7% of the calculated stature. The normal percentage, (Topinard,) 15.4.

----------oOo----------

This completes the records of the ten observations which I desire to quote in detail; in addition I have studied, either in the original papers or in extensive summaries, some sixty-five other cases. Apart from the case of Magrath, those quoted were selected almost at random. The significance of the observations is discussed in the following chapter.

CHAPTER XVI.

PATHOLOGICAL GIANTISM.(continued)

AN ANALYSIS OF THE OBSERVATIONS QUOTED.

SECTION I. PRELIMINARY.

An analysis of the measurements quoted in the records of the giants is not unattended by difficulties. In the case of the three skeletons described in Observations VIII, IX and X., the exact height is a matter of conjecture, the mounter may have been too liberal in his supply of artificial intervertebral disc, or he may have added to the stature by straightening out a kyphotic or scoliotic curvature. Nor is it possible to calculate with accuracy the stature of a giant from the length of his limb bones. Different bones may give widely differing results and, at best, the formulae in use are known not to be reliable in the case of/

of individuals at the extremes of stature. It is well to realise at the outset, therefore, that the accuracy of some of the observations is not beyond dispute. For example, were we to employ the method used by Professor Cunningham in calculating the stature of Magrath, to calculate the stature of the American Giant we would obtain as our result a height of about 7 feet, 10 inches. whereas, the skeleton as mounted measures only 7 feet, 6 inches. Again, were the same formula applied to the giant described by Verneau we would obtain a stature of about 2m063, whereas, the skeleton as mounted measures 2m14. The possible intrusion of a fallacy is thus obvious. Magrath's skeleton as mounted measures 7 feet, $2\frac{1}{4}$; the calculated heights vary from 7 feet $4\frac{5}{8}$ to 7 feet, $1\frac{5}{8}$, and Professor Cunningham accepts the latter as the less inaccurate. With this I am sure everyone will agree, but few, I think, will accept it as absolutely accurate. A less careful observer might with justice have adopted a lower estimate and obtained a clearer demonstration of some of the special characteristics of the later stages of giant growth. The conservative estimate adopted, in one sense, renders Professor Cunningham's observations more valuable.

SECTION/

SECTION II. CHARACTERISTICS OF GIANTS IN WHOM NUTRITIVE OVERLOADING IS ESTABLISHED EARLY IN LIFE.

The giants described in Observations I-IV form a group characterised by the earliness of the onset of their nutritive overloading. To this group, too, belongs "Le Grand Charles" (Chapter XI.) The exact time of onset in all these cases is uncertain, but it is certain that Constantin was of unusual height at the age of fourteen: that Miss Ella Ewing "shot up rapidly to a great height," her active growth manifesting itself in her tenth year: that Machnow was of normal size until he was four years old: that Lady Aama was on show as a giantess when she was about fifteen and that "Le Grand Charles" was taken for a lad of twenty when he was only twelve years old.

Nor is it surprising that the exact date of onset is uncertain for at its commencement the condition has no appearance of disease. Charles, it will be remembered, was remarkable not only for his height, but for his strength throughout the whole of his service as an artilleryman: Constantin was never remarkable for strength, but he was apparently quite a healthy child. Ella Ewing was quite well at the age of twenty-three: Machnow was certainly fairly well when he was

on/

on show in London. Aama at the beginning of her life as a professional freak was apparently healthy.

Their period of apparent good health obviously synchronizes with the period of greatest cell vigour, in other words, the concentration of nutritive material, in the body fluids is for several years amply sufficient for the body cells. As a result the bodies and the metabolisms of giants are for a time precisely similar to those of healthy children. In this respect I find the record of the analysis of "Le Grand Charles'" urine particularly interesting. It is, of course, an isolated observation, but in spite of that, the fact that the amount of chlorides and phosphates eliminated, though excessive for an adult, was just equal to the average for a child of about ten can only mean that his metabolism on that day, even if only for that day, was infantile in type.

In other ways these giants resemble children: for example, their epiphyseal cartilages are active; but the activity is abnormal for they all become hypermacroskelic: thus Charles' stature was 2m04. his height seated was only 960mm: Constantin's femur is 760mm in length which corresponds to the calculated height of 2m779 while he himself on his show card only claimed/

claimed to be 2m59: Ella Ewing had such long legs that she had the appearance of being on stilts and her arms were so long that she could stretch 10 feet 2 in.; Machnow's stature was 2m38, his height seated 1m130; Aama's height as calculated from her femur should have been 7 feet; her real height was only 6 feet 7½ inches.

The first stage of the giantism of nutritive overloading established early in life, therefore, is characterised by fair general health and by an infantile habit of the body in which rapid growth is not only possible, but compulsory. The growth, however, though, in general, similar to the child's is in one way dissimilar. Godin found that the normal growth of long bones showed alternating phases of activity and quiescence and that the period of cessation of growth in length was utilized by the bone to grow in circumference. There is no evidence to show whether the growth of the bones of giants is characterised by these alternating phases or not, but it is certain that during the early stages of their growth the bones find relatively few opportunities of increasing in thickness. In this connection Hinsdale's observation upon the skeleton of the American Giant is of interest. He notes that the femora are slender, being only 84

or 85mm, in circumference and 20mm in diameter. Interesting too, is the fact that Ella Ewing broke her tibia by jumping to the ground off a stump two feet high and that the tibia healed quite well afterwards.

In Chapter I. we saw that the facts of growth necessitated the stimulus to macroplasty being little favourable to euryplasty; we are now in a position better to understand why this is so.

We have seen that the highly nutritive body fluids drive the cartilage cells to divide to save their race from extinction and that when, because of individuation, genesis is no longer possible, the older cells become larger and larger until they die, their places being taken by the osteoblasts. We have also seen that the osteoblasts have a wider range of possible nutritive adjustment.

The peculiarities of the growth of bones seem to me to admit of adequate explanation in terms of these bone and cartilage cell peculiarities. What I conceive as happening is this; the nutritive supply to a young bone is greater than the necessities of cell replacement and cell repair demand, the cartilage cells being overfed, proliferate rapidly only to die and to be replaced by osteoblasts. The mass of the bone having increased, the nutritive supply must be relatively less/

less, unless the arteries of supply have also suddenly increased. But arteries do not increase in diameter by sudden leaps and the result therefore must be that the cartilage cells are no longer threatened with surfeit with the result that they cease to proliferate. Any surplus nutrition there may be now becomes available for the less absorptive osteoblasts and the bone is increased in thickness by the deposition of new layers--euryplasia succeeds macroplasia. But the arteries of supply steadily growing day by day deliver more nutrition to the bone. At last the time comes when the cartilage cells again are overfed and again are forced to proliferate--macroplasia succeeds euryplasia. And so the seesaw goes on, the macroplastic phases diminishing in length as the general food concentration falls and as absorptive power declines until, at last, the cartilage cells with their narrow range of nutritive adjustment, die out and macroplasia ceases.

On this view it is the high concentration of nutritive material which causes the early stages of giantism to be characterised by the relative absence of the normal euryplastic phases. It follows that in the later stages, as nutritive concentration diminishes growth must become wholly euryplastic and that the

more /

more absorptive the cells of any area may be, the more marked relatively will be their multiplication, for in conditions of diminished nutritive concentration only those cells which can readily absorb will multiply. If now a condition of unequal cell anabolic power exist, of the same kind as that believed to underlie the partial physiological giantisms, the part of the body so endowed will continue to grow after the rest of the body has stopped growing. Again, if there be areas of the body normally composed of cells more anabolic than those of other areas these too will continue to show cell multiplication and growth. This, I think, is obvious.

We are now in a position better to understand the changes which occur in the later stages of giant growth.

SECTION III. AN ANALYSIS OF THE LATER STAGES OF GIANT GROWTH.

We are fortunate in the case of "Le Grand Charles" in that there exist two sets of measurements which can be regarded as reliable and comparable, the first, made in May 1899, the second, in November 1902. (See Chapter XI.) The period between the observations corresponds/

corresponds to the period of marked increase in Charles' disabilities, we may, therefore, claim to be observing the close of the first stage of the giant's career and the opening of the second stage; the period of transition when hyperanabolism is passing and katabolism is increasing, owing to the somatic cells having multiplied almost to the limit of support and owing to their diminishing absorptive power. It is at this stage that euryplasia begins to replace macroplasia though macroplasia of the more anabolic cartilages will for a time persist.

In 1899 Charles was 1m990: in 1902 he was 2m040 so that in three years he added 5mm. to his stature. His growth, however, was greater than appears for the lower limb during the same time increased by no less than 19mm. There is evidence to show that the apparent loss of 14mm was due to the development of spinal curvatures.

In 1899 the biacromial diameter was 490, in 1902 it had fallen to 425. The circumference of the chest had in the same period increased from 1015mm to 1040. This in connection with the loss of height increment makes it seem probable that the spine was yielding, pushing the ribs out slightly more horizontally and/

and allowing the scapulae to fall forward and to approach the middle line.

During the same period the breadth of the pelvis increased from 303mm to 321mm.

The femur increased 12mm (529 to 541mm) or 2·25%: the tibia 7mm (502 to 509) or 1·34%: the foot 12mm (287 to 299) or 4%.

The humerus increased 41mm (381 to 422mm) or 10.7%: the radius not at all: the length of the hand 10mm (233-243mm) and the breadth 6mm (97.to 103mm) or 4·3% and 6·2% respectively. The breadth of the humerus at its lower extremity increased 12·1% and the greatest diameter of the wrist 3·75%

The general tendency of the muscle masses was to decrease.

In the same three years the skull grew in certain of its diameters, in others it did not alter. The bimastoid width increased 2·5mm or 1·75%: the antero-posterior diameter ·5%: the ophryo-mental height 5·5mm (154 to 159 5mm) or 3·57%: the bizygomatic width 4mm or 2·7%. The gonio-mental diameter increased 3mm or 3%: the transverse maximum 3mm or nearly 2%. The nose increased in breadth 1mm or nearly 3%.

The stature face index in 1899 was 7.73: in

1902/

1902, 7·81: the ophryo-alveolar stature index in 1899 was 5·12: in 1902, 5. It is, therefore, evident that the mandible was not only actually, but also relatively increasing, whereas the ophryo-alveolar height was actually constant, but relatively decreasing. The bimastoid and bizygomatic breadths and the transverse maximum diameter of the cranium increased slightly and the antero-posterior diameter very slightly. Although no figures exist for the earlier years of Charles' growth it is interesting to compare the 1893 photograph with those taken later and it seems to me that the forehead has got much flatter, as if the base of the skull had increased without any corresponding increase in the mass of the brain. This is, of course, purely a matter of opinion and upon it I lay no stress.

Papillault[1] has published tables comparing the 1899 measurements with those of three Parisians with the average stature of 1m770. He gives the following figures.

COMPARATIVE/

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(1) Papillault, op. cit.

COMPARATIVE TABLE OF SOME OF THE SKULL MEASUREMENTS.

	A. Charles	B. Average of 3 Parisians	Index. B = 100
Naso-Alveolar height	87mm	74·5mm	116
Naso sub-nasal height	64	56.7	112
Ophryo-alveolar height	102	95·2	107
Antero-posterior diam.	199	196	101
Ophryo-mental height	154	153·5	100·3
Transverse max. diam.	156	163·5	95·4
Frontal minimum "	104·5	109·7	95·2
Bi-parietal "	136	147·5	92

These indices suggest that Charles' cranium is less well filled and less expanded by its contents than the crania of average men. I believe the cause of this to be the length of base of the skull, the length of the cranium being 101% of the normal, the transverse maximum diameter 95·4%.

When we pass to consider the observations upon the other giants of this group we find ourselves restricted to a consideration of the definitive condition: comparison with their former selves is impossible.

Constantin/

Constantin was remarkable for the prolonged persistence of his epiphyseal cartilages, the enormous growth of his femur, the slight hunching of his back and the great size of his jaw. The photographs show these characteristics well. The manner of his death was peculiar: symmetrical gangrene attacked the tips of his lower extremities.

Ella Ewing had remarkably long weak limbs, enormous feet and hands and a heavy jaw, a prominent nose and prominent malar eminences.

Machnow's height is recorded as 2m38; his height seated was 1m130: the height of his symphysis pubis was 1m268. In general terms, therefore, it is permissible to say that his lower limbs were relatively longer than normal. The length of his hand was 251mm. The hand length stature index, therefore, is 10·55: the average as stated by Topinard is 11·7. The photograph of Machnow shows very well some of the characteristics of the right hand, the fingers look big and thick and the dorsum very fat, its actual breadth is 109mm. The length of the foot is 370mm. The foot length stature index, therefore, is 15·55: the average as stated by Topinard is 15·4. The breadth of the foot is 149mm.

The/

The measurements of the limbs and trunk are incomplete and avowedly approximations, for Machnow refused to take off his clothes when Professor V. Luschan examined him.

His cranium measures 220mm by 173; the cephalic index, therefore, is 78·6. The face stature index is 6·5; the naso-alveolar stature index is 4·1. Professor Cunningham (1) gives the average of these indices for seven Irish skulls; they are 7·01 and 4·26 respectively. It, therefore, appears that Machnow's lower jaw is not unusually deep considering his great stature. This, however, is not a satisfactory guide for it is obvious that if it be employed an undue growth of the femur will tend to obliterate and an unusual curvature of the spinal column will tend to accentuate any excessive growth of the face that there may be. It is better, therefore, to follow Professor Cunninghan's suggestion and to compare the face with some measurement less liable to variation. The circumference of the cranium best meets this requirement for, first, it is in great measure dependent upon brain mass which is believed not to be much affected by giant growth, and second, by using it we get accurate/

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(1) Professor Cunninghan. op. cit.

accurate information about the proportions of the skull.

The indices obtained in this way are:—

1. Length of Face from nasion to chin compared with the size of the cranium.

Circumference of Cranium = 100.

Machnow -- -- -- -- -- -- 25

Seven Irish Skulls (average) 22·8 (Cunningham)

2. Naso-alveolar length compared with the size of cranium.

Circumference of Cranium = 100

Machnow -- -- -- -- -- -- 16

Seven Irish Skulls (average) 13·8 (Cunningham)

These indices place it beyond dispute that Machnow's skull is characterised by an unusual development of the mandible and superior maxilla. The proportion to which each is affected is shown by comparing the naso-alveolar height with the height of the symphysis menti.

3. Relations of Maxillary to Mandibular portions of the face.

Naso-alveolar height = 100.

Machnow -- -- -- -- -- 55

Seven Irish Skulls (average) 46·5 (Cunningham)

The depth of the lower jaw is, therefore, increased/

increased out of proportion to the increase of the superior maxilla. But the superior maxilla is itself considerably increased in height. This is shown by the facial index obtained by comparing the naso-alveolar length with the bizygomatic diameter.

4. Naso-alveolar height compared with bizygomatic breadth.

Bizygomatic breadth = 100

Machnow -- -- -- -- --	59·3
Seven Irish Skulls (average)	55.7 (Cunningham)

From the results of the analysis of Machnow's measurements it is obvious that though his early growth had been excessively macroplastic there had been at some time prior to the date of V. Luschan's observations a distinctly active euryplasia progressing. From the result of the analysis of "Le Grand Charles'" measurements and from the general hypothetical considerations I am inclined to think that Machnow, at the time under discussion, was just in the transition period between the unduly prolonged infantile state and the unduly rapid senile state. Within a few years he was dead, but I have no further information about him.

The fifth and last of the giants of this group is Lady Aama. In her case it is unnecessary to enter into/

into a full analysis, it is sufficient to point out a few of the more important peculiarities of her body form.

The length of her lower limb was 47 inches, or nearly 60% of her total height, in place of the average 52·1%: the length of the upper limb was 37 inches, or nearly 47% of her total height, in place of the average 42%. This is in full accordance with the usual results of hypermacroplasia.

The hands are described as having been peculiarly spade-like, with long square-tipped fingers of uniform breadth throughout their length.

The length of the hand was 11·25 inches: this may be compared with the stature.

LENGTH OF THE HAND COMPARED WITH THE STATURE.

STATURE = 100.

Aama -- -- -- -- -- --	14·2
Average (Topinard) -- --	11·7

The length of the foot was 13·75 inches.

LENGTH OF THE FOOT COMPARED WITH THE STATURE.

STATURE = 100

Aama -- -- -- -- -- --	17.4
Average (Topinard) -- --	15·7

It is, therefore, clear that, in spite of the undue exaggeration of the stature resulting from the great/

great length of the lower limb, her hands and feet were relatively very large: absolutely, they must well have deserved the epithet enormous.

The measurements of the skull given by Woods Hutchinson are not of great value: the series is too incomplete. I have, however, constructed from his figures an index to show the great development of the mandible which so much impressed him. In this I compare the gonio-mental length with the cranial circumference.

I. GONIO-MENTAL LENGTH COMPARED WITH CRANIAL CIRCUMFERENCE.

Cranial Circumference = 100

Aama -- -- -- -- -- -- -- -- --	30
Average -- -- -- -- -- -- -- -- --	18·7

If we compare the gonio-mental length with the stature we get equally striking results.

II. GONIO-MENTAL LENGTH COMPARED WITH STATURE.

Stature = 100

Aama -- -- -- -- -- -- -- -- --	7·91
Average -- -- -- -- -- -- -- -- --	5·75

In/

In both the above tables the average is based upon figures given by Woods Hutchinson in the various comparisons which he adopts. They are probably not quite accurate as averages, but their error is on the side which minimises the great increase of the mandible.

Aama's superior maxilla and nasal bones were also enormously increased.

Now, in Aama's case, we are looking at the very last stage of precocious giantism. The manner of her death, which is best described as a general collapse, and the condition of her bones show that she had passed the stage of active hyperanabolism. Her somatic cells had in fact multiplied beyond the limits of support and the whole organism died of starvation. Woods Hutchinson says, "the body was extremely emaciated." Aama is, in fact, the purest example of an individual that grew to death with which I am acquainted, and we see that her hands and her feet and the bones of her face had increased out of all proportion to the rest of her body. The body was extremely emaciated, but the hands were spade-shaped and the fingers of uniform thickness. The general body cells found their environment too impoverished, but the cells that formed the hands and the feet and the/

the lower jaw were still able to obtain nutrition and to multiply.

From the details of the foregoing analyses we are enabled to construct an ideal picture of the course and possible modes of termination of a case of precocious giant growth.

A child is born which appears healthy in every respect, and its growth and development proceed on normal lines for some years. Then, suddenly, possibly after an acute illness, possibly for no apparent reason, it begins to grow more rapidly. At first there is nothing to show that this growth is pathological and for years the individual may appear to be in perfect health, may even be unusually strong, and then the strength begins to fail and the hands and the feet and the face begin to increase out of all proportion to the rest of the body, the spine begins to bend, the muscles to degenerate. If now the individual's cells are naturally of rather low absorptive power the greater part of the body may be starving to death, while the cells of the more absorptive areas are still multiplying--such was the case in Aama. Or the anabolic power of a part of the body may lead to its increase beyond the limits of the local food supply, when it must die--such was the case in Constantin, who died

from/

from the extremities like a tree when its roots have struck the rock. Or the individual may continue to grow in parts, euryplasia replacing macroplasia, his spine yielding and his giant frame become bowed--such is the case in "Le Grand Charles," but a far better example is furnished by the case of Jean Pierre Mazas. géant de Montasture. The record of this case I quote in full, as a type of the complete picture of the less acute forms of precocious giant growth.

JEAN PIERRE MAZAS

GEANT DE MONTASTURE. (1)

Jean Pierre Mazas was a professional freak and he was with difficulty persuaded to permit of a complete examination.

Personal History.

Mazas is 47 years of age. He was born at Montasture (Haute Garonne) of peasant parents of whom he is unable to give any particulars. There is considerable difficulty in getting any information out of him as he cannot, or will not, speak anything but his/

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(1). Brissaud et Meige, Journ.de Méd.et de Chir.prat. 25th Jan. 1895. (Summary).

his native patois. He understands French perfectly, but returns the most laconic and evasive answers which are translated by a woman who acts as his "showman" and interpreter.

He says that his family is healthy and of good height, but in no way gigantic. He, himself, was a healthy boy of ordinary size until he was about sixteen when he commenced to grow unusually rapidly. He remained, however, perfectly well and worked in the fields where he was chiefly remarkable for his enormous strength.

At the age of 21, when he was passed as a recruit by the medical board, he was 2m12 in height. He ultimately grew to the height of 2m20, and for fifteen years he remained well, being renowned through all the country side for his great strength. His weight was 160 kilogrammes.

When he was about 37 he was one day lifting a heavy weight when he felt a sharp pain in his back, he thought that he had broken his spine. Be that as it may, it is from that time that his stature has steadily decreased as the result of a steadily progressive spinal curvature. He became weak and feeble and had to give up his work as a labourer when it was suggested to him that he should tour the fairs as a freak./

PLATE LIX.

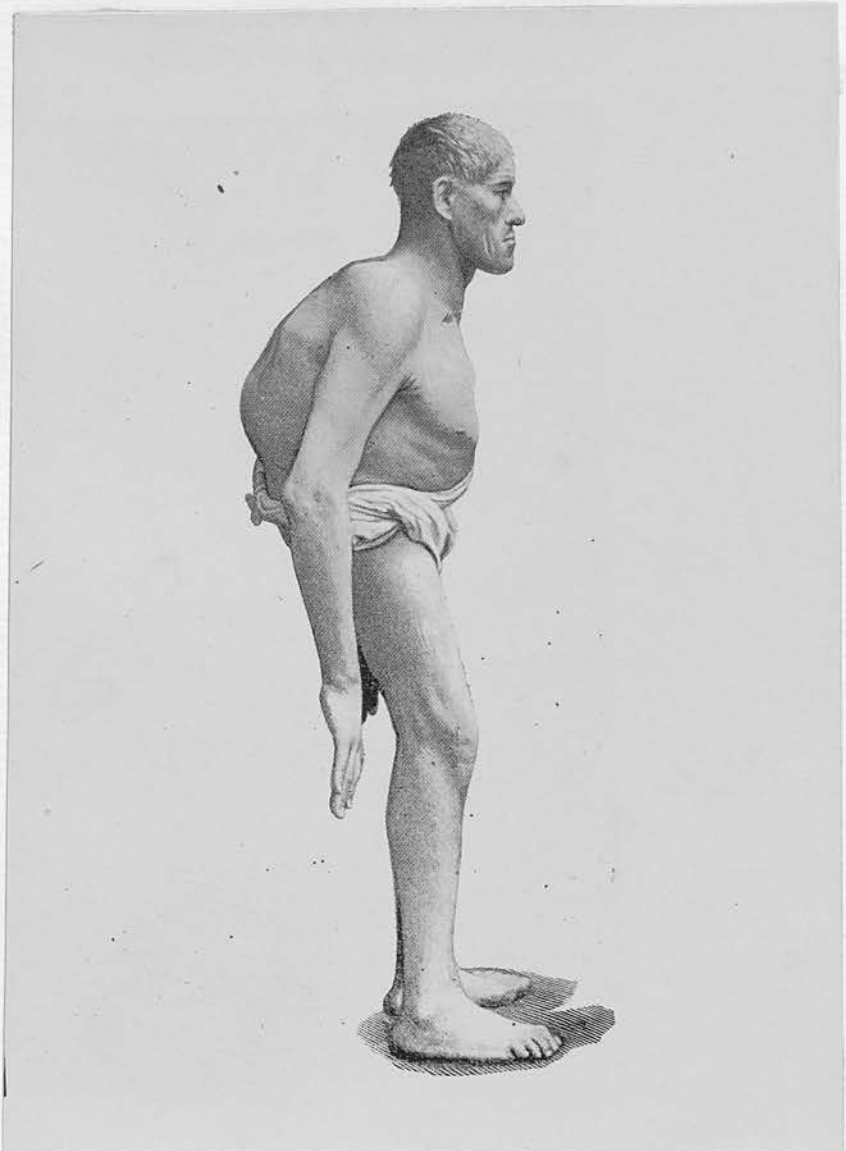


PLATE LX.

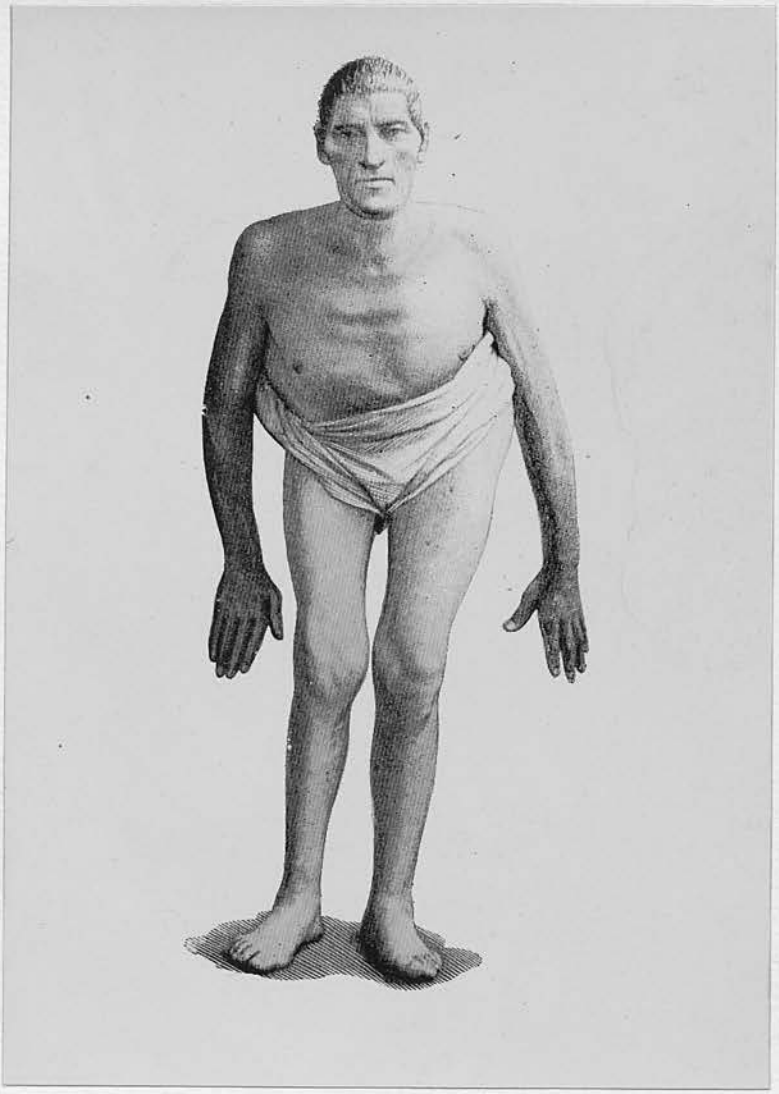


PLATE LXI.

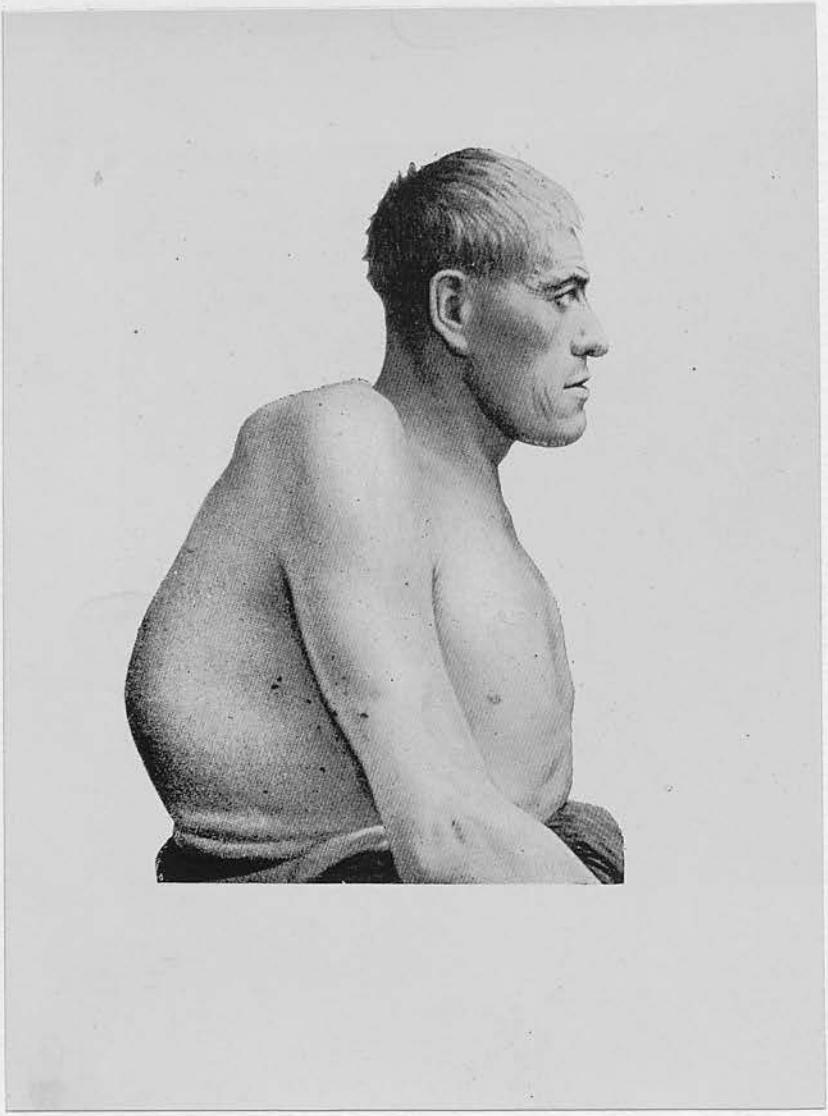
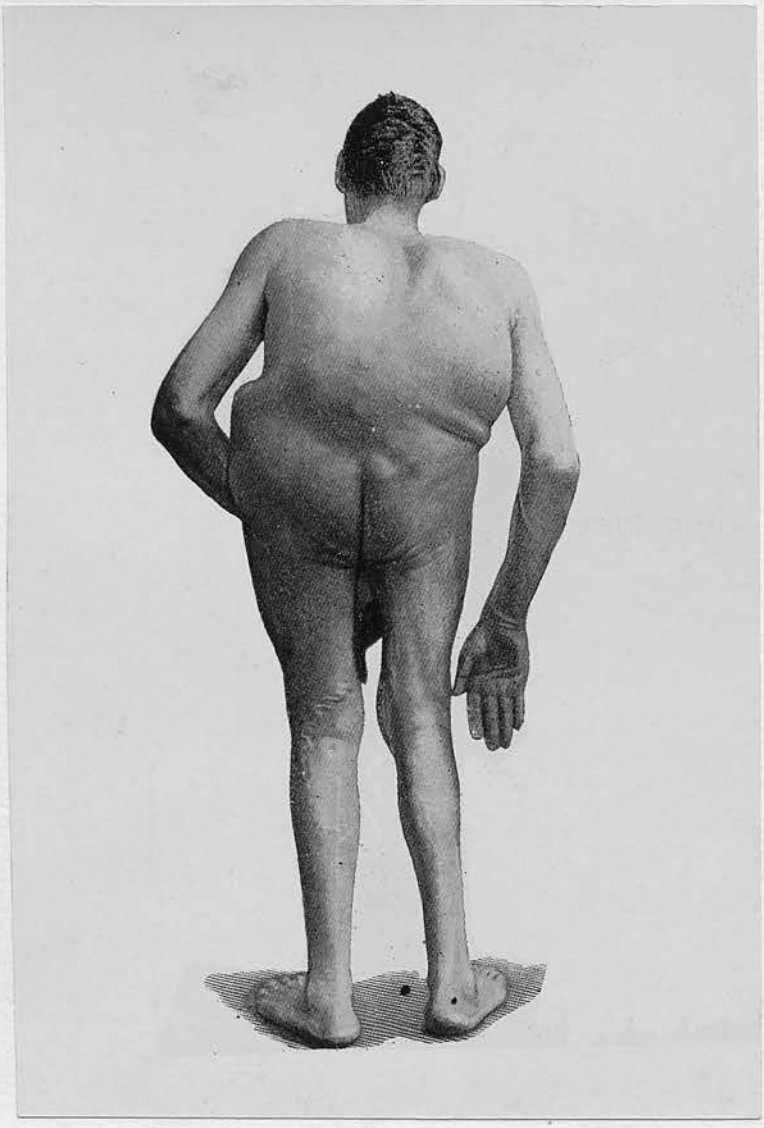


PLATE LXII.



PLATES.

LIX, LX, LXI AND LXII.

Jean Pierre Mazas

----After Brissaud and Meige.

freak. He fell in with the idea and has become a very popular giant.

He was formerly 2m20; now, he is only 1m86, but what he has lost in height his bust has gained in thickness. His limbs are of enormous size; his hands and feet are monstrous. During the last two years his health has changed for the worse. He has had repeated attacks of pleurisy and his skin shows the marks of the blisters that have been applied on these occasions. He now suffers from night sweats. His thirst is enormous, he drinks large quantities of water, wine, spirits, anything. He complains continuously of feeling tired, and for the last year he has neither by day nor night been free of headache.

His intelligence is poor, his temper is gloomy and uncertain. Sexual desire is conspicuous by its absence.

Present Condition (15th June 1894).

Body Form:--

The accompanying photographs give a better idea, than any written description could convey, of the principal features of his deformed and colossal frame.

With/

With his great arms hanging to below mid-thigh, with his bowed body and his great cheeks and jaw, he resembles in some ways one of the anthropoid apes.

In the length of the limbs, the breadth of the shoulders and pelvis, in the enormity of his hands and feet, he is still the giant that he was, but his body seems to have been telescoped so that the lower part has disappeared within the upper. At least 300mm. of height have been lost in this way, but in their place have developed two enormous bosses, one in front and one behind. They are the humps of Punch whom he further resembles in his big nose and prominent chin.

The posterior boss is the result of a thoraci-co lumbar kyphosis; the anterior, of the forcing for-ward and downwards of the lower ribs and the crowding forward of the abdominal contents by an exaggerated lumbar curvature. There is also some scoliosis as a result of which the right iliac crest is pushed into the outlet of the thorax, whereas, on the left side, the ribs are pushed down into the false pelvis.

The thoracico-cervical junction is almost vertical; to get the face vertical the neck is arched backwards. The circumference of the neck is 460mm, but/

but the thyroid does not seem to be especially developed.

The chest, at the mammary level, measures 1m55: the maximum circumference is 1m86. The anterior abdominal wall is represented by rolls of the soft tissues owing to the diminution of its extent by the falling down of the thorax; the nipples are on the same horizontal plane as the anterior superior spines of the ilium.

The bones of the limbs are huge, but well-proportioned. In the neighbourhood of their extremities they are greatly thickened.

The internal tuberosities of the tibiae are very large, but it is at the level of the malleoli that the osseous hypertrophy is most marked. The internal and external malleoli form two enormous lumps which completely modify the shape and proportions of the tibio tarsal region; the circumference just below the tips of the malleoli is 380mm.

The wrist also is very large; its circumference is 250mm. Next to the torso the hand is the most strikingly monstrous thing about Mazas. In shape it is normal, but it is increased almost beyond belief in all its diameters. The soft parts do not seem/

seem to have increased so much as the bone although the skin is enormously thick. By comparison the nails are rather small. Longitudinal striation is most marked. The thumb is big enough to completely cover a five franc piece.

Face:--

The most striking peculiarities of the face are the extraordinary size of the mandible and the unusual prominence of the malar eminences. The red margin of the upper lip is completely hidden, the lower is prominent without being increased in thickness. The cause of this is, without doubt the size of the mandible: the teeth in the lower jaw are in front of those in the upper. The hypertrophy of the lower jaw is not symmetrical, the left side being the larger. The tongue is large and thick.

Cranium:--

The cranium does not appear to be much increased: possibly it is a little lengthened. The sutures are very prominent especially posteriorly: the external occipital protuberance is very strongly developed.

The voice is deep and monotonous.

It/

It is not possible to state anything with regard to the external genitals as the patient resolutely refused to permit them to be examined. As noted above, however, sexual desire is completely lost.

Measurements:--

Stature (formerly) -- -- -- -- -- -- --	2m12
Stature (at the time of examination) -- --	1m86
Height of head (vertex to chin) -- --	293mm
Chin to root of nose - -- -- -- -- -- --	140mm
Binumeral Diameter -- -- -- -- -- -- --	550mm
Length of the arm (acromion to tip of middle finger)	1030
Elbow	620
Hand	260
Middle Finger	156
From internal tuberosity of tibia to the ground	575
From great trochanter to internal tuberosity of the tibia	590

Circumferences:--

Neck at level of thyroid cartilage	460
Thorax at level of nipples	155
" Maximum	186
Thigh	590
Calf/	

Calf	400
Arm (at mid-point)	310
Arm (above elbow)	310
Forearm	320
Wrist	250

Hands:--

(Note: The measurements for the right and left hands are practically identical.)

Length of hand (from crease at the wrist to the tip of middle finger)	260mm
Length of fingers (flexed at the metacarpo phalangeal joint.)	
Index	130
Middle	156
Ring finger	140
Little finger	110
Thumb	90
Breadth at middle point	140
Circumference at heads of metacarpals	320
" of Thumb (2nd phalanx)	100
" " (1st phalanx)	95

Feet:--

Total length	350
Circumference at mid-point	330

Circumference/

Circumference of great toe	125
" at level of malleoli	380

Muscular System:--

Mazas was of enormous strength in his youth: his muscles now are weak and flabby.

The Skin:--

The skin is very thick over all the body.

General notes:--

There are marked varicose veins on the legs, more especially on the left.

Sensibility is normal: hearing, taste and smell are intact.

His eyes were thoroughly examined and found to be normal.

Such is the history of Jean Pierre Mazas, Géant de Montasture, selected type of the giants of early nutritive overloading.

With regard to Mazas and Le Grand Charles an interesting question arises. Is it possible that the hard work and not too plentiful food of their early lives have, to a certain extent, prevented them growing and/

and have saved them from the fate of Constantin or of Aama?

SECTION IV. CHARACTERISTICS OF GIANTS IN WHOM NUTRITIVE OVERLOADING IS ESTABLISHED AFTER THE PROPER AGE OF PUBERTY AND BEFORE THE PROPER AGE OF MATURITY.

The three giants whom I class in this group are described in Observations V., VI., and VII of the preceding chapter. They are Goliath, Drum-major K. and Simon Botis. At the present moment I have nothing to add to what has been already written about Goliath: his case is of a transition type, standing between true precocious and true adolescent giantism, but inclining, however, if anything more towards the later. In many respects he resembles Mazas, in rather more he resembles Drum-major K. and Simon Botis.

The first point of interest with regard to K. is that he was a member of a family remarkable, through at least two generations, for its stature. At the age of 18 he was 1m76 and apparently normal in every way when suddenly, without assignable cause, he began to grow. By the time he was 20 he was 1m96: during the whole or some part of the next 14 years he grew to the height/

height of 2m12. It was specially noted by K. himself that the growth of his hands and face did not come on until a period subsequent to that at which he commenced suddenly to increase in stature. The various indices which we have already employed show to what an extent the special growth of the face was carried.

First comparing the height of the face, nasion to chin, with the stature:--

VERTICAL DEPTH OF FACE COMPARED WITH STATURE

Stature = 100

Drum-major K.	7·5
Seven Irish Skulls (average)	7·01 (Cunningham).

We have already seen that this index is apt, in a man of unusual stature, to mark the unusual growth of the face. The increase of size is nevertheless apparent but it is minimised. Comparing the length of the face with the circumference of the cranium we get a most striking result.

VERTICAL DEPTH OF FACE COMPARED WITH THE SIZE OF THE CRANIUM

Circumference of Cranium = 100

Drum-major K.	25·8
Seven Irish Skulls (average)	22·8 (Cunningham)

The photographs of K. show the difference in his/

his build from that of the earlier class of giants: the great development of limb length is obviously not present. This is hypothetically correct, the later onset of the condition reducing the possible endurance of macroplasia.

The length of the hand and foot as compared with the stature are, however, of interest. The hand length stature index is 11·3: the average, as stated by Topinard, is 11·7. The foot length stature index is 15: the average, as stated by Topinard, is 15·4. These indices are particularly interesting, for the hands and feet appeared very large: the breadth of the hands in life was 120mm or exactly 50% of the length, the percentage normally met with is between 42 and 45. In the same way the foot was very wide. The increase, therefore, was chiefly confined to the soft parts: again, this is hypothetically correct, the late onset reducing to a minimum the chances of endochondral ossification.

It is obvious, however, that were the condition of nutritive overloading to develop slightly earlier in the period of adolescence the epiphyseal cartilages or some of them would be caught unobliterated and be forced to proliferate and that the period of macroplastic/

macroplastic growth would be prolonged. Such a giant was Simon Botis, the subject of Observation VII. His case is full of interest, but at present it is sufficient to draw attention to the undue growth of some of his long bones, of his hands and feet and face.

SECTION V. A PRELIMINARY CONSIDERATION OF THE EFFECTS OF THE ESTABLISHMENT OF NUTRITIVE OVERLOADING AFTER THE ATTAINMENT OF FULL MATURITY.

It is obvious that the effects of nutritive overloading established after the attainment by the patient of full maturity will differ markedly from those discussed in the preceding sections: it is, however, hypothetically necessary to recognise that such a combination is possible, We have seen that the effect of hypernutrition is to compel the cartilage cells to proliferate, provided that cartilage cells still exist. If, however, there be no cartilage cells to proliferate there can be no marked increase in the length of bones. All the cells in the body, however, will be affected and the more anabolic the cells of the body or of any area of the body, the more marked will be the general or local increase.

In/

In discussing the possibility and meaning of physiological giantism we saw that it could only be the result of unusual local or general cell anabolic power. There is, however, a further consideration which I have not yet dealt with. So far, in speaking of growth, I have dealt with it almost entirely from the stand-point of the nutritive concentration of the body fluids: only incidentally have I referred to the possible effects of the disturbances in uniformity of blood supply consequent upon stimulus. It is essential, however, to realise that, though all growth is directly consequent upon cell anabolic power and food supply, the latter is not simple but compound. Without any increase of nutritive concentration there may be increased nutritive delivery. In other words growth is dependent upon use stimulus and nutritive concentration. Therefore, given the amount of growth as constant, these must vary inversely.

In normal growth use stimulus is the predominant factor and growth is continued to the limits of the increased food supply consequent upon use; therefore, two parts equally used will grow to the same size in spite of small differences in anabolic power. If, however, use stimulus be small the food nutritive concentration/

concentration must be great and slight differences of inborn anabolic power will show themselves as differences in resulting mass. Therefore, in all hyperanabolics it is reasonable to expect marked inequalities in the length of corresponding bones and marked disproportion in the growth of parts of the body. Restated corresponding organs equally stimulated by use will grow to the same size while corresponding organs, which receive unlimited food, will grow to sizes proportionate to their innate anabolic power.

That this is so is well seen in many of the measurements already quoted. Most striking, perhaps, are those of the Giant of the Natural History Museum, Paris, described by Verneau, where the bones of the left side are considerably the larger; this is exactly comparable to the case of hemi-asymmetry recorded in Chapter IV., but as in this case the conditions are obviously pathological I repeat the table, giving the measurements of the bones of Pirsche's guinea pigs.(1)

No.1/

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(1). V.S.Record of Experiment II., Chapter III.

PLATE LXIII.

2

PLATE LXIV.

PLATE LXV_

1

2

1

PLATES

LXIII, LXIV AND LXV.

Various photographs of the giants Wilkins and Hugo to show the asymmetry of their faces and in Hugo's case the genu valgum.

1,1,1. Wilkins.

2,2,2, Hugo.

	No.1 Castrated		No.2 Castrated		No.3 Entire	
	R	L	R	L	R	L
Femur	46½	47	47¼	47	44	44
Tibia	49½	50	50½	50¼	46½	46½
Humerus	39	39	40¾	41	38	38
Ulna	44	43	43	43	42	42¼

This result is most striking and is undoubtedly in series with the cases of asymmetrical giantism which are not uncommon.(1) The photographs of Wilkins and Hugo(2) show that they also were hemi-hypertrophic. Such irregularities of anabolic power may, of course, be distributed in any way; no laws are known to govern them; there is, however, strong evidence to show that certain parts of the body are normally more fully endowed with anabolic power than others. This proposition is so important that the next chapter is devoted to its consideration. On it obviously depend the results of the establishment of nutritive overloading after the attainment of maturity.

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(1). Wilkins, described by Dana, The Journal of Nervous and Mental Diseases, 1893: by Lamberg, Wien klin Wochenschr.t XLVI. no.19,1896, p.359; by Bassoe, The Journal of Nervous and Mental Diseases, Sept.1903.
(2). Short notice by Launois and Roy, Op.cit.

CHAPTER XVII.

THE UNEQUAL DISTRIBUTION OF ANABOLIC POWER TO THE BODY CELLS AND SOME OF ITS RESULTS.

SECTION I. PRELIMINARY.

The results of the experimental castration of guinea pigs were described in Chapter II. It will be remembered that for a time the animals grew very rapidly their bone growth being macroplastic, but that after about four months macroplasia ceased. Growth of the paws continued, however, and was so striking that their pituitaries were examined with negative results.

Léri's observations upon the condition which he calls Spondylose Rhizomélique were described in Chapter VIII. It will be remembered that in that condition which I regard as the physiological expression

of/

of a precocious senility, the changes are most marked in the spine and then, in descending order of frequency in the region of the hip and shoulder and at the knees, the region of the small joints of the feet and hands very rarely and then only at a very late period becoming involved.

Placed beside the later growth changes of giantism these observations suggest that the cells forming the hands and feet are more absorptive than those forming the more proximal segments of the limbs.

It is, of course, open to argument that the conditions were abnormal and that the observed phenomena have a totally different meaning. I, therefore, take as my basis of observation the non-pathological type of body form described by Manouvrier (1) "as the rustic clown type."

The characteristics of the type are:--

The great size of the hands and feet.

A tendency to brachycephaly.

The excessive length of the upper limb.

A twisted and shortened trunk.

"It/

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(1) Manouvrier Etudes sur les rapports anthropométriques en général et sur les principales proportions du corps, Bull. et Mem. de la Soc. d'Anthropologie. 1902.

"It bears," he says, "a close relation to the occupation of the individual, and is associated with the performanence of hard manual labour. It occurs especially in men, but also in women who have evolved towards the masculine type."

I interpret Manouvrier's observations as follows:--a child with the average possibilities of growth and development is born to some peasant woman. Subjected to hardship and food shortage its metabolism is less anabolic than that of a healthy child of prosperous parents. Less threatened by surfeit its cartilage cells proliferate slowly. Early compelled to work, its arms receive a greater proportion of the available food than its legs which are degraded, to perform the humble task of carrying the body and arms to the appointed place of labour. In the general food scarcity the more anabolic cell areas are alone able to proliferate at all freely and the parts which they form show a disproportionate growth. The hands and feet are especially affected, therefore, I think, that they are composed of cells of relatively great anabolic power.

Developmentally, however, the hands and feet are formed at the tips of body processes and ontogenetically are younger than the body axis. I, therefore, make/

make a guess which I put in the form of a generalisation:-- "The cells of the ontogenetically and phylogenetically more youthful areas of the body are more anabolic than the cells of the older areas."

In order to establish this as an hypothesis, it is necessary first to decide which are in this sense the younger areas of the body and then to examine all available evidence to see if in conditions of hyperanabolism these are the areas of most marked cell proliferation.

SECTION II. THE PHYLOGENETICALLY AND ONTOGENETICALLY YOUTHFUL AREAS OF THE BODY.

The evidence of ontogenetic and phylogenetic youth can best be arranged under two heads.

1. The evidence of Embryology.
2. The evidence of Morphology and Anthropology.

The evidence under the first head is of the simplest kind: that under the second is more complicated.

1. The Evidence of Embryology.

From a developmental point of view the body may be regarded as made up of two symmetrical halves: taking the medullary groove as the line of division

each/

each half of the embryonic plate is responsible for the formation of one half of the body.

Development of the Face and the Structures in the Neck.

The face is formed from five processes which spring from the base of the primitive cerebral capsule. In the human embryo these processes appear about the middle of the first month, but do not unite to form the face until the end of the second month. The manner of their growth is comparable to that of an ordinary vegetable axis. Length is gained by rapid cell proliferation at the tip, the cells left behind proliferating more slowly and being responsible for the increase of thickness.

The leaf of the daffodil and the human hair provide good examples of the opposite type of growth in which proliferation takes place at the base, the first formed tissue being pushed forward.

The five facial processes are, the median, or fronto-nasal which is unpaired and the lateral or maxillary, and mandibular which are paired.

The fronto-nasal is composed of symmetrical halves. It projects beneath the fore brain and is responsible for the formation of the bony nasal septum, the cartilages of the nose, the praemaxillary part of the/

the upper jaw and the middle third of the upper lip.

The maxillary processes spring from the base of the mandibular and grow forward below the eye, separating it from the mouth. In it are formed the zygomatic process of the temporal, the superior maxilla and the soft palate and the soft parts covering them. The lines of junction between the maxillary and fronto-nasal processes are marked in the adult by the lachrymal sac and nasal duct.

The mandibular processes grow forward, unite in the middle line and form the first visceral or mandibular arch. The tips of the processes meet in the middle line and form the symphysis menti.

Later, certain portions of the mucous membrane lining the nasal cavities grow out to form the air sinuses.

The tongue is developed in the floor of the primitive pharynx. It consists of two wholly distinct parts, a buccal and a pharyngeal. The buccal part is formed by an outgrowth, the tuberculum impar arising from the mandibular arch and from the first interbranchial space, and by two symmetrical laterally placed outgrowths of the mandibular arch. The pharyngeal part is derived from the ventral extremities of the second/

second and third visceral arches.

The Larynx is developed from the anterior ends of the fourth and fifth visceral arches.

It is, therefore, evident that the nose, the nasal septum; the buds of mucous membrane which form the air sinuses; the superior maxillae; the mandible, more especially the parts near the symphysis; the tongue and the larynx are ontogenetically the youngest portions of the head and neck.

Development of Structures in the Ventral Median Line.

The development of the ventral median line of the body is not so simple a thing as has frequently been supposed. It is not formed by a series of crescents growing forward from the dorsal aspect, meeting and fusing tip to tip. Arthur Keith (1) aptly compares the growth of the blastoderm outward from the umbilical ring to the expansion of a soap bubble blown from the end of a pipe. In an embryo of 4mm the umbilicus occupies 3mm of the ventral line: in an embryo of 15mm the/

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(1) Human Embryology and Morphology, London 1904, page 349.

the umbilicus is still about 3mm in length.

The paraxial columns of mesoblast become segmented early and form the muscle plates: from each muscle plate a process grows forward into the undifferentiated somatopleure towards the ventral line. The segmentation of the somatopleure is, therefore, a late phenomenon, differentiation spreading from the dorsal to the ventral side. There is, however, a definite band of mesoblastic tissue which remains undifferentiated and separates the right processes from the left. In this ventral band are developed the sternum and the linea alba. The ribs are formed in the septa between the muscular segments of the somatopleure. In them chondrification begins dorsally and spreads ventrally: this shows that they are formed by growths from behind. The inner end of the clavicle is formed from the precoracoid, is ossified in cartilage and corresponds to the pubis. Strictly the tissues of the lines of junction of the fronto-nasal and maxillary processes, the symphysis menti and the angle of the thyroid cartilage belong to the median ventral line; with them, we can associate the inner ends of the clavicles, the sternum and the anterior ends of the ribs in respect of ontogenetic youth.

Development of the Limbs.

The limbs appear about the end of the third week of development as flattened buds with anterior and posterior borders and dorsal and ventral surfaces Each bud is at first composed of an undifferentiated mesoblastic mass with an epiblastic covering. Differentiation begins proximally and the developing limb increases in length primarily by growth at its tip, secondarily by proliferation of the axial cartilages. The growth of the limb is, therefore, of two sorts; first, growth at the extremity which adds to the length at the end; second, growth in the middle which adds to the length by pushing forward the end. As is shown, however, by the distribution of the nerve supply in the adult arm, the growth of the soft parts covering the skeletal base is most active at the tip.

Hypothetically then the epiphyseal cartilages, because of the inherent qualities of the chondroblasts, should be the prime anabolic areas of the limb, but because of their ontogenetic youth, the distal segments, tissue for tissue, should be more anabolic than the proximal.

The embryological evidence, therefore, shows that/

that the nose, the superior maxillae, the palate, the air sinuses, the mandible, the tongue, the hyoid, the larynx, the inner end of the clavicles, the sternum, the anterior extremities of the ribs, the pubis, and the distal segments of the limbs are ontogenetically the most youthful areas of the body.

2. The Evidence of Morphology and Anthropology:--

Face:--The embryological evidence has made it clear that the skeleton of the face is formed by cells ontogenetically more youthful than those which form the base of the skull. In order to determine which parts of the face are phylogenetically the younger I propose to describe the face of the gorilla and to consider in what points it differs essentially from the face of man.

The Skeleton of the face of the gorilla.

The upper portion of the face of the gorilla has a peculiar rectangular appearance which is due to the great supra-orbital ridges. These are continuous practically without interruption from the massive strongly projecting external angular process of the one side to that of the other. The outer margins of the orbits/

orbits are indistinct and bevelled. The lachrymal bones are small. The nasal bones fuse early and the resulting median nasal bone is of peculiar and characteristic shape and descends well below the level of the orbits.

The lateral margins of the anterior nares are formed by the praemaxillae which extend upwards to articulate with the nasal bone. The lower margin of the nasal aperture is quite indistinct.

The mandible is large and heavy with no mental prominence, but a retreating chin and deep symphysis. The genial tubercles are commonly represented by a single sharp ridge. The lower incisors project forwards. The sigmoid notch is shallow.

Tabular list of the more marked differences between the skeleton of the face of a gorilla and European.

In the skeleton of the face of a gorilla as compared to that of a man's:—

1. The supra-orbital ridges are much more prominent.
2. The praemaxillae are much larger.
3. The external orbital margin is less prominent.
4. The cheek is less upstanding.

5./

5. There is no chin.

6. There is marked prognathism.

7. There is no infra-nasal crest or nasal spine.

In the same characteristics, but to a less degree, the facial skeletons of the lower races differ from those of the higher. It is obvious, therefore, that the nose, the superior maxillae, the malars and the mandible comprise in the face of the European the phylogenetically most youthful areas.

Trunk:--- The embryological evidence has made it clear that the structures formed in and near the median ventral line are formed of cells ontogenetically more youthful than the cells forming the axial structures. A study of the morphology of the sacrum, however, shows that it is a progressive structure; nor is this surprising when it is remembered that the lateral mass of the sacrum is composed of true costal elements and that the cells forming the outer portions of the alae and the bone in the neighbourhood of the auricular surface are strictly homologous with the cells forming the anterior ends of the costal arches.

In a comparison of the sacra of the simiidae and the hominidae, the relative narrowness of the former/

former is evident at a glance. The simiidae are markedly dolicho-hieric with indices ranging from 72 in the gorilla and 77 in the chimpanzee to 87 in the ourang-outang and 89 in the gibbon. Sir William Turner[1] has shown that within the hominidae the sacrum increases in breadth as we pass from the lower races to the higher. Thus in the Bush race, the Bantus and the Australian the sacrum is dolichieric; while in Europeans, both male and female, it is platyhieric. Among the Europeans, however, there is a marked sexual difference; the average male sacral index is 112·4, the average female 116.8. The difference is of interest considered in connection with the relative anabolism of the female as it is hypothetically correct for the more anabolic to have the wider sacra.

In the same way the pelvis of the higher races is broader than that of the lower, the pelvis of the lower races in turn being broader than that of the simiidae.

Among the hominidae, the Bushmen, Australians and Hottentots are dolichopellic; the Negroes, Tasmanians and New Caledonians are mesatipellic; the British, French and Germans are platypellic.

Pelvic/

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(1) Challenger Reports. The Bones of the Skeleton, Part II., Vol. XVI.

Pelvic breadth, therefore, is a phylogenetically modern characteristic.

Limbs:----The hominidae are distinguished from the simiidae by the great development in bulk and length of the lower limb; in the latter the combined lengths of the humerus and radius exceed the combined lengths of the femur and tibia, in the former the converse obtains. The "intermembral" index for these groups ranges from 141 for the ourang-outang to 103·5 for anthropopithecus niger and from 83·6 for the Bambute Pygmies to 69.7 for Europeans and even lower for some of the negro races.

Length of the lower limb is, therefore, obviously a progressive characteristic, but it is wholly dependent upon the proliferation of cartilage cells and, therefore, can only be affected by hyperanabolism established prior to maturity.

Within the lower limb of the hominidae there are some further progressive modifications. The lower end of the fibula increases in relative length as we pass from the chimpanzee to the Australian and from the Australian to the Caucasian. Further, the skeleton of the human foot is distinguished from the foot of the anthropoid ape by the vastly stronger and greater development of the great toe and by the greater

development/

development of the tarsus, but especially of the os calcis, astragulus, scaphoid and internal cuneiform so that these too must be classed as phylogenetically youthful areas.

SECTION III. SOME HYPOTHETICAL APPLICATIONS.

If the guess that I have made be correct it is necessary from the developmental, morphological and anthropological evidence to regard as especially absorptive cell areas:—

1. The face, but more especially the chin and to a less degree the superior maxillae and malars.
2. The mucous membrane forming the air sinuses.
3. The palate, in both its hard and soft portions.
4. The tongue and hyoid bone.
5. The larynx.
6. The inner ends of the clavicles.
7. The sternum.
8. The anterior extremities of the ribs
9. The region of the pubis. } Together responsible for sacral width.
10. The lateral parts of the sacrum } Together responsible for sacral width.
11. The extremities of the limbs.
12. Certain points in the axes of the limbs, in the lower limb more especially than in the upper.

13/

13. The lower part of the fibula.

14. The great toe and parts of the tarsus.

Hyperanabolics, therefore, should be characterised by unusual growth of these parts, the amount of growth depending upon the relative absorptive power of the type of cell involved. We have already seen that chondroblasts are more absorptive than osteoblasts, therefore, in young hyperanabolics the latter will not be accorded an opportunity of multiplying except in the wake of the surfeited cartilage cells. Ultimately, however, when the pinch of food shortage is felt, the cartilage cells will die out and macroplasia will be replaced by a specialised euryplasia. Assuming for the moment the general hypothesis to be true certain deductions can be made. First, as the lower limb is composed of more absorptive cells, it will grow more, than the upper; but the rest of the body, though growing more slowly, will be steadily increasing in size, therefore, the amount of nutrition supplied to the lower limb will relatively, and, if there be no increase in the total amount of nutrition absorbed, absolutely, diminished. Whereas in the upper limb which is less macroplastic, the relative diminution will be very slight and the absolute diminution for a time immaterial.

It/

It follows, therefore, in hyperanabolics of long standing and in whom the condition was established before maturity that the foot may be starving while the hand is prospering. Absolute starvation will, of course, mean death; relative starvation a condition of precocious senility with its attendant so-called rheumatoid arthritis. Therefore, it is hypothetically correct to expect to find an occasional giant dying of gangrene of the feet. This means that the epiphyseal plates of the femur and tibia were unusually anabolic. More commonly, however, we would expect to find affectin the skeleton of the lower limb a condition of precocious senility which reached its greatest intensity in the foot while in the skeleton of the upper limb the so-called rheumatoid changes should be intense at the shoulder and elbow and little, if at all, marked at the wrist and in the hand. The reason for expecting great intensity of rheumatoid changes at the elbow is that the lower end of the humerus and the upper ends of the radius and ulna are shown by the course

of/

of ossification and the direction of the nutrient arteries[1] to be less anabolic than the upper end of the humerus and the lower end of the radius and ulna.

A further consideration is, that as a result of the great increase in the breadth of the pelvis there must be an increased obliquity of the femur. The weight transmitted through it will, therefore, not be directly taken by the head of the tibia, a simple shear will result. If now the ligaments or muscles are weakened, or are relatively weak, the knee will yield inwards and genu valgum will be occasioned.

It now remains to consider how far these hypothetical considerations are borne out by the observed phenomena of early and late giantism.

SECTION /

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(1) The epiphysis to which the nutrient artery is directed is the first to be united with the shaft. It is also found that while the increase in length of the long bones takes place at the epiphyseal cartilages, the growth takes place more rapidly and is continued for a longer period where the epiphysis is the last to unite. It follows, therefore, that the shifting of the investing periosteum, which results from these two factors, leads to obliquity of the vascular canal by drawing the proximal portion of the nutrient artery towards the more rapidly growing end. Moreover when a long bone has only one epiphysis, the nutrient artery will be directed towards the end which has no epiphysis. Morris, "A Treatise on Anatomy." page 3.

SECTION IV. COMPARISON OF THE HYPOTHETICAL AND ACTUAL RESULTS OF GIANT GROWTH.

The growth in height of giants, the growth more especially affecting the lower limbs, the great increase in pelvic breadth the changes affecting the facial part of the skull and more especially the mandible, the growth of the frontal sinuses, the tendency to undue increase in the size of the hands and feet have been so repeatedly reiterated that no further comparison on these points is necessary. With regard to the last, however, the increase is often not very marked in the bones of giants. Thus, though Magrath's hand was described as the size of "a middling shoulder of mutton," his skeleton is not characterised by great increase in the length of the bones. The explanation of this, I believe. to be that during the active stages of the macroplasia of the long bones there was relatively little nutrition available for the hands, but that after the period of active macroplasia had ceased there was relatively more. This is strictly in accord with what Godin (1) found to be the rule in the normal growth of long bones.

As is hypothetically correct the sacral index is/

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(1) V.S.

is raised in giants. In Magrath it is no less than 144.6 in place of the normal 112.

We have seen that it is hypothetically correct to expect an undue growth of the fibula: it is interesting to note that the fibulae of the American Giant were so increased in length that they formed an arc which at its maximum point was 47mm from the perpendicular.

Professor Cunningham describing Magrath's skeleton says, "the first metatarsal bone and its proximal phalanx are remarkable on account of their massive size and the great expansion of their extremities. But in addition to all this, the foot shows a certain degree of distortion from another cause. The growth of its several bones has not been uniform. Some of the bones such as the os calcis, astragulus, scaphoid and internal cuneiform are disproportionately large, whilst the others are relatively small." Compare this with what is written above of the phylogenetically youthful areas of the foot and I think no one can reasonably doubt that it is the phylogenetically and ontogenetically younger areas of the body which are the seats of unusual growth in conditions of excessive nutritive supply.

With/

With regard to the localisation of the most marked starvation changes in giantism compare again what Professor Cunningham wrote of Magrath with what was found to be hypothetically probable.

In Magrath the upper end of the humerus is comparatively free from arthritic changes; the elbow joint is particularly affected, the articular margins being lipped and the range of movement circumscribed; the skeleton of the hand is almost entirely free from osteophytic projections.. In the femur the arthritic changes are more marked at the lower end than at the upper, at the extremities of the tibia and fibula there are well marked arthritic changes; in the foot the arthritic disease has attained its maximum degree of development. This is exactly what was found to be hypothetically probable. A concrete example of the hypothetically possible form of starvation in which the foot dies en masse is furnished, as we have seen, by the giant Constantin.

The occurrence of genu valgum is exemplified by "Le Grand Charles," Magrath and many others.

We are now in a position to return to a consideration of the problem of the effects of the establishment of nutritive overloading after the attainment of full/

Plate LXVI.

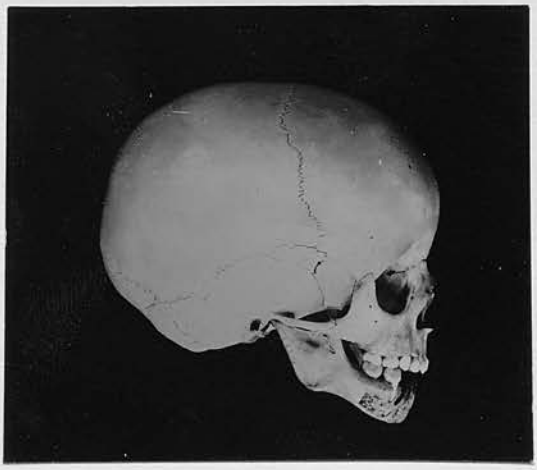


PLATE LXVII.

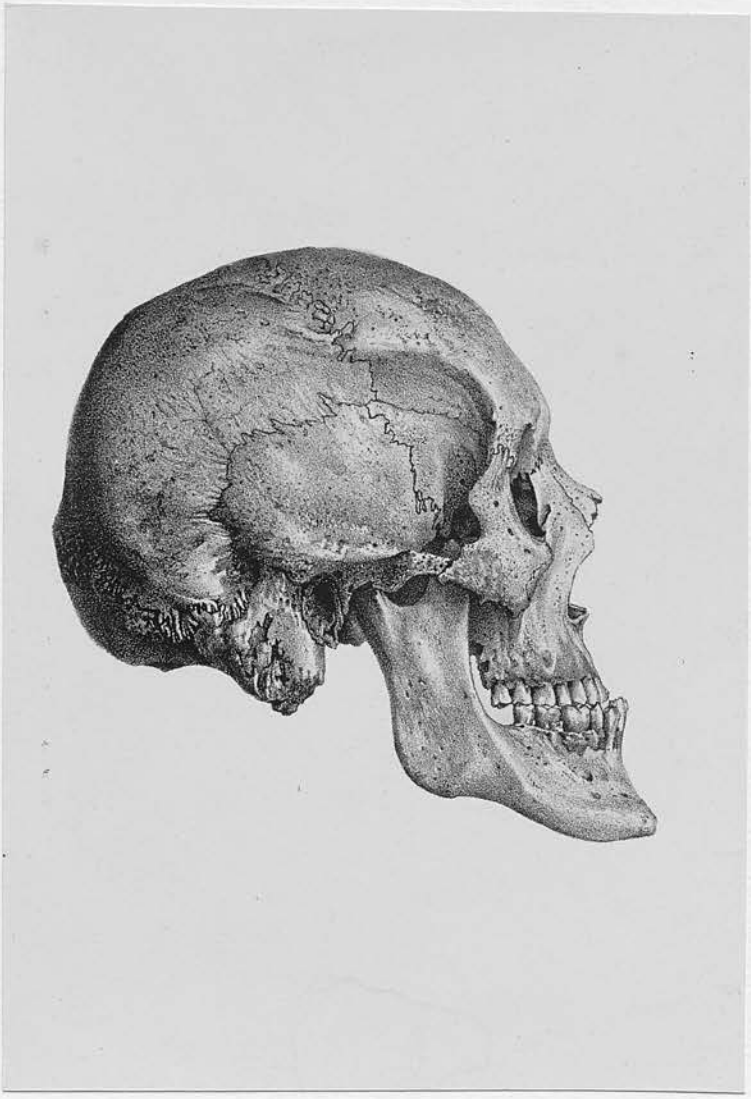
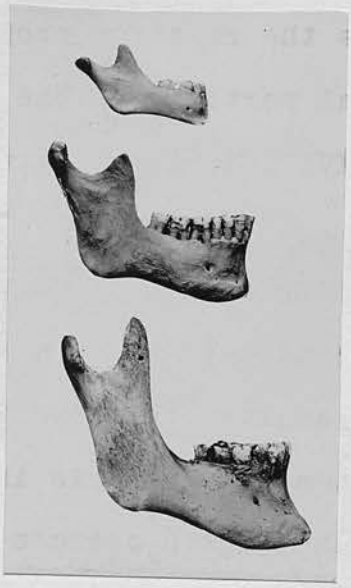


PLATE LXVIII.



PLATES LXVI., LXVII., LXVIII.

Plate LXVI. is a photograph of the skull of a child and shows the relative proportions of the cranial and facial portions of the skull.

Plate LXVII. is a photograph of the skull of Cornelius Magrath.

Plate LXVIII. is a photograph of three mandibles, the highest, is that of a child; the middle, that of a normal adult; the lowest, that of Magrath.

The series of plates is included to show the localisation of the growth changes in cases of nutritive overloading.

---- From the Collection of Professor D.J. Cunningham.

full maturity.

SECTION V. THE EFFECTS OF THE ESTABLISHMENT OF NUTRITIVE OVERLOADING AFTER THE ATTAINMENT OF MATURITY.

At maturity the last of the epiphyseal cartilages disappears and the possibility of macroplasia is excluded. Thereafter growth of the skeleton must be euryplastic, and the areas most affected will of necessity be those which are composed of the more absorptive cells. It would be tedious to repeat what those areas are.

One result of such growth must not be overlooked, however, The greatly increased weight of the masticatory apparatus will demand some increase or change in the supporting structures. The increased anterior projection of the skull will require a stronger posterior musculature to balance it and a stronger bony column for its support. Also there will of necessity be a curving backwards of the upper part of the cervical column. This will necessitate a compensatory dorsal kyphosis and a lumbar lordosis. In result the lower part of the muscle multifidus spinae, passing from the sacrum to the lumbar vertebrae, will be subjected to increased strain, the thoracic centra

and/

and intervertebral discs will be subjected to increased pressure and the muscles attached to the occipital squame will be subjected to increased tension. From this it follows that coincident with the growth changes forced on by the excessive nutriment there will be secondary abnormal bone growth manifestations which are strictly in series with all growth consequent upon the stimulus of use. That is to say, increased blood supply, consequent upon the active performanence of function, will render more food available for certain less absorptive cell areas and will cause them to grow in a manner analogous to, but not homologous with that of the more absorptive cell areas. A further point requires to be considered. The cells forming the hands and feet are the most anabolic of their respective limbs. If, therefore, nutritive overloading be established just as the epiphyseal cartilages are on the point of commencing to ossify the process of ossification may be stayed in the epiphyseal plates of the hands and feet and in them alone, all others closing in the normal manner. It will result from this that in some cases the metacarpals, metatarsals and phalanges will show macroplasia, the rest of the body euryplasia.

A/

A further consideration affects the tissues which are katabolically dividing. We have seen that the production of spermatozoa is essentially a katabolic process. If the supply of nutrition to the testicles be suddenly increased, the theoretic result will be either to cause a sudden and complete cessation of cell division or else to lead to the most riotous and excessive cell multiplication. This is easily understood. In the first case it means that the cells can support their increased mass without feeling the effects of the disproportionate increase of content and surface; in the second, that they cannot, and are forced on to divide in a similar manner to the chondroblasts. Clinically the result will be either a complete suppression of sexual desire or the occurrence of wild sexual orgies like those of Simon Botis. In either case the ultimate fate is the same, complete sterility. Similarly the hair which is the product of katabolic division will either be increased in thickness and length or will fall out and disappear.

We are now in a position to construct an ideal case of delayed nutritive overloading.

The condition will, by definition, only affect persons in whom the epiphyseal cartilages are obliterated/

obliterated. The resulting growth will, therefore, be euryplastic, and will affect the whole body slightly, but will reach its maximum in the more anabolic face and hands and feet and pelvis.

In the feet, the growth will particularly affect the great toe and the inner tarsal bones.

In the pelvis, the sacrum and pubis will be especially affected; growth in pelvic diameter will result.

In the hands the growth will be uniform, the hand either increasing in all its circumferences, or, if the condition be established just before the cartilages disappear in the length of all its long bones.

In the face, the lower jaw and more especially the chin will increase in size. To balance this, changes will take place in the posterior cervical muscles and ligaments and in the curvature of the cervical segment of the spinal column. This will provoke compensatory thoracic and lumbar curves.

Later, as the absorptive power of the body cells diminishes, starvation effects will be produced. Spinal intervertebral discs subjected to pressure will be absorbed in part and ossified in part. A vicious circle will result; for, advancing absorption will necessitate/

necessitate a greater curvature; a greater curvature, a greater compression; a greater compression a greater absorption. In result, there will develop a marked thoracic kyphosis, with marked compensatory cervical and lumbar lordoses.

A little later, and the diminishing cell absorptive power and the resulting cell starvation will be evidenced by the development of the growth changes of precocious senility or of the so-called disease rheumatoid arthritis.

A little later still, and general starvation osteoporosis will result, the cells with their diminishing absorptive power being unable to extract sufficient nourishment from the body fluids in which the nutritive concentration has long been maximised and to the limits of which the cells have multiplied in their younger and more absorptive days.

Long ago Virchow said that the clinical picture of acromegaly was that of a general degeneration following upon a general hypertrophy, and under the title of "the effects of the establishment of nutritive overloading after the attainment of maturity." I have described the signs and symptoms of acromegaly, during the stage of general hypertrophy and during the stage/

stage of general degeneration.

With this I close Part II. In the next part I consider Acromegaly as if it really were an independent disease.

END OF PART II.

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PART III.

OF

ACROMEGALY.

CHAPTER XVIII.

ACROMEGALY.

SECTION I. THE HISTORY OF ACROMEGALY.

"There exists a disease which is especially characterised by an hypertrophy of the hands and feet and face which we propose to call acromegaly; that is to say, hypertrophy of the extremities, not because they are alone affected, but because their increase is an initial lesion, and constitutes the most characteristic feature of the affection."

In these words, in the year 1886, Pierre Marie introduced to the medical profession this peculiar condition of partial giantism which has since been found, sporadically, to affect individuals of every country and of every race.

"The enlargement of the hands and feet is chiefly/

chiefly caused by an increase of thickness: in comparison with these bulky, clumsy parts, the forearm and lower part of the leg which are not enlarged, but rather of feeble muscular development offer a striking contrast. In the skull, the forehead markedly protrudes, the nose is increased in size, the mandible is, unusually powerfully developed, so that the chin projects and the lower teeth overlap the upper. With these obvious changes, there are associated, curvature of the spinal column, thickening of the clavicles, ribs, patellae and pelvis.

In females menstruation ceases at the beginning of the illness. The disease (entité morbide spéciale) has nothing to do with myxoedema, leontiasis ossea, congenital hypertrophy of a single member or osteitis deformans."

This is, in brief, Marie's original description: to it subsequent observers have added singularly little. But, though the deformities were not recognised as a recurring phenomenon until 1886, there had been prior to that date a large number of isolated cases recorded in the literature.

The oldest known case of Acromegaly is that observed by Professor Cunningham:[1] it affects the skeleton/

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(1) Unpublished.

PLATE LXIX.

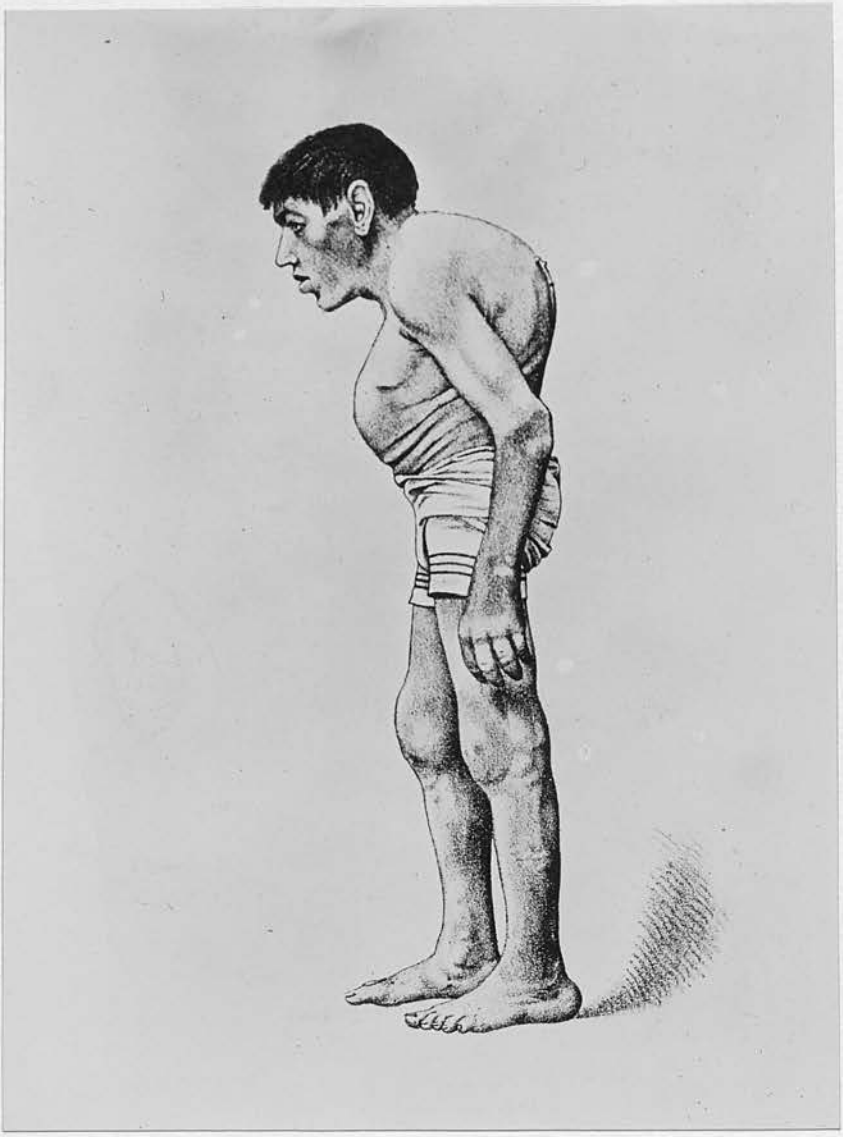

PLATE LXX.

PLATES LXIX. AND LXX.

Reproductions of drawings of the individual Peter Rhyner described by Fritsche and Klebs in their celebrated work on giant growth. The face, the spine, the hands, the feet attest the identity of this prehistoric case with the malady described by Pierre Marie.

After Fritsche and Klebs.

skeleton of an Egyptian mummy some 3000 years old; the oldest historical document of the disease is said by Sternberg[1] to be the life-size portrait of a giant painted in 1553; the oldest medical record is that written by Saucerotte and Noel (1772-1779).

In the prehistoric days of Acromegaly certain memoirs and papers were published which to this day stand out as landmarks.

In 1872 v. Langer of Vienna published his celebrated anatomical memoir on giants. It it he described two forms of giant skull, the first merely the normal skull magnified, the second characterised by the dilatation of the pituitary fossa, the disproportionate increase of the mandible, the dilatation of the air sinuses and the contraction of the nerve foramina. With this type of skull he associated certain peculiarities of the skeleton, exostosis upon the vertebral bodies, bony outgrowths in the region of joints and peculiarities of the soft parts, increase in the size of the nose and tongue, and degeneration of the hypophysis.

In 1884 Fritsche and Klebs[2] published their celebrated /

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(1). Nothnages, Specielle Pathologie und Therapie, VII. Band 2. Die Akromegalie.

(2). Ein Beitrag zur Pathologie des Reisenwuchses, Klinische und patologische-anatomische untersuchungen, Leipzig, 1884.

celebrated work on giant growth.

In 1885 Marie called the disease acromegaly and established its existence as a recurring phenomenon.

With this event the real history of acromegaly opens.

In 1890 two important works were published, the first by Souza-Leite drawing attention to the frequent association of pituitary enlargement with acromegaly, the second by Alexis Thomson describing as definitely acromegalic, the skeleton of an individual whose case had been described by Professor Cunningham in 1879. After the publication of Souza-Leite's painstaking collection of cases and discussion of the diagnosis, and after Thomson's recognition of the real nature of the Edinburgh skeleton, the existence of the disease "acromegaly" may be said to have been established in the eyes of the medical profession.

In the same year Marie rendered the diagnosis more certain by his recognition and description of the superficially somewhat similar condition which he has called "Osteo-arthropathie hypertrophiante pneumique." This he expressly states is not a disease, but a growth process secondary to some disturbance of the respiratory apparatus.

In/

In January 1891 Professor Cunningham announced that the skeleton of Magrath was definitely acromegalic, This stimulated workers on the Continent and in America to further efforts,and Brissaud and Meige, Dana and Woods Hutchinson have produced numerous publications on the subject. None of them, however, add much to the work of v. Langer and Cunningham.

In 1894 Sternberg committed himself to the definite opinion that giantism and acromegaly are separate conditions.

In 1896 Marie modified his original description slightly; stating that the hand in acromegaly might be enlarged in length (type en long) as well as in breadth (type en large.)

In 1897 Sternberg produced his classical monograph "Die Akromegalie", and, lastly, in 1904 Launois and Roy's Memoir, entitled "Etudes Biologiques sur les Géants" was published.

During the twenty years covered by this brief review innumerable cases of acromegaly have been described in medical and scientific magazines and periodicals, and the difficulty is now not to collect cases but to avoid being swamped by the enormous mass of cases to be dealt with.

For /

For the purposes of this thesis I have studied the records of 200 cases of undoubted acromegaly, as, however, the number is not sufficient to obtain a true index of frequency of symptoms I avoid giving percentage tables.

As I do not wish to lay myself open to the charge of constructing a hypothesis of acromegaly from the study of a case which was not acromegalic, as has happened to other workers in this difficult field, I include,here,a standard account of the signs and symptoms of the condition. The position that I take up is this, if the description which I quote is a description of acromegaly then my case is a case of acromegaly; if it is not, then the word is being used by different people with different connotations. To this end I have selected the description written by A. Souques and published in the Traité de Médicine by Charcot, Bouchard and Brissaud, Second Edition, Paris 1905, Tome X. page 491-498. This I quote in full.

SECTION II. THE SIGNS AND SYMPTOMS OF ACROMEGALY.

Symptomatology of Acromegaly:--

The symptoms of Acromegaly are of two classes, the first essential and primary, the second, contingent or/

or accessory. The primary are constant or almost constant, they are hypertrophy of the extremities, hands, feet and face, dorsal kypho-scoliosis, headache and, in the female, some disturbance of menstruation. We shall commence by studying these.

Primary Symptoms:--

A. Hypertrophy of the hands.

As a rule the hands are the earliest parts affected. Their unusual bulk contrasted with the normal appearance and size of the other parts of the upper limb arrests attention. They are thick and broad without being deformed or markedly increased in length. Because of their strange appearance the hand is described as "courtaude" (thick-set) "camarde" (snub-nosed) "en battoir" (battledore) or spade-like.

Sometimes the hand does not develop on these lines (type en large) as P. Marie has shown. "The second type is also marked by the increase of hand-bulk, but this time, there is some development in length, almost proportionate, in fact, to the increase of thickness. In result, the hand, being longer and not so thick, has a less monstrous appearance than in the former type where its development is marked almost entirely/

PLATE LXXI.

PLATE LXXII.

PLATE LXXIII.

PLATES LXXI., LXXII. AND LXXIII.

Figures illustrative of Acromegaly. Copied from M. Souques' paper. The original sources are in each case acknowledged by him.

entirely by an increase in breadth." This "type en long" occurs especially in patients who are affected early and so definite is this that it is possible by looking at the hands to say at what age the disease commenced.

The hypertrophy of the hands affects all the tissues, the bones, the muscles, the connective tissue, the fat and the skin.

The skin is dense and strong, there is no oedema and the colour tends to be slightly darker than usual. The interphalangeal folds are deep and separate great fleshy cushions. The thenar and hypothenar eminences are enormously increased in size and the lines on the palm are deeper and more marked than usual. The fingers are enormous and are as thick at their tips as at their bases; they are not deformed either at the joints, or in their direction, or in their length. They are just like the sausages to which Marie has likened them. In a case observed by Lombroso the thumb measured 120mm. in circumference. The nails by comparison look small, they are flat and broad and are marked, almost always by longitudinal striae. Exceptionally, the fingers are lumpy as the result of nodes upon the phalanges. This hypertrophy without deformity/

deformity affects the fingers and the regions of the metacarpus and carpus, but stops short at the wrist. The forearm and arm, although larger than normal, are not hypertrophied to an extent that is really comparable to the hands.

In spite of the great increase of size the functions of the hands are intact and their movements cause no pain. In only two of the thirty-eight cases quoted by Souza-Leite is the condition of "dead fingers" noted.

B. Hypertrophy of the Feet:--

Like the hands, the feet become broad and thick without marked increase in length. In the same way the deepened creases separate great fleshy cushions. The hypertrophy stops at the ankle, the legs and thighs being more or less unaffected. The ankle and the knee are sometimes increased, but always much less markedly than the foot. As in the hand, all the tissues, bones, muscles, etc. are affected. The appearance of the skin is absolutely identical. The toes maintain their usual form and direction: they are simply thick and broad and massive as if they belonged to a colossus. The nails are short, flat and broad, and are marked almost/

PLATE LXXIV.

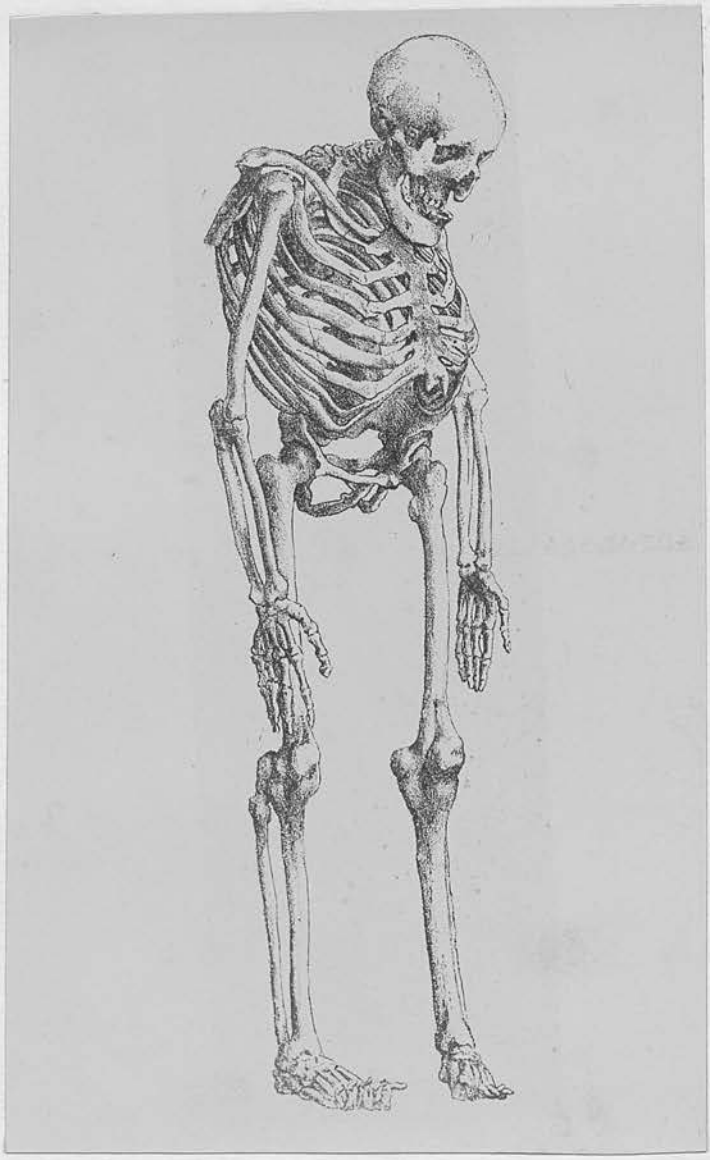

PLATE LXXIV.

Acromegalic Skeleton ---- after Brigidi.

almost always by longitudinal striae.

C. Hypertrophy of the Head:--

There are no marked changes in the cranium. A slight increase in antero-posterior length has been noticed. The occurrence of bony crests along the suture lines and in the neighbourhood of the external occipital protuberance and of the mastoid processes has also been noticed. The face is especially affected. It is lengthened and becomes oval in outline. The forehead is low, the orbital borders are extremely prominent; the eyelids are thickened. The eyes as a rule appear small, but sometimes there is slight exophthalmos. The nose is increased in all its diameters and forms an enormous projection. The cheek-bones are very prominent. The lips are much thickened; the lower being often in ectropion, the chin becomes enormous and projects most markedly. The superior maxilla is but slightly altered: the mandible, on the other hand, undergoes a monstrous hypertrophy causing a marked prognathism. In some cases the ears are larger than normal.

Together these changes constitute the acromegalic facies.

PLATE LXXV.

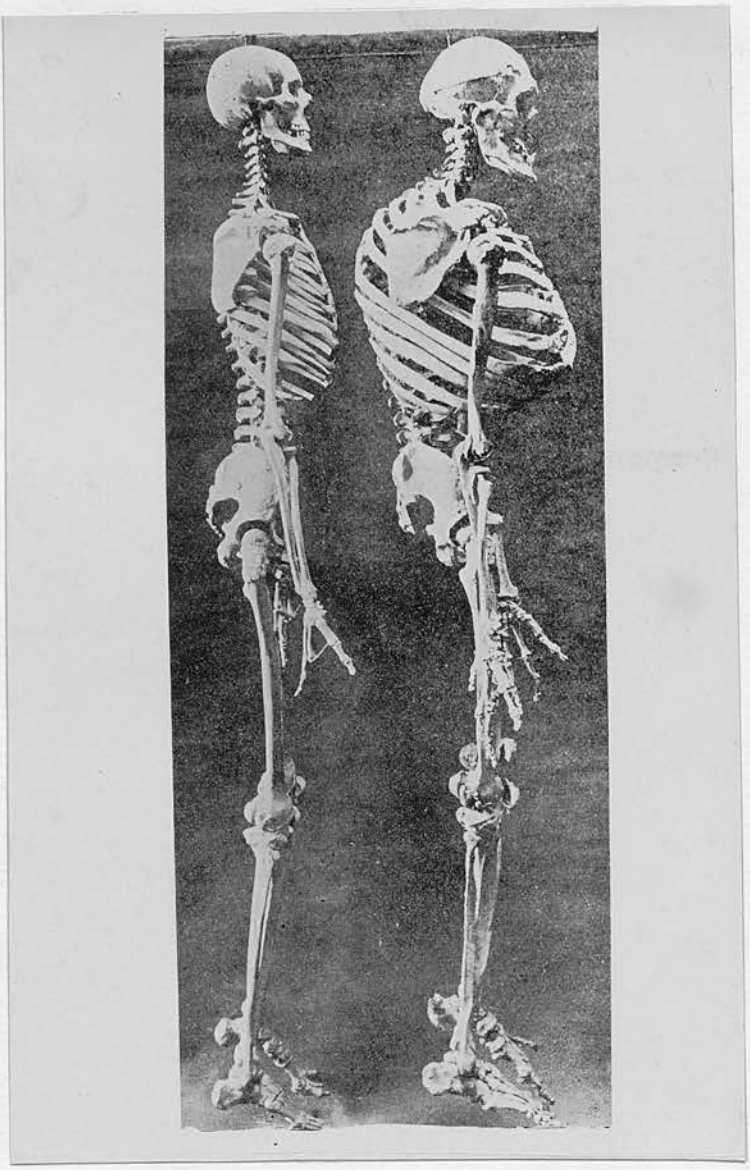

PLATE LXXV.

Comparison of an acromegalic and normal skeleton.

---- After Hinsdale.

The tongue is large (macroglossia); sometimes so huge, indeed, that there is not room for it in the mouth when its size renders speech and swallowing difficult. The palatine vault, the pillars of the fauces, the uvula, the soft palate, the tonsils may share in this hypertrophy and add to the difficulties of voice production and deglutition. Henrot has noted in his case that the teeth were increased in size.

As a whole, the skin is of a brownish yellow tint which deepens somewhat at the extremities. It is dry and is much too large for the organs which it covers. It has, fairly frequently, pathological outgrowths upon it. The hair of the head is abundant and thick, that on the body coarse and hard.

Béclère examining, radiographically, the cranium of a typical case of acromegaly has noted three deformities, inaccessible to other means of investigation, which are characteristic of the condition. These are:--

1. Irregularities in the thickness of the cranial walls.

Sometimes this thickness is so great as to render radiographic examination of the sella turcica impossible/

PLATE LXXVI.

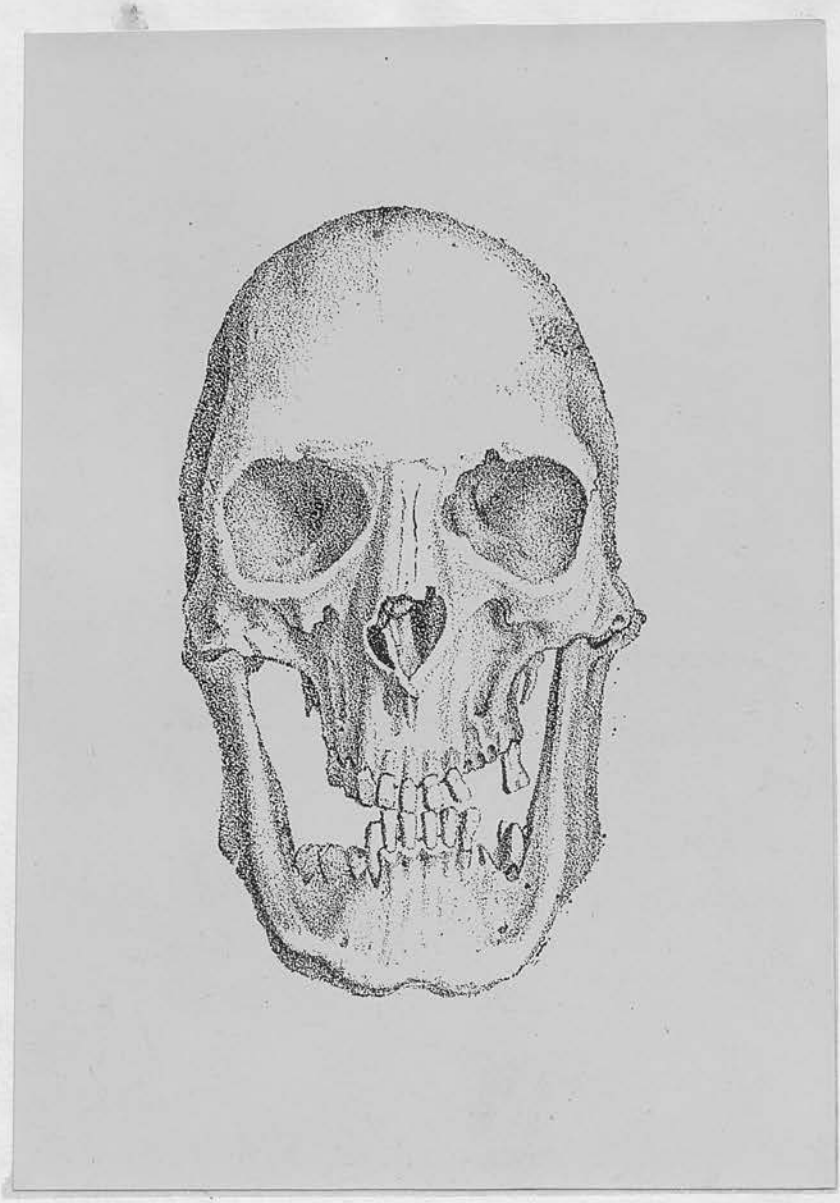

PLATE LXXVI.

Acromegalic Skull.

----- After Taruffi.

impossible. The shadow of the cranium is limited externally, not by a rounded, but by a polygonal margin. The inner and outer tables approach and recede from one another by turns in a way that is quite characteristic.

2. Extraordinarily large development in height and breadth of the frontal sinuses.

With this one can associate an analogous hyperdevelopment of the maxillary antra.

3. Great increase in the depth and more especially in the antero-posterior diameter of the sella turcica.

The walls are thickened and in a radiograph it has the appearance of a large hemispherical bowl.

To these three signs we may add the exaggeration of the post lamboid ressaut described by Pappillault and obtain the schema of the acromegalic cranium which Launois and Roy have published in their "Etudes Biologiques sur les Géants."

D. Thorax:--

The deformities which affect the thorax are especially concentrated upon the vertebrae. The vertebral lesions are responsible for the cervico-dorsal kyphosis which may be accompanied by a lumbar lordosis and/

PLATE LXXVII.

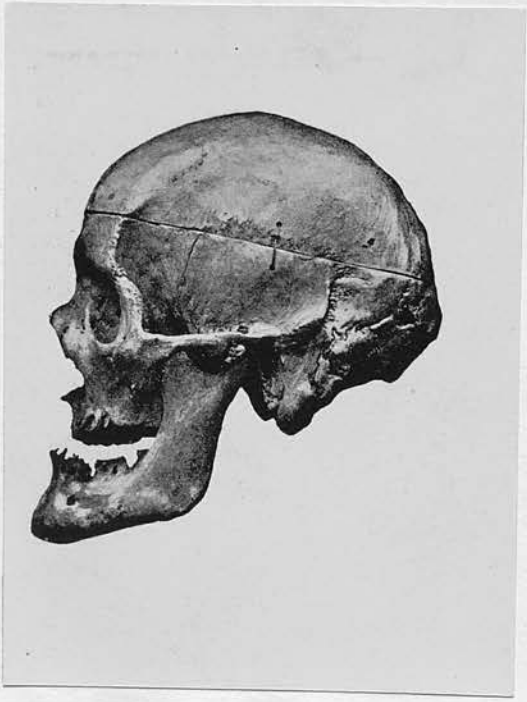

PLATE LXXVII.

Face and profile views of an acromegalic skull.

---- After Sternberg.

and by scoliosis. The amount of kyphosis varies from case to case; it forms sometimes a true dorsal hump and is frequently associated with a forcing up of the antero-inferior region of the thorax. The coexistence of these prominences constitutes the so-called double humps of Punch.

As a whole, the thorax is flattened from side to side and increased in its antero-posterior diameter. On analysing the conditions of the different bones, the sternum is found to be markedly hypertrophied, the clavicles are large, the ribs and costal cartilages are thickened and even the scapulae are increased.

Respiration is often affected by these multiple deformities and becomes purely abdominal.

E. Headache and Amenorrhoea:--

Headache is often the first symptom complained of by the patient. Sometimes it is continuous, sometimes paroxysmal; it varies in intensity. As a rule the pain is localised to the occiput or to the nape of the neck; more rarely it is diffuse, affecting the entire head.

In women, amenorrhoea is frequently the first symptom. Sometimes its establishment is sudden; sometimes/

PLATE LXXVIII.

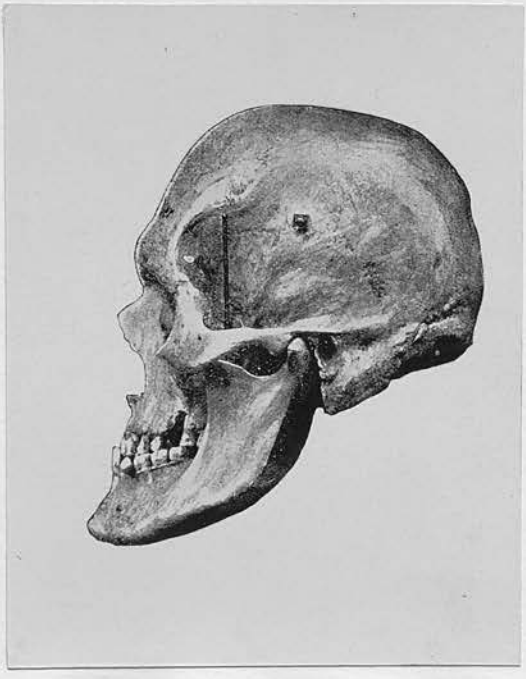

PLATE LXXVIII.

Face and profile views of an acromegalic skull.

---- After Sternberg.

sometimes it follows upon several months of irregularity or suppression. Sterility is absolute. In a case of acromegaly with amenorrhoea reported by Burchard, the periods were replaced for two years by recurring oedema of the arms and eyelids.

Such are the essential signs and symptoms of acromegaly; they are necessary and sufficient for the diagnosis of the disease. To them it is necessary to add a series which may or may not be present. These it is impossible to describe didactically.

II. Secondary Symptoms:--

With the constant hypertrophy of the head, hands and feet, acromegalics frequently have short thick necks, the head being, as it were, set into the shoulders. As a rule the thyroid is atrophied, it may, however, be very large or of normal size. The larynx is projecting, the cartilages are thickened, sometimes ossified. This is especially striking in female patients. Their voices become deep and strong, for they have functionally and anatomically "masculine larynges." The breasts are soft and atrophied, the abdominal wall is slack and pendulous, the pelvis is sometimes increased in breadth. In women the external genitals/

genitals are thick and broad; the uterus is, as a rule, atrophic. In men the penis is frequently increased; the scrotum and testes may be either increased or diminished. These modifications of the genitals coexist with diminished sexual appetite and power.

The muscles may be either normal, hypertrophied or atrophied. Atrophy is probably the most common; functionally it is expressed by the weakness of the patient and his extreme liability to early fatigue. The muscular atrophy was so extreme in the case studied by Duchesneau that he proposed to introduce a special class for its reception---Amyotrophic Acromegaly. The muscles show no disturbance in their response to electrical stimulation; Erb holds that their excitability is diminished; Verstracten, that it is increased.

The joints, especially the knee and wrist, are sometimes large and creak on movement.

The reflexes may be normal, diminished or abolished; they are never increased.

In the circulatory system, hypertrophy of the heart with palpitation and arterio-sclerosis have been noted. The veins are frequently varicose.

The lymph vessels and glands may be hypertrophied.

Huchard/

Huchard in 1895 noted the existence of circulatory disturbances in acromegaly, and J.B.Fournier collected twenty-five examples, twelve of which were examined post-mortem. He concludes from his observations that there are two sorts of cardiac hypertrophy. The first, the smaller form, is not accompanied by degeneration of the cardiac muscle, the second, the larger form, is. In the former we have simple cardiomegaly which is rarely associated with valvular incompetence; in the second, there is a true sclerosing myocarditis which is accompanied by the usual signs and symptoms, arterio-sclerosis, hyposystole, venous congestion of the liver, oedema of the limbs, etc. Finally, the deformities of the spine and thorax may lead directly or indirectly to dilatation of the right heart.

In acromegaly, then, the heart may participate in the general enlargement of the organs. The cardiac arythmia which is sometimes present may be regarded as a direct result of the action of the toxin of acromegaly upon the heart muscle; the not infrequent association of syncope is supposed to be secondary to lesions in the sympathetic system, or, to excitation of the bulbar nuclei of the vagus.

Acromegalics/

Acromegalics frequently perspire to excess; they may suffer from polyuria, from glycosuria or peptonuria. Duchesneau has recorded crises of phosphaturia.

The occasional glycosuria is especially interesting. Hausemann has found this symptom present 12 times in a total of 97 cases; Hinsdale 14, in 130 cases. It is, however, probable that these statistics underestimate its frequency. P.Marie thinks that it is present in from 25 to 50% of all cases. The difference is to be explained by the fact that the urine has not invariably been examined. Be that as it may, the frequency of diabetes cannot be explained away as a pure coincidence. Various hypotheses have been advanced in explanation of the relationship of the two conditions. It is necessary first to exclude all cases in which a lesion of the pancreas or of the floor of the fourth ventricle has been found. Pressure exercised by the enlarged pituitary upon the surrounding parts has been urged as sufficient explanation in other cases.

The first hypothesis advanced by Arnold Lorand appears most improbable. In short, the assumed hypofunction of the pituitary, if one is prepared to accept that/

that the gland is inactive, is scarcely in accordance with its invariable hypertrophy. On the other hand, the hyperfunction, if one is prepared to accept that, scarcely accords with the experimental results of Caselli who finds that diabetes occurs in animals from whom the hypophysis has been removed. The second hypothesis advanced by Loch and defended by Launois and Roy is feasible, in the light of what we know of diabetes of nervous origin. They suppose that the enlarged pituitary presses upon a new glycogenic centre situated somewhere near, possibly in, the tuber cinereum.

The existence of glycosuria directly caused by a tumour of the pituitary is not universally accepted. There are on record many cases of such tumours which showed neither glycosuria nor acromegaly. But these are negative cases. Gilbert and Carnot explain the diabetes of acromegaly as a result of hyperfunction of the liver.

With regard to the alimentary functions it is necessary to note the frequent increase of appetite and thirst, and the less frequent occurrence of dyspepsia. In Duchesneau's case there was not only enteroptosis, but also nephroptosis.

Sensation is, as a rule, normal; exceptionally analgesia and anaesthesia have been noted. It is not/

not so rare to find in these patients an unusual susceptibility to the effects of cold and extreme sensitiveness to pain. Pains, in addition to headache, are frequent. According to Sainton and State,who have especially studied this point, they are present in half the recorded cases. They affect sometimes the viscera, sometimes the spine, sometimes,and probably most frequently, the limbs. As a rule they are symmetrical and present in all the four limbs. They are sometimes vague like extreme fatigue or lumbago. At other times they are more or less intense and like the pains of a localised or generalised osteo-arthritis. Occasionally there are neuralgias facial, sciatic, crural or intercostal. At other times there are muscular cramps, or pseudo-tabetic lightning pains or pains in the extremities or acroparaesthesias. These are, as a rule, made worse by fatigue, pressure, cold or damp: they are relieved by warmth. Often the aches and pains are transitory: sometimes they persist to the very end of the disease. Facts of this sort led to the establishment of the "forma dolorosa" of acromegaly to which the cases of Duchesneau, of Meunier and of Sainton and State belong.

All the special senses may be affected. Hearing may be altered on one or both sides, there may be buzzing/

buzzing in the ears or deafness, either partial or complete. Taste and smell may be altered. More frequently than any of the other special sense organs, however,the eye is affected. There may be amblyopia or blindness, caused by pupillary congestion or there may be intra ocular pains, or irregular diminution of the field of vision or bitemporal hemianopsia. In addition there are, in half of the cases of acromegaly, clear signs of intra-cranial tumour.

It now only remains to mention some general symptoms and psychical troubles. On the one hand there is general lassitude, feebleness and inability to work, on the other, there are alterations in character which may become gloomy and irritable, although intelligence, as a rule, persists to the end. Farnarier has drawn attention to the frequency with which psychosis and neuroses are found in the families of acromegalics, and to the frequency with which the stigmata of degeneration are met with in the patients themselves who may be intellectually feeble, or even suffer from dementia. He thinks that persons with a neuro-arthritic heredity provide a favourable soil for the development of acromegaly. This hypothesis urgently demands some proof.

III./

III. The Onset of Acromegaly.

Acromegaly, as a rule, begins between the twentieth and twenty-sixth years. Exceptionally it is precocious; exceptionally it is delayed. Its advance is progressive, but slow; sometimes it is characterised by alternating periods of arrest and advance.

Its duration is very variable, on an average, probably, 20 or 30 years. From this point of view Sternberg recognises three forms; first, the benign, which may last for 50 years; second, the ordinary, which may last for from 8 to 30 years; third, the acute, which lasts only three or four years. This last has been found only 8 times in 240 cases. In these acute, malignant cases sarcoma of the pituitary has always been found. Hanau, in this connection, has pointed out that diffuse hypertrophy of the pituitary has certain characteristics strongly resembling sarcoma and he states that the pituitary tumour described by Gabler as a sarcoma is not a sarcoma.

The termination of the disease is death. Inevitably the sufferer succumbs to a slight cachexia or to some intercurrent affection. Sometimes, but very rarely, death is sudden and due to syncope.

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In future, then, when I speak of acromegaly I mean the condition with its primary and secondary symptoms as given in the description which I have quoted.

In the next chapter I describe in detail a case of acromegaly.

CHAPTER XIX.

A CASE OF ACROMEGALY.

SECTION I. PRELIMINARY.

In August 1907 a woman who was a victim of Acromegaly, died in Edinburgh: her body was obtained for the Anatomy Department of the University. Through the kindness of Dr. G. A. Gibson who has permitted me to make use of his clinical records and who has furnished me with many references I am enabled to give a complete clinical record of the case. To Professor D. J. Cunningham, in whose laboratory the work of dissection, of preparation of specimens, and of microscopic examination has been performed I am indebted for much advice and for the use of books, notes and instruments.

For convenience of reference I refer to the subject of this investigation as E.A.S. 07. When I come/

come to speak of the older Edinburgh Acromegalic Skeleton described by Professor Cunningham and Mr Alexis Thomson I shall refer to it as E.A.S. 79.

SECTION II. THE CLINICAL RECORD OF THE CASE OF ACROMEGALY. E.A.S. 07.

Dr. G. A. Gibson's Notes of 1899.

A woman E.A.S.07, aged 42, unmarried, a housewife, born and residing in the County of Kinross was admitted to Ward XXVII Royal Infirmary Edinburgh on the 21st February 1899, complaining of weakness and of stiffness in the back and limbs, with enlargement of the body. The duration of the illness was 17 years.

History of the Patient.

The following facts were ascertained:--

Hereditary Tendencies.

Her father died at the age of 84 of "old age"; he had always been healthy. Her mother was alive aged 77: she was rheumatic, but otherwise well. One brother had died at 37 of phthisis. One brother and two sisters were alive and healthy.

SOCIAL/

PLATE LXXIX.

PLATE LXXIX.

Photograph of E.A.S. 07 at the age of twenty-five at the very commencement of the disease.

Social Conditions.

The patient had always had a very comfortable home and plenty of good food. She had taken a moderate amount of tea and alcohol only medicinally. Before her illness she was a lady's maid and her duties were very light.

Previous Illnesses.

She could not remember having had any childish illnesses, but for several years she was subject to heavy winter colds.

Present Illness.

The commencement of her illness was as follows:-- seventeen years ago, when she was 25 years of age and in a situation, she had a sore throat. (Her appearance at this period is shown in Plate LXXIX.) A medical practitioner was consulted and he said that the throat was "diphtheritic". She remained in bed for three days and used a gargle. After this illness her friends remarked that she did not look well, and she has always thought that her present condition dated from that indisposition. She never regained her health, and although the sore throat left her she became anaemic.

A few months later the patient noticed that her/

her hands had begun to swell. They became very painful, the pain being most acute at the phalangeal joints and worst at night. After a time, however, the swelling gradually subsided and the hands became less painful. She did nothing for the swelling of her hands, except soak them in hot water. This relieved the pain. After the swelling had subsided, she noticed that they felt "knotty".

A few months later she again consulted the doctor who told her that she was suffering from rheumatic gout. He gave her some medicine which she continued to take for some time, without benefit.

A month later the catamenia stopped. She was ordered a course of Turkish baths and some medicine, but menstruation was not re-established. Five years later it reappeared for one occasion only. Apart from this exception, she has not menstruated for 17 years.

The doctor thought that the place she was living at did not suit her so she returned to her home in Kinross. After two months' holiday she felt better and took another situation for two years, during which time her illness apparently made no advance; the hands however, remained slightly enlarged. She then returned home for family reasons and was tolerably well for/

PLATE LXXX.

PLATE LXXX.

E.A.S. 07 aged twenty-seven.

Comparison with the appearance depicted in Plate LXXIX. shows that in the two years there were marked changes in the hair, nose, lips and chin.

for some months. After this she began to feel languid and tired on exertion, she also felt sleepy all day, and at night fell into a "dead heavy sleep". She noticed that she perspired very freely on any exertion and that her hands had begun once more steadily to enlarge. Then the feet began to enlarge. The somnolence and languor increased so much that, about four years ago, she took to her bed.

After taking to bed, her thyroid gland began to swell, but the tumour did not become very large; the lower jaw began to enlarge, and the feet also grew larger. After the thyroid had begun to swell the tongue began to increase in size, becoming thicker and broader. It protruded between the lips somewhat, so that proper articulation became impossible. The sense of taste also deteriorated. Next the lower lip increased in size and the whole face became very large and had a swollen appearance. Her hair also became much coarser and thicker, but she does not think that her skin altered. (Her appearance at this stage is given in Plate LXXX.) Her intelligence was unimpaired, and she did not become nervous. Her whole body slowly increased in size, the face and lower jaw most markedly/

markedly so, and she became too weak to leave her bed. She lost the use of her hands except for writing which was, however, a great labour. The dorsum of the hands had a swollen appearance. The heavy sleep at night continued and even during the day the patient slept a great deal.

Avout a year and a half ago, while reading, she happened to close her left eye, when, to her astonishment, she discovered that her right eye was blind.

About the same time she noticed that her skin and more especially the skin of her hands was very pale, "of a deadly whiteness". She no longer had any pains, but at times there was a heavy feeling in her head. About this time too, she suffered from nausea and vertigo when she sat up, but this soon passed off.

A year ago, the patient went to Victoria Hospital, Glasgow, and was under the care of Dr. Napier. She was immediately put upon a course of pituitary and ovarian extract (three tabloids of each daily). She did not feel that this treatment made any difference in her condition, and, after some weeks of it she was one day leaning over the bed when, without any premonitory symptoms, she fell down in a fit. She was told/

told that she lay in a state of coma for an hour, but she herself knows nothing of what happened. After this the administration of the pituitary and ovarian extracts was stopped and thyroid tabloids administered. While in hospital it was noticed that she had albuminuria, but there were no other symptoms of renal disease. She took a bad cold and felt very much weakened. Perspiration was so free that her clothes used to be soaked. After this cold her health steadily improved and the thyroid gland became much smaller. The tongue diminished in size so that she was able to keep it in her mouth: her weight was also reduced from 9 st. to 7 st. 8 lbs. Her sense of taste improved and her face became thinner and less heavy. The earlier treatment was resumed and after a stay of three months in hospital she returned home.

Her neighbours remarked that her face was "sharper." She had improved so much that she was able to do simple work, such as sewing and knitting, her hands having become smaller and less clumsy. Also, she did not perspire so freely as she did before the administration of the pituitary and ovarian substance. She continued taking daily two tabloids of each gland for/

for about 5 weeks and steadily improved in health. She was able to walk with the aid of a stick and felt less languid and sleepy. There has been no apparent increase in size since her treatment in Glasgow: her colour also improved and her sleep was less heavy.

Condition on Admission:--

Height 5 ft 2 in: weight 9st 2lbs.

The patient was a large well-nourished woman with fairly well-developed muscles. She looked rather anaemic, but otherwise healthy. There was no evidence of injury or of previous illness apart from the general enlargement of the body. She seemed of a happy and contented disposition and looked intelligent and cheerful. She lay in bed on her right side as a rule.

The head relatively was most enlarged: the feet were next in relative size: the hands were not so much enlarged.

The face was much encreased vertically; the lower jaw was especially enlarged so that the lower part of the face looked broader than the forehead which was rather peaked and surrounded by a mass of coarse, wiry hair. The nose was considerably enlarged and its shape Roman. The lower lip was much thickened and tended/

PLATE LXXXI.

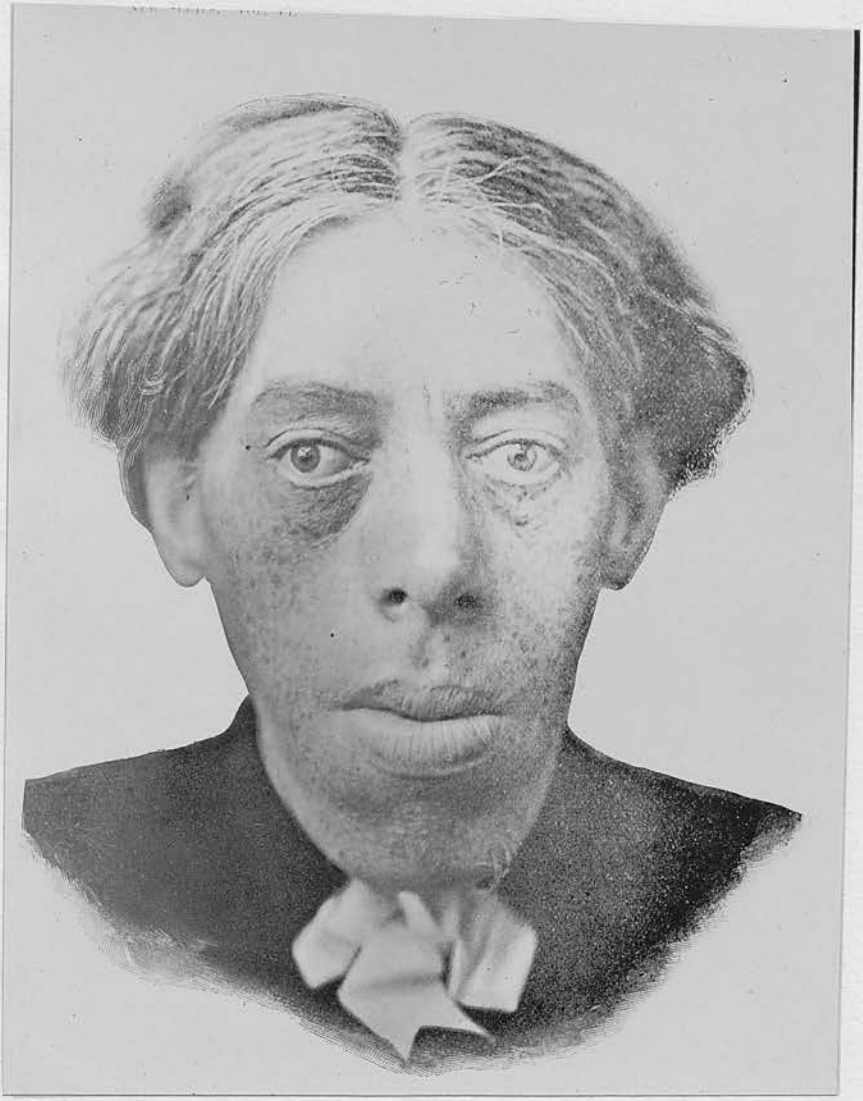


PLATE LXXXII.

PLATES LXXXI. & LXXXII.

E.A.S. 07 at the age of forty-two----full face and profile views.

tended to hang down, showing the lower teeth and the tongue. The upper lip was enlarged, but less so, (The appearance of the patient at this time is shown in Plates LXXXI & LXXXII.) The head inclined to fall forwards; the shoulders were also bent forwards. The spine showed one curve forwards. The complexion was fair. The patient was well-nourished, but muscularly weak, especially in the lower extremities. The gait was clumsy and the patient had considerable difficulty in walking.

The temperature was always subnormal 97°- 98°F.

Present Symptoms:--

The patient was very easily fatigued and suffered from a considerable amount of lassitude. She forced herself to take some exercise, but was not able for much exertion, for a walk of 400 yards, for instance. Before her illness though not a great walker she could cover five miles without being tired. At the commencement of her illness, she could only walk one or two miles; she generally came in very tired and had to give up all outdoor exercise. There was no headache at any time, but sometimes on first sitting up in the morning, there was nausea and swimming in the head. Occasionally/

Occasionally the nausea ended in vomiting. Two or three times she fainted, apparently without any reason, while sitting quietly. These attacks were preceded by singing in the ears.

The patient was not at all deaf.

There was temporal hemianopsia of the left and total blindness of the right eye.

The appetite was normal. She suffered from excessive thirst when she had these "turns of nausea".

She had no sensation of pains and cramps, but used to feel her hands excessively cold, her feet less so. This coldness was not felt so much about the time of her admission.

Detailed Description:--

(Note:-- Measurements of the various parts of the body taken at this time are included in the table of comparative measurements given at the end of this chapter).

Face:-- This was large in proportion to the rest of the body. The expression was intelligent and fairly happy. The colour was pale, and there was pallor of the conjunctival and buccal mucous membranes. The shape of the face was oval, the lower part being the larger/

larger and heavier. The face had altered very much since the illness began. The forehead had not changed very much. It was high and narrow in comparison to the rest of the face, and was rather peaked. The supercilliary ridges were enlarged. The eyebrows were thick, and the hairs were coarse. The orbital fissures were wide, and there was some exophthalmos. The eyelids were enlarged, but did not quite close over the right eye. The symptom of Von Graefe was not present. The eyelashes were unchanged.

The eyes were prominent and set wider apart than normal. The pupils were equal. There was very slight external strabismus of the right eye.

The nose was enlarged, straight and thickened at the tip. The nostrils were enlarged and thickened.

The cheeks looked rather depressed above, the malar eminences were not prominent and there was no malar flush.

The aperture of the mouth was increased and the mouth was kept open. The upper lip was much enlarged especially in the centre. The lower lip was larger than the upper: it was everted and thick in all its extent.

The/

PLATE LXXXIII.

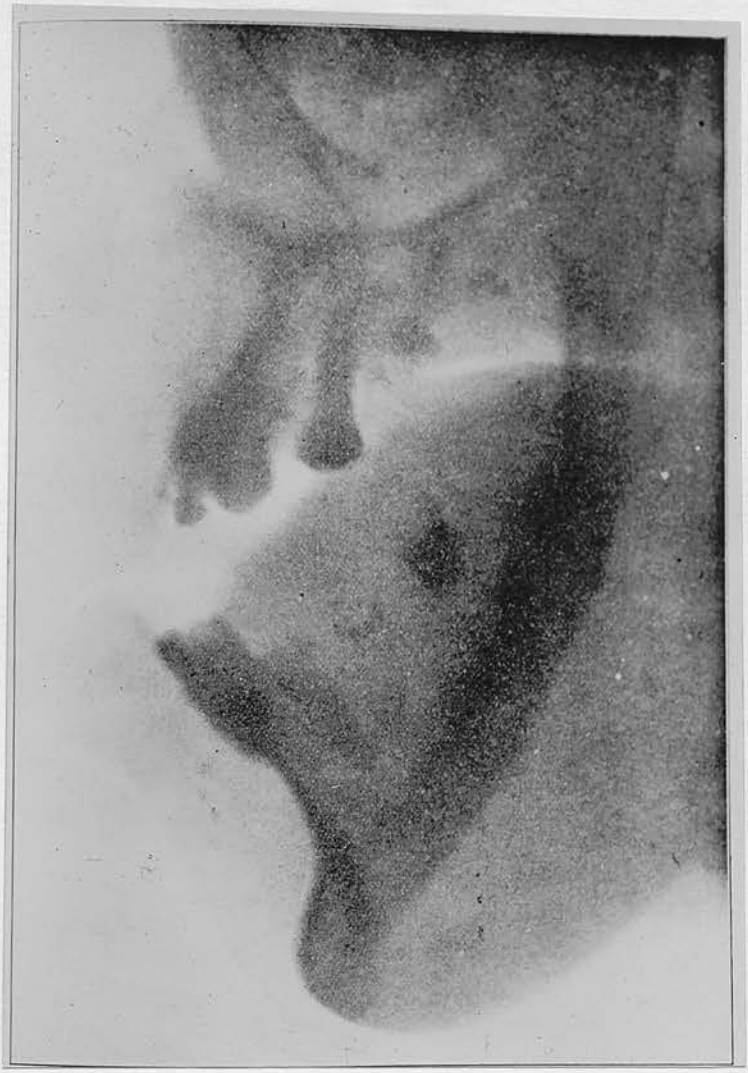


PLATE LXXXIII.

Radiograph of the face of E.A.S. 07 at the age of forty-two.

The palate was V shaped and seemed narrow.

The chin was very prominent and square. The angle of the mandible was rounded off. (See Plate LXXXIII for radiograph of the bones of the face). There were some coarse hairs on the chin.

All the upper teeth had crumbled away and a few carious stumps were left. The lower incisors were fairly good. The gums were enlarged and irregular.

The tongue was very much enlarged both in length and breadth. It was moist, fissured and tremulous, but not furred. It tended to protrude.

The salivary secretion was increased and dribbled from the mouth when the patient slept. The tonsils and uvula were enlarged.

Cranium:--

The cranium was of large size and of oval shape. The sutures were not prominent. The hair was luxuriant, dry, coarse, wiry and greyish brown or roan in colour.

Neck:--

The neck was short and thick, getting gradually larger at the base.

Larynx:-- /

Larynx:--

The thyroid cartilage was not large.

The hyoid bone was large and prominent.

The voice was deep - almost masculine.

The articulation was slow, thick and attended with difficulty.

Thyroid Gland:--

The isthmus was thickened and like a cord. The lateral lobes were slightly enlarged and lobulated.

Thymus Gland:--

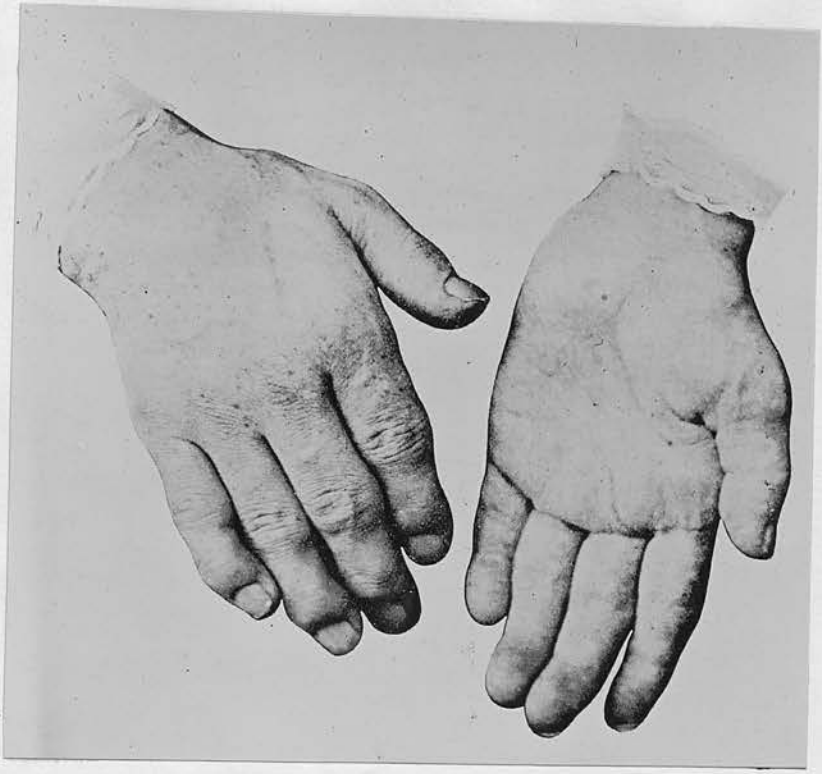
There was an area, dull on percussion behind the upper part of the sternum. This extended for about half-an-inch beyond each lateral border.

Upper Extremity:--

Hand:--

The hands were much enlarged. The former size of her gloves was $6\frac{1}{4}$, at the time of examination she required size $7\frac{1}{2}$. They were somewhat square shaped, being enlarged in all their dimensions. The terminal phalanges of the fingers tended to be pointed and they were slightly flexed. The nails were square, flat, enlarged, grooved longitudinally and inclined to stand/

PLATE LXXXIV.



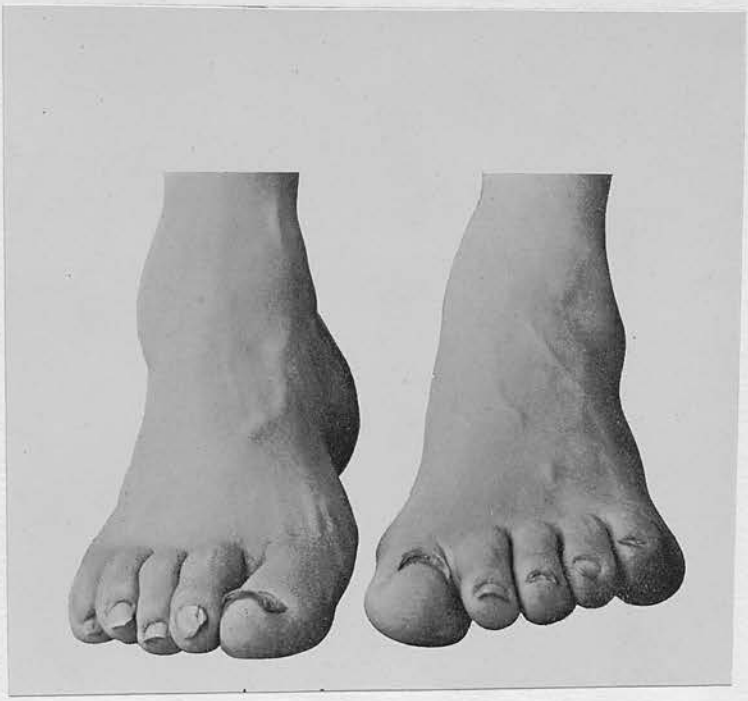


PLATE LXXXIV.

Hands and feet of E.A.S. 07 at the age of forty-two.

stand out from the fingers. The bones were enlarged and there were nodes on most of the phalangeal joints. The muscles of the thenar and hypothenar eminences were atrophied; the interossei and other muscles were also atrophied, but less markedly. The palm was covered with a thick pad of fat, the furrows were deeper and more strongly marked than is normal.

The wrist was enlarged. The lower ends of the radius and ulna were increased. The movements of the joint were unimpaired. There was no creaking or effusion.

The muscles of the forearm were flabby.

The elbow joint was normal.

The head of the humerus was slightly increased, but possibly the increase was more apparent than real and resulted from an increase of the glenoid fossa. The joint moved freely.

The clavicle was much increased; the scapula was increased, but less markedly than the clavicle.

The muscles of the shoulder joint were atrophied especially the deltoid.

Trunk:--

The thorax looked flattened and increased transversely./

transversely.

The mammae were small and the areolae pale; there were no hairs.

The sternum was large and rather flat with a very slight curve. It felt thick and broad.

The ensiform cartilage could be felt larger and less cartilaginous than normal, but still flexible. The ribs were increased vertically, the intercostal spaces being much diminished.

The abdomen was fairly plump and not pendulous. It showed no striae. The mons veneris was prominent; the pubic hair was abundant and coarse.

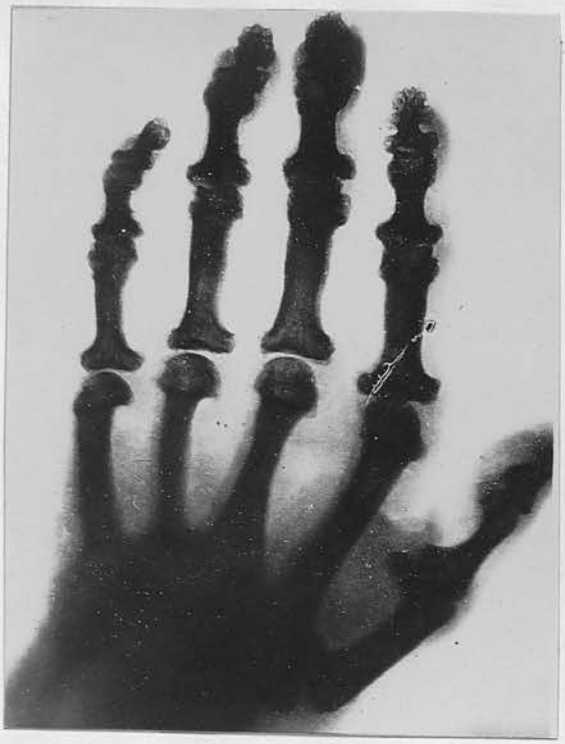
The pelvis was broad and roomy; the bones seemed massive and thickened.

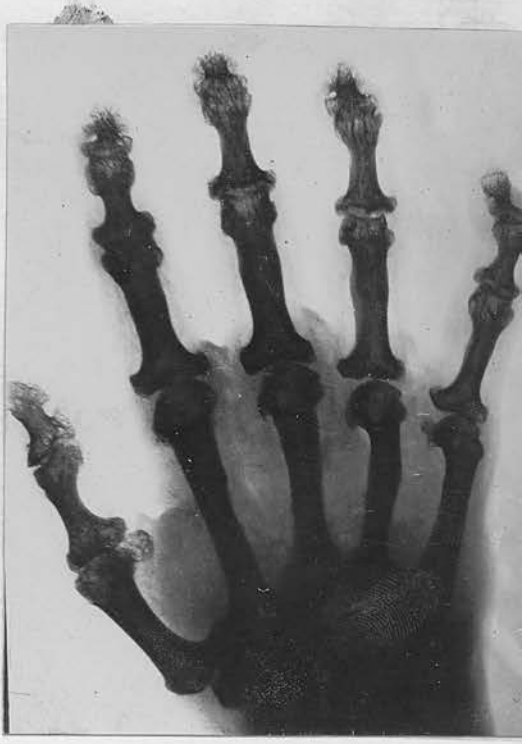
The external genitals were normal in appearance.

The spinous processes of the vertebrae could not be palpated except in the lumbar region. There was a cervico-dorsal kyphosis.

Lower Extremity:--

The foot was enlarged. The former size of her boots was 3; at the time of admission she required size/





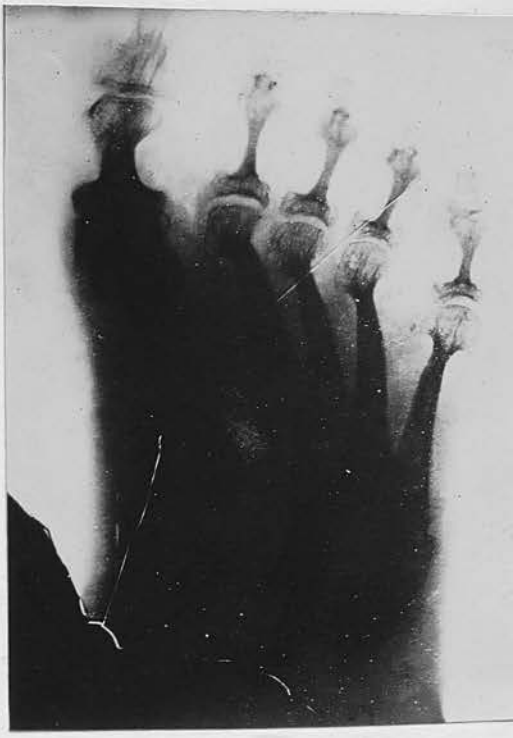


PLATE LXXXV.

Radiographs of the hands and feet of E.A.S. 07 at the age of forty-two.

size 7. It was very broad and flat, the great and little toes being especially increased in width.

The nails were small, had the appearance of being imbedded in the soft tissues and were grooved longitudinally.

The bones of the foot were all enlarged, but especially the phalanges and tarsals.

There was a thick pad of fat on the sole of the foot: this was especially thick over the meta-tarso-phalangeal joint and last phalanx. The furrows on the sole were deep and well marked.

The malleoli and astragulus were considerably enlarged, the os calcis less so. There was no abnormality about the movement of the ankle joint.

The muscles of the leg were poorly developed and rather soft. There was little subcutaneous fat.

The knee joint was enlarged, the bony prominences in the neighbourhood being thickened. There was some grating on movement.

The thigh was not enlarged. The muscles were poorly developed and soft. The buttocks were flattened and atrophied.

The right hip joint creaked on movement. The bone round the acetabulum was thickened. The great trochanters/

trochanters did not seem to be enlarged.

ALIMENTARY SYSTEM:--

The mouth, teeth and tongue have been described. The excessive salivation and occasional attacks of thirst have been noted.

The bowels tended to be constipated.

The stomach and liver were not enlarged.

HAEMPOIETIC SYSTEM:--

The pallor of the mucous membranes has been noted.

Examination of the Blood.

Haemoglobin 75%.

Red Blood Corpuscles 4,300,000 per cmm. some were crenated and shrunken.

Thyroid Gland:--

Formerly the gland was considerably enlarged; at the time of admission the enlargement had almost disappeared. Its characteristics have been noted.

Spleen:--

There was no enlargement.

Lymphatic Glands:--

There was no enlargement.

CIRCULATORY/

CIRCULATORY SYSTEM:--

There were no subjective phenomena.

The pulse was felt with difficulty. The rate was 80 per minute. The rhythm was regular in time, but irregular in force, an occasional stronger beat being followed by a weaker.

Heart:--

The apex beat was visible in the 5th costal interspace 4½ inches from mid-sternum.

The upper border was situated in the second interspace; the right border was 1½ inches from the right margin of the sternum.

The heart sounds were faint. The second sound was accentuated in the aortic area; in the pulmonary area, sometimes reduplicated. The sounds were otherwise normal.

INTEGUMENTARY SYSTEM:--

There were no subjective phenomena. In the sunshine or before a hot fire, a rash came out on the back of the hands. The rash caused great itching, lasted for a few days and disappeared.

The colour of the skin was pale; the texture, soft and smooth; the thickness, increased. It was inclined/

inclined to be moist; if the patient exerted herself in any way, it perspired freely. There was a brown patchy eruption over some parts of the body. There were three warts on the neck and warts on the extremities, but these were thought by the patient to have been present before the illness commenced.

URINARY SYSTEM:--

About a year before admission there was slight incontinence of urine, which spontaneously ceased after some months.

Urine:--

Average quantity -- -- --	30 oz.
Colour -- -- -- -- ---	Amber
Specific Gravity -- -- ---	1020
Reaction -- -- -- -- ---	Acid
Albumen -- -- -- -- ---	present.

No sugar, no bile, no blood, no phosphates, no deposit, except mucus.

Table showing amount of Albumen per oz.

10 Daily Observations, average amount of urine 30 ozs.

Day/

Day 1.--·35gr. per oz.		Day 6.--·7gr. per oz.	
2.--·43 " " "		7.--·7 " " "	
3.--·43 " " "		8.--·52 " "	
4.--·43 " " "		9.--·52 " "	
5.--·7 " " "		10.--·32 " "	

Table showing amount of Urea per oz.

10 Daily Observations, average amount of urine 30 ozs.

Day 1.-- 4·5gr. per oz		Day 6.-- 6·5gr. per oz.	
2.-- 1 " " "		7.-- 6 " " "	
3.-- 4·5 " " "		8.-- 5 " " "	
4.-- 2·4 " " "		9.-- 8·5 " " "	
5.-- 6·5 " " "		10.-- 5 " " "	

REPRODUCTIVE SYSTEM:--

The catamenia began at the age of fourteen and for six years were regular. There was no dysmenorrhoea. About the age of twenty, there were attacks of fainting just before or after her periods. She was medically treated and the fainting attacks stopped.

As already noted, the menstrual flow stopped shortly/

shortly after her illness began and since then has appeared once only about twelve years ago.

NERVOUS SYSTEM:--

There were no abnormal sensations, except that the hands often felt very cold. Sensibility to touch, pain, heat, cold, and electric stimuli was intact.

Sight:--

As already noted, the right eye was blind, except to slight perception of light; the left eye showed temporal hemianopsia. The pupils were equal and the margins regular. The left eye contracted to light and to accommodation. When the left eye converged, the right eye diverged and vice versâ.

Opthalmoscopic examination showed advanced optic atrophy in the right retina and in the nasal half of the left.

The sense of smell was unimpaired.

The sense of taste was not acute; her food required to be strongly seasoned before she could taste it.

Hearing was rather diminished on the left side. Bone conduction was normal

The muscular sense was normal.

Motor/

Motor Phenomena:--

The organic reflexes were normal. The cutaneous reflexes were intact save for some increase of the plantar reflex. The knee just on the left side was exaggerated, but no clonus of knee or ankle was present. Voluntary movement was perfect and there was no interference with co-ordination.

The vaso-motor and visceral functions were intact.

Intellectual Faculties:--

The patient was very intelligent and good tempered, possibly the memory was not quite so good as formerly.

Sleep:--

She was often drowsy during the day and at night slept long and heavily, about twelve hours.

Locomotor Condition:--

Walking was difficult, probably this was due to muscular weakness and to changes in the joints of the lower limb. Stooping and rising were attended with great difficulty.

DIAGNOSIS/

DIAGNOSIS:---ACROMEGALY.

TREATMENT:--

Thyroid gland substance was administered in the usual way. The amount given from time to time is not recorded.

PROGRESS OF THE CASE.

1899.

Weight:--

March 21st	9 st. 1 lb.
April 3rd	8 st. 12½ "
" 10th	8 st. 12 "
" 23rd	8 st. 11¾ "
May 1st	8 st. 11¼ "
" 8th	8 st. 11¼ "
" 16th	8 st. 10½ "
" 22nd	8 st. 9 "
" 29th	8 st. 8 "

The general condition seemed much improved when the patient left hospital in June 1899.

In/

In November 1899 she reported that she had steadily improved in health and was able to do some house work. She was also able to move about and to go for short walks.

For the next five years the illness progressed slowly, the patient's general state of health remaining fairly good. She continued able to do house work.

In March 1905, she returned to hospital for the treatment of two symptoms, fainting turns and slight lameness which, for some months, had been troubling her.

The record made on this occasion is:--

Present Age 48.

Readmitted March 4th 1905.

Present Complaint:--

Fainting turns and slight lameness. Patient has been fairly well since she was last in hospital two years ago. She has been able to do ordinary house work although her back has been always rather weak and she has had difficulty in stooping. She has been subject to attacks of faintness for many years and during/

during the last few months these attacks have become worse. Once she lost consciousness for a few moments. She has always been sitting when the attacks occurred and has never fallen or injured herself in any way. A year ago she slipped and hurt her left hip and since then she has suffered from stiffness and pain in it which have caused her to limp somewhat.

GENERAL FACTS:--

The patient is a picture of acromegaly. She has a slight cough. The morning after admission she took a fainting turn while sitting in bed. She became very white and lost consciousness, but did not fall back or cry out.

CIRCULATORY SYSTEM:--

The patient feels a warning feeling of nausea before the faint turns come on. These attacks have occurred about twice a week for several years back. There is no pain or dyspnoea.

Heart:--

Right Border 2½ inches from mid-sternum at 4th rib.

Left Border 4½ inches " " " " " "

Auscultation:--/

Auscultation:--

There is a soft systolic murmur in mitral and tricuspid areas; otherwise the sounds are healthy. The Pulse is regular in time and force. The vessels are healthy.

Expansion is small; pressure moderate.

ALIMENTARY SYSTEM:--

No subjective phenomena.

Stomach not enlarged.

GENITO URINARY SYSTEM:--

Urine:--

Reaction	Acid.
Specific Gravity	1012.

No sugar, no albumen, no blood, no bile.

NERVOUS SYSTEM:--

There is blindness, except for perception of light, in the right eye. On converging the right eye moves but slightly. There is some external strabismus of the right eye.

PROGRESS NOTES:--

There/

There were frequent attacks of petit mal. Bromides were administered with good effect.

Under massage the left lower limb became much less stiff and the patient was able to walk better. There have been no fainting turns since the day after admission. General health is excellent.

Measurements made at this time are included in the Comparative Table.

On the 29th of March 1905, she left hospital and retired to her home in the country where she remained until 10th April 1907, on which day she was readmitted to hospital for further treatment.

Her condition is recorded as being slightly more advanced.

Her height was 5 ft. 2 in.; her weight 8 st. 3½ lbs. She was able to move about and to do light work. She remained in hospital until the 30th of July pending arrangements being made for her future welfare, as her old home in the country was no longer available. During her stay in hospital, about the end of June, she had influenza. She got over this in a few days.

On/

PLATE LXXXVI.

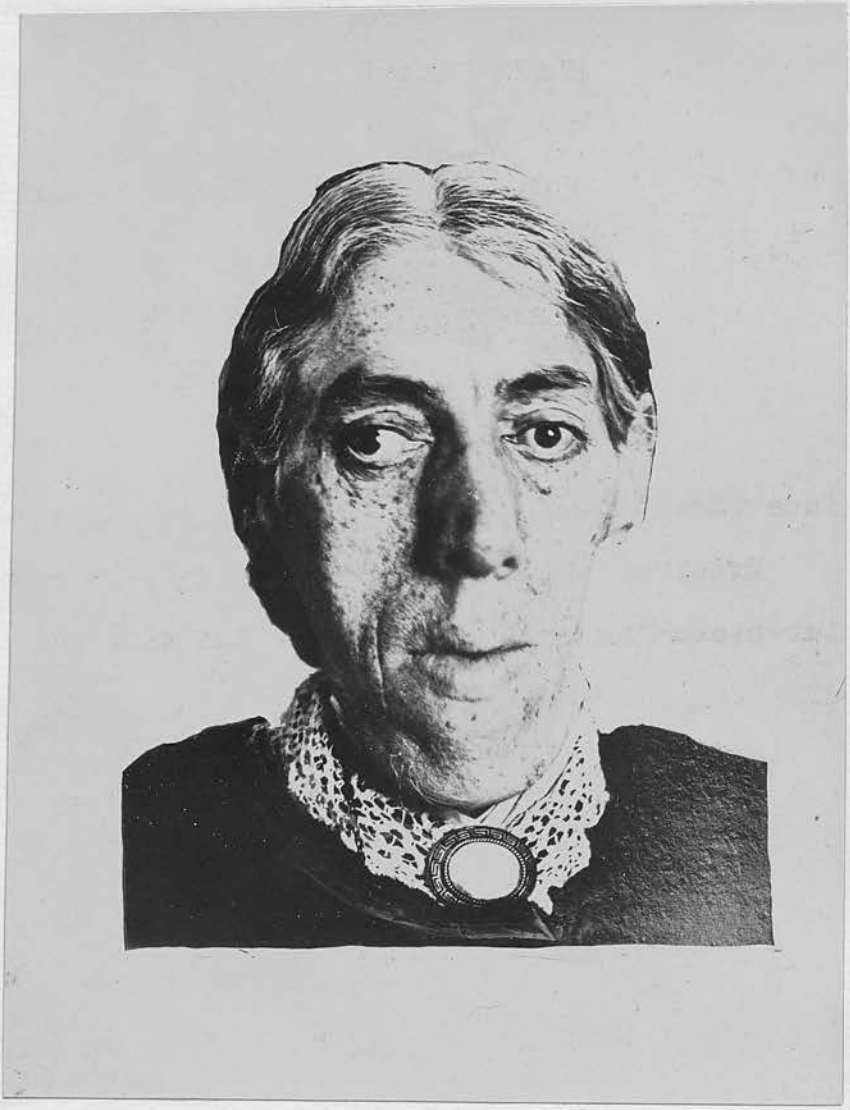


PLATE LXXXVI.

Full face view of E.A.S. 07 at the age of forty-nine.

External strabismus of the right eye and a peculiar blotching and freckling of the skin are well marked.

On the 6th of August she returned to hospital with an acute synovitis of the right knee, said to have been due to an accident.

On admission her temperature was 101.6° F.; her pulse 110. Her tongue was furred and she was perspiring freely.

Local treatment was adopted with, apparently, entire success. In two days her temperature was normal and nearly all the swelling had disappeared.

Next day the temperature rose again to 99° F. and the heart became affected.

Strophanthus and alcohol were administered without effect. The temperature remained above normal; the pulse was rapid, 110.

With a slowly falling temperature the pulse and respirations rose and she died at 7-30 a.m. on the 11th of August 1907.

Her weight, a few days before her death, was 9 st. 2 lbs.

Tables of Comparative Measurements.

The measurements recorded in the first two columns of these tables were made in 1899 and in 1905 by Dr.G. A. Gibson: those in the third column were made by me in 1907 after the patient's death. In order to/

to secure a standard for comparison they were made in a similar way and from the same points.

The results are recorded in millimetres.

E.A.S. 07. TABLE I.

Measurements of the Head and Face.

Date of Observation	1899	1905	1907
Circumference of the Head.	596	596	596
Length of Head, Antero-posterior arc, glabella to occiput.	350	380	378
Occipito Mental Length.	506	---	565
Ophryo-mental Length	243	245	256
Ophryo-nasal Length	82	83	84
Nose:--Greatest Breadth	47	50	38
From nasal spine to tip.	34	37	42
Septum Nasi to tip of chin	103	106	108
Bi-malar Breadth	140?	140?	126
Width of Mouth	70	68	55
Vertical depth of lower lip	65	--	62
Vertical measurement of lower jaw, from free border of gums to chin.	33	54	55
Length from Tempero maxillary joint to chin.	157	168	170
Bigonial mandibular arc.	309	---	310
Ears:--maximum Length	72	74	75
" maximum Breadth	43	--	44

Analysis/

Analysis of the Measurements of the Head.

A point of considerable interest is that in the eight years under review the circumference of the head remained absolutely constant, whereas the antero-posterior arc, glabella to occiput, increased about 30mm. The cranium, therefore, became more markedly akrocephalic.

The three measurements of the ophryo-mental length, 243, 245 and 256, are very remarkable. As, however, in 1907 it was impossible to close the mouth the probability is that the increase of 11mm in the two years 1905-1907 is due, in part at least, to posture.

The measurements recording the symphyseal height, 33, 54 and 55, and the length, tempero-maxillary joint to chin, 157, 168, 170, make it sufficiently plain, however, that the mandible grew steadily.

The recorded bimalar widths have obviously been taken in some way differently and, therefore, are useless for purposes of comparison.

The measurements of the nose show that it increased in prominence, but diminished in breadth.

Similarly, the ears grew slightly in height and breadth and the mouth markedly diminished in breadth/

breadth, presumably because the soft tissues or of the face were growing.

E.A.S. 07. TABLE II.

Measurements of the Neck.

Date of Observation	1899	1905	1907
Circumference at upper border of thyroid cartilage.	380	385	415
" at level of thyroid gland	400	---	430
Length of hyoid bone.	105	---	---
Depth of hyoid vertically in centre.	15	---	---

E.A.S. 07. TABLE III.

Measurements of the Trunk.

Date of Observation	1899	1905	1907
Circumference of chest over nipples.	880	---	880
Antero-posterior diam. of chest	310	---	206
Lateral diameter of "	342	---	286
Circumference of abdomen at umbilicus.	820	---	870
Circumference of pelvis over antero-superior spines.	875	---	840
Average width of ribs.	25	---	22
Sternum length	190	---	194
Breadth at 2nd costal cartilage	80	---	64

Analysis/

Analysis of the Measurements of the Neck and Trunk.

The neck markedly increased in size: probably this is to be explained by the growth of the goître. The fact that the circumference of the chest remained constant while the antero-posterior and transverse diameters apparently decreased enormously, suggests again that there was some difference in the method adopted. The circumference of the abdomen markedly increased; the circumference of the pelvis over the anterior superior spines decreased. That, as is shown later, was probably due to dilation of the colon; this to loss of fat.

E.A.S. 07. TABLE IV.

Measurements of Upper Extremity

Date of Observation	1899		1905		1907	
Side of Observation	R	L	R	L	R	L
Length of Arm; Acromion to Olecranon.	365	350	---	---	368	355
Circumference of Arm at mid-point.	240	240	---	---	205	190
Length of Forearm; Olecranon to Ulnar styloid.	205	175	---	---	255	252
Circumference of Forearm at mid-point.	180	165	---	---	205	175
Circumference of wrist	175	175	---	---	185	175
Length/						

E.A.S. 07. TABLE IV. (Continued)

Date of Observation	1899		1905		1907	
Side of Observation	R	L	R	L	R	L
Length of mid-finger; palmar fold to tip.	110	110	---	---	155	165
Circumference of little finger.	55	45	68	---	70	65
Length of mid-finger on dorsum knuckle to tip.	105	105	106	---	112	105
Length of little finger on palmar aspect.	55	50	68	---	45	45
Length of thumb on dorsum carpo-metacarp. joint to tip.	95	95	105	---	105	105
Circumference of thumb.	85	82	76	---	70	65
Antero-posterior diam. of middle finger.	24	20	---	---	26	20
Lateral diam. of middle finger.	10	14	---	---	26	24
Length of nail of middle finger.	14	13	---	---	11	11
Breadth of nail of middle finger.	15	15	---	---	13	125
Length of nail of thumb.	13	13	---	---	12	11
Breadth of nail of thumb.	20	20	---	---	17	16
Circumference of hand without thumb.	210	185	234	---	231	195
Circumference of hand with thumb.	235	220	---	---	260	234
Breadth of hand at meta-carpo-phalangeal joints.	105	90	---	---	117	105

E.A.S. 07. TABLE V.

Measurements of Lower Extremity.

Date of Observation	1899		1905		1907	
Side of Observation	R	L	R	L	R	L
Length of Thigh; Iliac crest to head of fibula	525	514	---	---	---	---
Circumference of thigh; mid-point.	398	380	---	---	385	350
Circumference of knee round patella	350	336	---	---	355	330
Vertical diam. of patella	75	70	---	---	74	71
Transverse " "	76	80	---	---	80	80
Length of leg from head of fibula.	380	380	---	---	380	385
Maximum circumference of calf	274	274	---	---	275	260
Circumference of ankle	255	240	265	---	260	255
Maximum length of foot	227	215	233	---	230	228
Circumference over heel and instep	326	326	---	---	345	335
Circumference of foot over back of toes	229	229	---	---	290	280
Maximum circumference of foot	270	270	310	---	290	280
Circumference of great toe	100	100	---	---	112	113
Circumference of mid-toe	50	50	---	---	---	---
Circumference of little toe	72	70	---	---	---	---

Length/

E.A.S. 07. TABLE V. (continued).

Measurements of Lower Extremity.

Date of Observation	1899		1905		1907	
Side of Observation	R	L	R	L	R	L
Length of nail of great toe	10	9	---	---	12	17
Breadth of nail of great toe	18	21	---	---	19	17
Length of great toe	60	58	86	---	80	76
Length of second toe	55	50	---	---	55	52

Analysis of the Measurements of the Extremities.

There are two exceedingly interesting points brought out by the tables of comparative measurements.

1. The right extremity is in both cases the larger.

2. The circumference of the proximal segments of each limb decreased markedly. The circumference of both forearms and of the right leg showed slight increase. The circumference of the left calf slightly decreased. The hand and foot definitely increased.

The/

The percentages of decrease and increase were:--

Right Arm	-- 17·1%	Right Thigh	-- 3· 3%
Left Arm	-- 21· %	Left Thigh	-- 8· %
Right Forearm	+ 14· %	Right Leg	+ ·36%
Left Forearm	+ 14·5%	Left Leg	-- 5· 1%
Right Hand	+ 10· %	Right Foot	+ 7· 4%
Left Hand	+ 5·4%	Left Foot	+ 3· 7%
		Right Great Toe	+ 12· %
		Left Great Toe	+ 13· %

It is worthy of note too that wherever a 1905 circumferential measurement is recorded it is greater than the 1907 measurement.

By hypothesis the greater growth of the right side of the body is diagnostic of an unequal distribution of cell anabolic power in favour of the right side. By hypothesis more proximal limb segments are less anabolic than more distal segments. By hypothesis the great toe is more anabolic than any other part of the lower limb.

Because of the definite diminution in the amount/

amount of the circumferential measurements of the limbs, and because of the diminution in pelvic circumference and nose width, I conclude that there was in 1906-7 a progressive loss of adipose tissue which corresponds admittedly to a rise of katabolism.

The percentage losses and increases therefore directly indicate the relative anabolism of cell areas, and it is evident from the table of percentages of decrease and increase that the left side, as a whole, was less anabolic (more katabolic) than the right, and that the more proximal segments were less anabolic (more katabolic) than the more distal: a striking demonstration of the working of the hypothetical principles advanced.

In the following chapters I describe the results of the post-mortem examination.