

**The cause and treatment of rickets : a thesis for an act for the degree of M.D. in the University of Cambridge / by Norman Moore.**

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THE CAUSE AND TREATMENT  
OF  
RICKETS.

A THESIS FOR AN ACT FOR THE DEGREE OF M.D.  
IN THE UNIVERSITY OF CAMBRIDGE.

BY  
NORMAN MOORE, M.D.,

OF ST. CATHARINE'S COLLEGE, CAMBRIDGE; WARDEN OF THE COLLEGE OF ST. BARTHOLOMEW'S  
HOSPITAL; CASUALTY PHYSICIAN AND LECTURER ON COMPARATIVE  
ANATOMY AT ST. BARTHOLOMEW'S HOSPITAL.



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*With the writer's kind regards.*

# THE CAUSE AND TREATMENT

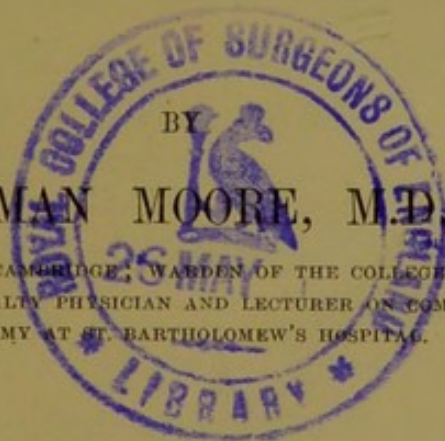
OF

# RICKETS.

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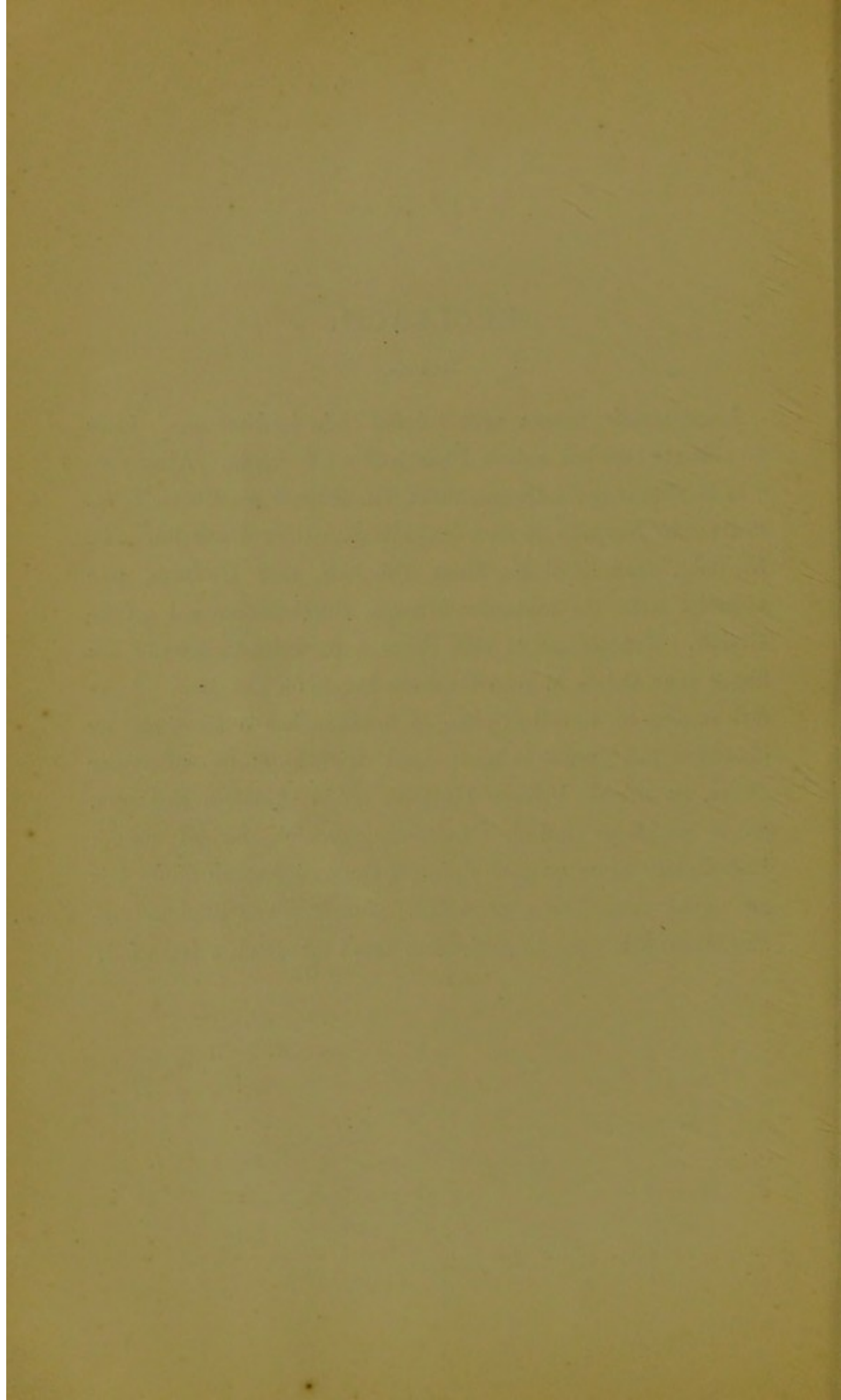
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## BROLLACH.

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Locc, aimsir, pearsa agus t-úcáid do 'n leabhar seo. Locc dó coláiste ospidéil naímh Phártholáin i Londoin. Aimsir dó ó lá Bealtaine go lá Deasgabhála, bliadhain d' aís Chríst 1876. Pearsa dó Normán Moore ó choláiste naímh Chaitríona. i . Normán, mac Roibeirt Ross Rómhan, mic Uilliam, mic Uilliam &rla. do mhuintir Mhoore Ruathalmhuine i ccùige Ulaidh. T-úcáid do, lé fáth ricets a thosbánadh agus lé n-a bheth mar thésis lé grád Dochtúr Leighis a fhágail. Agus fáth imorro an bhrollaigh seo lé buidheachas a thobheirt ar ghabhála mo ghráid is áirde agus deiridh go mo mháthair dhílis, go m'oide Uilliam Hérford, go 'n choláiste Eoghans, go 'n choláiste naímh Chaitríona, go 'n oispidél naímh Phártholáin agus go gach duine, a thug cúghnamh dhum leis an ngrád réráidhte a ghabháil. Buidheachas mór uaimse dhoibhson uile agus go gcuirfhidh Dia i mbealach a leasa iad.



# THE CAUSE AND TREATMENT OF RICKETS.

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No one, I suppose, now maintains what Boerhaave asserts of Rickets \*—"That about the middle of the seventeenth century there arose a new disease in the inland parts of Great Britain, spreading itself from thence through the whole kingdom and all the northern parts of Europe, called the Rickets." The first writer on the subject found it easier to believe that a new disease had arisen, than that one always existing had been overlooked. We who have before us so many examples of discoveries which seem to have been lying open before mankind since study began, but have yet remained unseen century after century till our day, must surely be inclined to reverse the order of probability. The history of science is full of instances which justify this. I will support my argument by two. Almost the whole range of diseases which we determine by auscultation must be considered as unknown till this century. It is true that some of their symptoms had been noticed and grouped, and that the diseases themselves were talked of and

\* Van Swieten, "Commentaries on Boerhaave's Aphorisms" (translated), Edinburgh, 1776, vol. xvii., p. 337.

sometimes truly distinguished; but accurate differential diagnosis was unattainable. Yet no elaborate apparatus, no vast advance of collateral science was necessary. Even the hint had been given, for Hippocrates had put his ear to the chest. He had listened, but he had not listened long enough; and this simple method of accurate diagnosis lay obvious but unseen till Laennec, two thousand and more years afterwards, set it before the world. The history of simple ulcer of the stomach presents another astonishing example. The disease may run an obscure course, but when perforation takes place the symptoms are terrific, and the *post-mortem* appearances easily recognised. The symptoms were observed. In the famous case of the Duchess of Orleans the morbid anatomy of the observers is accurate\* in its details. Yet it was a century and a half before Cruveilhier† appeared to put ulcer of the stomach on the list of well-known diseases.

If Pott had claimed the discovery and not only the explanation of angular curvature, the statues of Æsop would have been evidence against him. Among the ancient sculpture at the British Museum, there is a piece which seems modelled from an enlarged wrist-joint, but the fragment is too small to be of much value. Sculptors, no doubt, chose well-formed models. They were imbued with the principle that it is the province of Art to exhibit beauty and not deformity, and strove to exceed the best forms before them rather than to copy the first men they came across. The early painters followed the same plan, and though in one or two

\* Littré: "Médecine et Médecins," ed. III., Paris, 1875, p. 465.

† Littré: "M. et M.," p. 460.

instances I have noted a curve which seemed a representation of rickets, a more minute examination showed that the drawing in other parts was not accurate enough for argument from detail. The precept of Aristotle, that men should be represented not as they are but as they ought to be, has perhaps deprived the works of the great sculptors and painters of a good deal of pathological interest. I cannot quit this part of the subject without naming, though he lived too late to bear on my argument, a painter who has shown his skill in the illustration of this disease. In Hogarth's picture of the "Pool of Bethesda" a rickety infant in the arms of its nurse is represented in the back-ground. The enlargement and curves of the bones, the shape of the head, the position as the child sits on its nurse's arm, are accurately delineated. It is a tradition that the figures in this picture were drawn from patients of St. Bartholomew's Hospital. This one is certainly from the life.

Historians give incidental information on some varieties of disease, but rickets occurs too early in life to come under their notice.

In old medical writers, symptoms due to rickets are certainly described, though the morbid condition as a whole is unnoticed. The passage sometimes quoted from Hippocrates\* on joints is vague. Most of what he says is more applicable to caries of the vertebræ than to rickets. One sentence, however—"ἡδὴ δέ τισιν ἔλυσε καὶ δυσεντερίη πολυχρόνιος γενομένη"†—seems to me to indicate that his not very clear account of spinal curvatures includes some recollection of observations of

\* Littré: "Hippocrates," Paris, 1844, vol. iv., p. 177.

† Littré: "Hippocrates," vol. iv., p. 178.

rickets. The passage quoted by Navier,\* while giving its author no claim to a discovery, conclusively establishes the existence of rickets before the seventeenth century. Dr. Theodosius, writing about 1540, says :

“ The complaint is a weakness and inability to move, so that this child of seventeen months old can in no manner move itself, nor stand, and when it is carried in the nurse’s arms it can scarcely hold its head upright. Another symptom, the most cruel of all, is that three of the vertebræ of the true ribs bend outwardly and form a kind of hump-back, and the ribs appear to be arched in the manner of a bow.”

To sum up what records furnish against the hypothesis that rickets began in the seventeenth century. The presumption from the history of science is against it. Descriptions of symptoms more probably referable to this disease than to any other are to be found in older writers.

I ought not to pass on without a short account of the books on Rickets since its first accurate description. The honour of its discovery belongs to Glisson, one of the long train of physicians who, passing out of Dr. Caius’ Gate of Honour, have done so much to place English medicine in its high position. Seven other physicians, among whom was a Dr. Paget, assisted Glisson in the observation of the disease, and by the discussion of the several propositions of a treatise †

\* Van Swieten, vol. xvii., p. 347.

† The earliest edition of this book is dated 1650. The preface implies that more than five years had been spent in the preparation of the work, and from the fact that seven physicians discussed the design and composition, it is obvious that Glisson’s observations must have been widely known for some time before the actual publication

which was printed with the names of Glisson, Bate, and Regemorter upon the title page. The priority of his name indicates, what general reputation confirms, that Glisson had the largest share in the work. It is interesting to note how far the first series of observations went.\* The first chapter treats of the name and origin of the disease. The name is admitted to be in every-day use, but a classical derivation is suggested. Dorset and Somerset are thought to be the places of origin. The second chapter describes the *post-mortem* appearances. A large head, wasted muscles, loose skin, enlargements of the ends of the bones, deficient rigor mortis, pigeon breast, ribs with beads and distended abdomen are the chief points noted. Twelve chapters follow, which investigate the essence of the disease and a variety of similar questions necessary to bring the account of it into the formal position required by the medical system of the age. The next five chapters treat of the cause

of his book. Dr. Whistler, for whom this discovery is sometimes claimed on account of a thesis read at Leyden in 1645 (I have only seen an edition of it printed in London in 1684), ended his career by taking advantage of his presidency to defraud the College of Physicians. His thesis does not allude to any definite observations of his own, and has not the general aspect of an original work. If he read it in 1645, this was the very year that the plan of Glisson's book was made public. On the title page of Whistler's reprint are the words, "Ob defectum exemplarium novis typis conservandas hasce theses author voluit," and as it came out in the year of his death, but I think not after that event, it may indicate that he desired late in life to obtain more merit for his university exercise than it deserved. Glisson died in 1677, and though Whistler had been a Fellow of the College of Physicians from 1649, there is no history of any controversy during Glisson's life. I am of opinion that if Whistler did write on Rickets in 1645, he was indebted to Glisson.

\* Glissonius: "De Rachitide," ed. 3, Lugd. Bat. 1671.

and affinities of rickets. It is decided to depend on very many causes and to be hereditary in the same sense that gout is hereditary. The varieties, symptoms, diagnosis, and prognosis, are the subject of chapters xx, xxi, xxii, xxiii. The list of symptoms is long and accurate. The skin and flesh are less firm than natural, the joints weak, the body bent, the child learns to walk late and is averse to being shaken, there is a pigeon breast, the abdomen is swollen, very often there is a cough, the child will not lie on either side but only on its back, the pulse is feeble, a moderate ligature tied round a limb causes less swelling than in a healthy child, many bones bend, most often the tibia, fibula and radius, less often the humerus and femur, the long bones sometimes do not grow, the bones of the forehead stick out, the teeth come slowly and soon rot, the head is big, the face full, there is a swelling of the wrists, and less often of the ankles. Later observers have not added much to this list. This, with the account of the *post-mortem* appearances, is the valuable part of the book. The seventeen chapters of obsolete pathology have their proper reflection in thirteen on treatment. In Glisson's day the long tyranny was tottering, but had not fallen,

“wherein our ancestors betrayed  
Their freeborn reason to the Stagirite,  
And made his torch their universal light.”\*

Sydenham was at the university, but he had not yet come forward to rid medicine of the crabbed method which it had inherited from centuries rich in treatises, but poor in observations. Notwithstanding its scholastic

\* Dryden : “ Epistle to Dr. Charleton.”

dryness, Glisson's book deserves high praise, and if it were his only work, would entitle his effigy to the place of honour recently given it by the authorities of his college. He wears an old garb, but he belongs to the new school. He looks like his predecessors, but in his subject he shows himself their superior. His accidents, to use his phraseology, are those of

"Bernard and Gatisden and Gilbertin," \*

his essence is that of Sydenham.

Sydenham† only just mentions rickets, and the next writer of value is Boerhaave. His ten aphorisms add little to the previous account of the disease, except the error that there is a continued fever throughout. He denies fatty food, but his treatment is in advance of that of Glisson. He prescribes a light diet, proper clothing, warmth and exercise. The interesting historical commentary of Van Swieten, makes the perusal of this part of Boerhaave necessary to every student of rickets. Five more modern treatises deserve to be put in the first rank of books on the subject, those of Guérin,‡ Beylard,§ Trousseau,|| Jenner,¶ Gee.\*\*

Guérin, after an excellent summary of the symptoms of the disease, discusses the date at which it appears. I

\* Chaucer, Prologue.

† Sydenham, corrected by Pechey, ed. xi., London, 1740, p. 52.

‡ Guérin : "Mémoire sur les Caractères généraux du Rachitisme." Paris, 1839.

§ Beylard : "Du Rachitis." Paris, 1852.

|| "Clinique Médicale." Paris.

¶ Jenner : "Medical Times and Gazette," vol. i., 1860, p. 259.

\*\* Gee, On Rickets, S. B. H. Reports, vol. iv., pp. 69 and 265. The Shape of the Head, S. B. H. Reports, vol. vii., p. 1.

give his table for comparison with my own observations. Its defect is that he does not state how the commencement is fixed.

GUÉRIN'S TABLE OF AGE OF RICKETS.

DATE OF COMMENCEMENT.	NUMBER OF CASES.
Before birth .....	3
First year .....	98
Second .....	176
Third .....	35
Fourth .....	19
Fifth .....	10
Sixth to Twelfth .....	5
	<hr/> 346

The disease has three stages, those of incubation, of deformity, and of resolution. The period of incubation lasts from two to six months before the period of deformity begins.

He lays it down as a law, that the deformities in rickets proceed from below upwards, and thinks that this is not merely due to the fact that the legs are most pressed on, and therefore first bent. The remainder of the work treats of the pathological processes which occur in the bones and their effect on growth. It is important to add that Guérin produced rickets in puppies by feeding them too early on flesh.

Beylard's thesis is in its commencement valuable as a continuation of the history of books on Rickets from the time of Van Swieten. It contains some admirable plates of extreme cases of rickets.

Trousseau treats the subject with his usual clearness. He accepts the division into three stages. He maintains

that scrofula plays no part in the etiology of rickets. Cod-liver oil he thinks the best remedy.

Of Sir William Jenner's work on Rickets, that may be repeated which Johnson says of Milton's epic, that it is only not the greatest of its kind because it is not the first. It is altogether drawn from observation of patients. He goes into the causes of death more fully than his predecessors have done. The commonest is bronchitis; the others general cachexia, albuminoid infiltration, laryngismus stridulus, chronic hydrocephalus, convulsions, and diarrhœa.

Dr. Gee's papers on Rickets contain another series of original observations. He has "never recognised rickets setting in *de novo* later than at twenty months." He adds to the subject a more precise account of the shape of the rickety skull than is to be found in any previous writer.

There are many other\* treatises on this disease, most of which I have examined; but all that is of value is to be found in the seven I have described. Van Swieten's Boerhaave and Beyland's should be read first, as an introduction to the book-knowledge of the disease. Glisson, Guérin, Trousseau, Jenner, and Gee are faithful guides

\* Mayow, J., "Tractatus quinque Medico-Physici," p. 109, Oxford, 1674; Whistler, D., "De Morbo Puerili," London, 1684; Van Dalem, J. F., "De Rachitide," Lugd. Bat. 1732; Jay, S., "De Rachitide," Lugd. Bat. 1762; Bromfield, "Surgical Observations," vol. ii., London, 1773; Zeviani, G. V., "Della Cura de' Bambini Attaccati dalla Rachitide," Napoli, 1775; Underwood, M., "A Treatise on the Disorders of Childhood," ed. 2, London, 1801, vol. i. p. 281; Weatherhead, G. H., "A Treatise on Rickets," London, 1835; Vogel, "Diseases of Children" (tr. Raphael), New York, 1871; Théryc, J., "De l'influence du Rachitis sur la dentition et sur la locomotion," Paris, 1872.

for practical study. Each gives the results of his own observation of a large number of cases. This thesis will, it is hoped, add another series of independent observations. And it is undertaken in the conviction that the repetition of observations is never work thrown away. The chief writers on rickets are agreed on all the main points. My observations confirm their accounts except in one point : the affection of the liver and other viscera. Glisson says he found the liver enlarged but otherwise normal, and Sir William Jenner describes an albuminoid condition of the viscera. This has not been present in the *post-mortem* examinations I have had the opportunity of making on rickety children, but these have not been very many.

I shall accept Sir William Jenner's definition : "Rickets is a general disease manifested by certain lesions of the structure of the bones," and shall proceed to give a short account of the disease exclusively drawn from my own observations.

Rickets is found in children only, and most often attacks them while cutting their teeth, or just before they cut them. In the following cases it seemed possible to fix the age at which the disease began. All the children when examined showed unmistakeable signs of rickets.

TABLE I.  
AGE OF THE COMMENCEMENT OF RICKETS.

NO. *	AGE. †	OBSERVATION FIXING DATE.
128	10 weeks.	Screams when taken up.
143	14 months.	Walked at 11 months. Off legs at 14 months.
160	20 "	Walked at 19 months. Off legs at 20 months.
161	14 "	One month ago well. Cannot now walk.
163	14 "	One month ago well. Cannot now walk.
172	12 "	Screams when touched.
19	22 "	Could formerly walk. Cannot walk now. When touched in pain.
23	10½ "	In pain: was learning to walk when the pain began.
40	7 "	In pain when touched.
44	14 "	Cries when lifted.

The earliest age at which I have seen rickets is ten weeks. The latest at which it seemed to begin twenty-two months. It is a disease of indefinite length. It usually causes pain at its commencement. In one case the child, when seen on September 8, was in pain, and was free from pain after October 13. In another the pain which had begun about December 30 lasted till January 20. Rickets rarely causes wasting. Out of two hundred cases given further on, there was wasting in eight only. A considerable degree of plumpness is common. When wasting occurs the disease is often fatal, otherwise it is rarely so. Its early symptoms are pain on moving, restlessness at night, enlargement of the abdomen. In addition to these mothers and nurses speak of profuse sweats of the head. The pain, judging from its manifestations, is like that of acute rheumatism. The child refuses to walk, it cries when lifted; even

\* In Table iv., p. 22.

† Of onset of Rickets.

slight pressure makes it uneasy, and it throws off the bed-clothes at night. The duration of the pain has been indicated above. The refusal to walk is soon followed by inability to walk. If the child have not yet learnt to go, walking is delayed. Loss of walking power or refusal to walk from rickets is often mistaken for infantile paralysis. Two points distinguish rickets: the equal affection of both legs: the healthy action of the muscles on faradization. The disease may now be considered as well established. The child sits in a heap on its mother's arm, its back bent outwards, its shoulders drawn up. Its head is larger than natural, the frontal eminences are too prominent, the fontanelles remain too long unclosed. Its forehead is more extensive than that of other children. I have not found, what some writers assert, that rickety children are as a rule more intelligent than others. The head is ill supported. Its magnitude caused it in former years to be mistaken for a hydrocephalic head. The outline of the hydrocephalic head projects very much more forward than the rickety. In the rickety head the eyes are never depressed, and there is never a thrill to be felt from side to side of the head on percussion.

The following example shows the outline of the head in a well-marked case of rickets. The patient was a boy aged one year and three months.

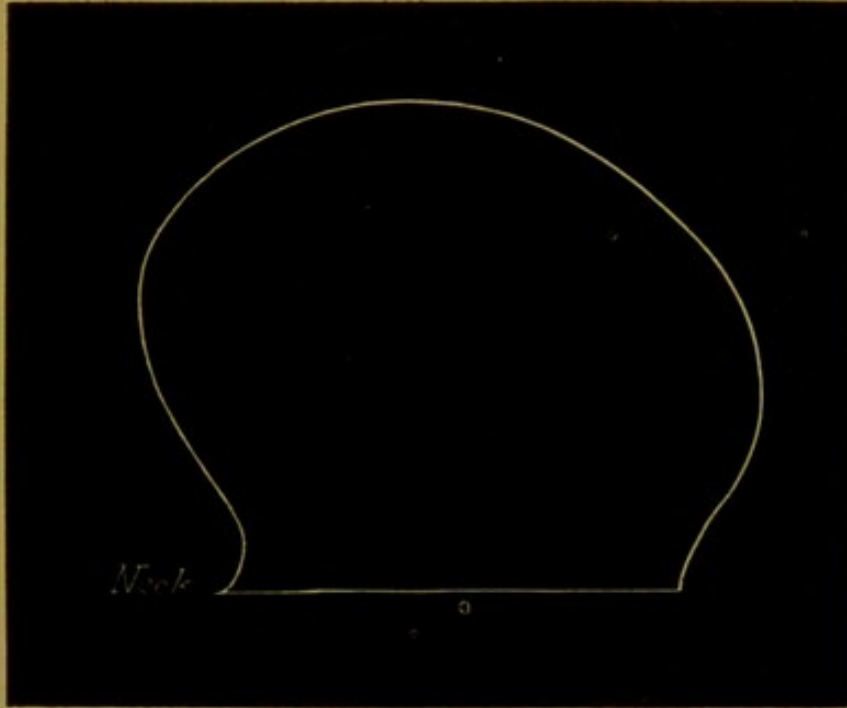


Fig. 1.

A thickening of the bone around the fontanelles is usually present. I examined every one of the two hundred cases in Table IV. with care, but did not find a single example of the softening and local attenuation of the occipital bone mentioned by Vogel. Nor have I seen any such appearance as that of his picture, in the *post-mortem* room. It is an almost universal symptom that dentition is retarded. The following Table illustrates this point.

TABLE II.  
DENTITION IN RICKETS.

NO. IN TABLE IV.	AGE OF CHILD IN MONTHS.	NUMBER OF TEETH AT THAT AGE.
19	24	12
23	21	11
24	16	6
30	13	2
31	11 $\frac{1}{2}$	2
35	17	12
36	12	2
37	18	10
41	24	6
42	12	0
82	20	10
83	14	6

In some cases the teeth decay soon, but I have not found this the rule. Out of the cases in Table IV., only six had decayed teeth. The muscles throughout the body are deficient in firmness. The softness of the bones is shown by the readiness with which those subjected to pressure bend. Sometimes this bending reaches the condition called greenstick fracture, in which the continuity of one surface only of the bent bone is broken. The bones most often bent are the tibiæ, and two varieties of flexure are common. In the more frequent of the two the tibia is simply bent outwards: in the other it is bent both outwards and forwards, so that in the one case it resembles that of a turnspit dog; in the other that of the armadillo. Next to the tibiæ the bones of the chest are most often bent. This is due to the atmospheric conditions to which they are subject in the pulmonary catarrh, which often

accompanies rickets, and the result is a pigeon breast. The following diagram shows the outline of chest thus produced in a rickety child.

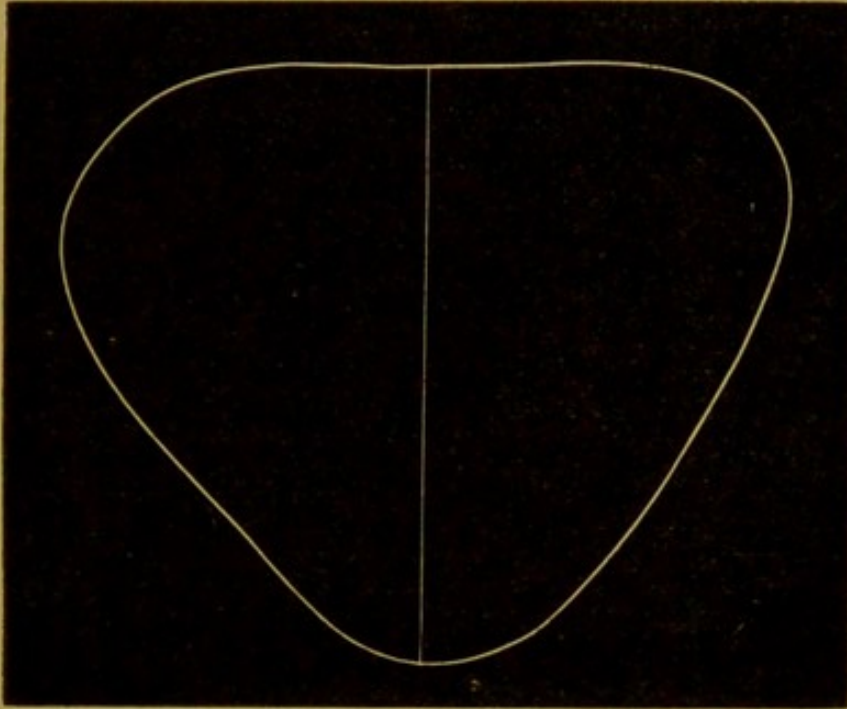


Fig. 2.

The arm bones and the femur are less often bent. The bones of the extremities are enlarged at their epiphyses. The ribs are beaded where they join the costal cartilages. The enlargement is partly on the bony rib and partly on the cartilage. These beads are sometimes absent on the upper ribs, and present on the lower ribs: they are more often on all, but are larger on the lower ones. They are found *post-mortem* to project more internally than externally. The vertebræ project internally above and below each intervertebral substance. This I have not found noticed in any author, but have observed in every *post-mortem* examination I have made. In one case I found some enlargements on the metacarpals

and phalanges of both hands. The temperature was not raised in a well-marked case of rickets, free from complication, which I observed morning and evening for some time in St. Bartholomew's Hospital.

Great variety in the grouping and degree of the symptoms occurs, but more than one is to be found in every case of rickets. The examples in the following Table illustrate this point :

TABLE III.  
COMBINATIONS OF SYMPTOMS IN RICKETS.

NO.	AGE IN MONTHS.	TEETH.	RIBS.	LIMBS.	OTHER POINTS.
79	36	All.	Small beads.	Great bowing of legs.	
80	10	6	—	Enlargement of wrists and ankles.	Very restless at night.
82	20	10	Beads small ; pigeon breast.	Great enlargement of wrists.	Restless at night.
83	14	6	Huge beads on ribs.	Enlargement of ankles ; bent legs.	Anterior fontanelle 3 inches wide.
84	21	8	Great beads.	Wrists not enlarged.	
85	29	All.	Beads small.	Phalanges and metacarpals enlarged ; wrists greatly enlarged ; ankles slightly enlarged ; slightly bent tibiæ.	Fontanelles closed ; restless at night.
87	17	7	Huge beads ; pigeon breast.	Wrists enlarged.	

Whatever the degree of the symptoms the rickety child has an extraordinary liability to pulmonary and intestinal catarrh and to eczema.

Authors are pretty well agreed as to these symptoms of a general morbid condition. As to the cause of the condition most are indefinite. The increase of manufactures, a bad constitution in the parents, these are the suggestions of early writers. Sir John Floyer, for whom no hypothesis is too far-fetched, thinks that the decline of the custom of baptizing infants by immersion may have something to do with it. Later writers generally give a considerable list of causes in which conditions of nurture are usually all classed together.

I have drawn up a Table of two hundred cases, the observation of which leads me to the opinion that the main cause of rickets acts through the digestive system and is improper feeding.

In this Table the age of the child is given in months.

TABLE IV.  
ETIOLOGY OF RICKETS.

NAME.	AGE IN MONTHS.	WHEN WEANED, IN MONTHS.	DIET.	AGE WHEN FED.	NO. IN FAMILY.	PARENTS.	OTHER POINTS.
Edgar Brandon.	18	13	Baked flour	Soon after birth			
Eliz. Avey . .	14	Never suckled	Dr. Ridge's food, topsand bottms., milk	Birth			
Wm. Harvey .	6	Never suckled	Nursery biscuits	Birth			
Eleanor Carter.	18	18					
Joseph Cave .	40	18					
Albert Holdsworth .	18	7	...	Birth			
Charlotte Manning . . .	36	12	Nursery biscuits	Soon aft. birth			
Geo. Burton .	14	12	...	...	First	Father 28 yrs. Mother 26 yrs.	
Robt. Brett .	29	12					
Alfred Webb .	30	30					
Walter Nye .	8	8	...	5			
Wm. Browse .	12	Breast but little	Beef tea, bread & milk, Robb's biscuits	Birth			
Chas. Coleman .	11	9					
Ann Hobbs .	18	13					
Chas. Vicary .	24	9					
Arabella Martin	26	9	Boiled bread	2	Fifth	Father 26 yrs. Mother 26 yrs.	
Henriet. Kenny	25	Never breast	Baked flour, condensed milk	1½			
Wm. Cooper .	9	11	Boiled bread	Birth	First	Mother 20 yrs.	
Edwin Hough .	24	...	...	...	Fourteenth	Mother married at 19 y., 15 children in 18 yrs.	
Henry Maynard	36	16	Bread & milk, gruel	Birth			

NAME.	AGE IN MONTHS.	WHEN WEANED, IN MONTHS.	DIET.	AGE WHEN FED.	NO. IN FAMILY.	PARENTS.	OTHER POINTS.
Jas. Baker . .	32	18	...	...	Third	Mother 24 yrs.	
John Timberlake . .	3	...	Robb's biscuits	2			
Ann Noble . .	21	22					
Alfred Thorne .	16	13	Bread & butter	5	Second	...	Whooping cough at 5 months
Charlotte Bonfield . .	21	20					
Ann Roseboro' .	23	22					
Saml. Elliston .	12	13					
Leopold Henry.	12	Not suckled	Condensed milk, bread	Birth			
Alfred Atkins .	15	13	Bread & butter, meat and potatoes	4			
Alice Boxall .	13	14	Boiled brd., Dr. Ridge's food	1			
Richd. Rogers .	11½	12					
Frederick Tribe	17	10	Bread	Birth			
Rebecca Haddingham .	27	15	Robb's biscuits	Birth			
Alice Davis . .	18	12	Various foods	3			
Claude Anderson .	17	13	Corn flour	6			
Robert Wilkins.	12	Never breast	Swiss milk	Birth]			
Ursula Cullum .	18	7	Bread, food of house	Birth	Second	Mother 25 yrs.	
Esther Smith .	7	...	...	...	...	...	At nurse, information uncertain
Alice Gunn . .	15	15					
Ann Brown .	7	4	Nursery biscuits	Birth	Fourth	Mother 27 yrs.	
Louisa Wade .	24	10					
Wm. Bateman .	12	...	Arrow-root, corn flour, bread & milk	3			

NAME.	AGE IN MONTHS.	WHEN WEANED, IN MONTHS.	DIET.	AGE WHEN FED.	NO. IN FAMILY.	PARENTS.	OTHER POINTS.
Edwin Brown .	23	14					
Wm. Evans .	14	9	Bread & milk	Birth			
Robt. Pennykek	25	18					
Thos. Daniel .	9	Never suckled	Corn flr., barley, oatmeal, bread	Birth			
Sidney Hadler .	21	$\frac{1}{2}$	Bread and milk	$\frac{1}{2}$			
Alfred Miller .	30	Never breast	Flour, bread & milk, Robb's biscuits	Birth			
Eleanor Simcox	60	18	...	...	Tenth		
Jane Dunnett .	12	12	Solids of all kinds	6			
John Sims . .	33	2	Various solids	2			
Henry Medley .	36	16					
Joan Philpotts .	22	12	Various solids	Birth			
Grace Barnes .	15	Never breast	Tops and bottoms, bread, Robb's biscuits	...	...	...	Twin
Florence Dive-price .	19	12	Corn flr., gruel, biscuits	Birth	Sixth		
Ellen Madoc .	22	11	...	...	...	...	Enlarge-ment of thyroid gland
Wm. Reid . .	42	18					
Chas. Lowe .	10	11	Boiled bread, bread & butter	Birth			
Harriet Serjeant .	9	10	Boiled bread & milk	Birth			
Alice Ansell .	12	13					
Horace Cleare .	30	14					
Jas. Allen . .	19	18					
Fk. Higgins .	19	11					
Arthur Cox .	33	19					
Edith Bribbe-combe .	14	13	Nursery biscuits	Birth			
Jas. Chambers .	12	Never breast	Oatmeal	Birth			

NAME.	AGE IN MONTHS.	WHEN WEANED, IN MONTHS.	DIET.	AGE WHEN FED.	NO. IN FAMILY.	PARENTS.	OTHER POINTS.
Ed. Brereton .	36	9	Various solids	3			
Florence Rogers	15	12	...				
Alfred Chater .	8	Never breast	Swiss milk	...	...	Mother 25 yrs.	
Remilion Snashaw . .	33	15					
Chas. Kent . .	6	6	Various solids	1			
Lottie Evans .	13	13	...	Birth			
Lydia Culpeck .	12	1	Con- densed milk, sago, bread pud- dings	1			
Edith Hodge .	11	Never breast	Various solids	Birth			
Geo. Hely .	22	23					
Esther Horne .	36	Never breast	Corn flour	Birth			
Grace Reynolds	12	11	Nursery biscuits, arrow- root, beef tea	Birth	...	...	Twin
Albert Jones .	10	8	Robb's biscuits, boiled bread	3			
Robt. Annisson.	13	15					
Wm. Karwell .	10	11					
Eliz. Walters .	24	12	Various solids	6			
John Powell .	20	21	...	6			
Hy. Baly .	14	15	Bread & milk	3			
Eliz. Warner .	21	Not suckled	Arrow- root, bread & milk	Birth			
Arthur Bellas- ton . . .	29	16	Bread & butter, bread & milk	9	Eighth		
Mary Clynch .	12	12					
Ernest Cham- berlayne . .	17	Never suckled	Dr. Ridge's food, baked flour, corn flr. Swiss milk	Birth			

NAME.	AGE IN MONTHS.	WHEN WEANED, IN MONTHS.	DIET.	AGE WHEN FED.	NO. IN FAMILY.	PARENTS.	OTHER POINTS.
John Evans .	25	9	Robb's biscuits	Birth			
Elizabeth Bell .	36	Never breast	Arrow-root biscuits, corn flr.	...	Second	Mother 24 yrs.	
Alfd. Beach .	13	10	Bread & milk	Birth			
Robt. Major .	16	16					
Florence Clarke	7	8	Robb's biscuits, arrow-root	Birth			
John Nailer .	16	13	Various foods	6			
Wm. Rints .	24	9	Robb's biscuits	Birth	Fourth		
Julia Applegate	40	16					
Henrietta Hynes .	36	2	Various solids	2	Seventh	Father 30 yrs. Mother 30 yrs.	
Harry West-land .	10	Never breast	Swiss milk, Robb's biscuits	Birth	...	...	Measles at 9
Jas Haith .	28	21					
Thirsa Hayley .	11	2	Various solids	2			
Constance Davison .	18	15					
Emma Wilson .	25	16	...	...	Seventh		
Robt. Brackenbury .	24	12	Boiled bread	2	Third	Father 24 yrs. Mother 26 yrs. Mother 27 yrs.	
John Knight .	14	13	...	...	Third	Mother 27 yrs.	
Richd. Ramsay.	18	18	...	...	Fifth	Mother 34 yrs.	
Lydia Bath-maker .	14	14	...	...	Second	Father 28 yrs. Mother 28 yrs.	
Susan Harrison.	32	12					

NAME.	AGE.	WHEN WEANED.	FOOD.	DATE OF FEED-ING.	OTHER POINTS.
Joseph Abrams .	10	...	Bread & butter	3	1st child (Died)
James Mansell .	4	No breast	Robb's biscuits, milk, Dr. Ridge's food	...	
Alice Theobalds .	16	16			
Amy Playle .	14	14	Various foods	6	
Charles Cooling .	19	19			
Eliza Smith .	36	12	Given brandy early		
Wm. Drew .	21	10			
Arthur Elgar .	63	11			
Wm. Griggs .	2½	No breast	Swiss milk, Du Barry's food, Dr. Ridge's food	Fr. b.	
Wm. Cronam .	12	13	...	...	Eclampsia nutans
Jas. Thane .	16	13	Sop-bread	3	
Albert Pelham .	9	10	Various foods	Birth	
Henry Smith .	12	12	Nursery biscuits	3	Great eczema
Frederick Burnet	4	...	Tea-cakes, con- densed milk	1½	
Kate Crook .	17	10	Robb's biscuits, bread & butter	2	
John Skinsley .	36	17			
Louisa Faucey .	22	½	Condensed milk	½	Twin
Wm. Fuller .	14	12			
Joseph Thompson	84	18			
Alice Davis .	20	20			
Florence Young .	17	...	Boiled bread and milk	Birth	2nd child
Ethel Fowler .	2½ (10 w)	...	Robb's biscuits	½	1st child
Henry Pepino .	2	2	Swiss milk, milk & bread		
Walter Hobbs .	27	8	Condensed milk	Birth	
John Caffle .	13	10	Various foods	1½	
Eleanor Gilbert .	15	2	Bread, &c.	2	
Wm. Matthews .	36	10			
Chas. Willcocks .	19	22			
Eliz. Smith .	6	...	Robb's biscuits	Birth	
Eliz. Steele .	22	11			
Harry Bateson .	24	No breast	Bottle-fed, Robb's biscuits	Birth	Mother 21, Father 27. Measles in 73
Louisa Wickens .	40	14			
Ann Pye .	12	...	...	...	1st child. Mother 24
George Middleton	16	No breast	...	Birth	
Ernest Mellows .	4	No breast	Dr. Ridge's food, condnsd. milk	Birth	
Francis Gommery	15	16			
Jane Grey .	13	½	Various	2	
Chas. Burton .	48	...	...	...	Mother mar- ried at 17 years
Agnes Burton .	24	...	...	...	Mother 31, Father 36 years

NAME.	AGE.	WHEN WEANED.	FOOD.	DATE OF FEED-ING.	OTHER POINTS.
Ernest Parkin .	8	No breast	Condensed milk, Robb's biscuits		
Wm. Cornell . .	36	...	...	...	1st child. Mother 27 at birth
Emily Fowler .	24	13			
Emma Cowing .	6½	...	Dr. Ridge's food	Birth	
Alexr. Hay . .	20	12			
Fk. Madell . .	36	12	Condensed milk	Birth	6th child. Mother 36, Father 32.
Eliz. Brimicombe .	27	9	Oatmeal, boiled bread	Birth	1st child. Mother 19 years
Arthur Gould . .	38	7	Bread	Birth	
Cath. Johnson . .	27	12			
Martha Gould . .	19	5	Various solids	Birth	
Art. Joyce . .	34	4	Foods of all kinds	2	
Alice Macelow . .	36	5	Various foods	Birth	
Wm. Gynge . .	22	13			
Alice Eames . .	22	15			
Thos. Marshall . .	15	12			
Herbt. Deer . .	8	...	Nursery biscuits, &c.	Birth	5th child. Mother 35 at birth
Geo. Astley . .	15	16			
Alice Webster . .	12	13	Bread & butter, &c.	3	
Wm. Heritage . .	29	No breast	Meal, milk, Dr. Ridge's food	...	1st child. Mother 25, Father 22
Louisa Cooper . .	15	3	Condensed milk, biscuits	3	
John Mitchell . .	16	13			
Ruth Parsons . .	27	13	Boiled bread	Birth	
Sarah Chambers . .	36	30			
Harry Barton . .	156	12	...	...	Scarlet fever at 15 m.
Joseph Turnbull .	36	12			
Lilla Brooke . .	12	3	Bread and milk	3	
Edith Walsh . .	14	13			
Emily Shord . .	12	13			
Ann Grange . .	26	13			
Alice Cooper . .	12	13	Various foods	Birth	
James Pain . .	36	Never breast	Various foods	Birth	
Alf. Richardson .	14	9	Corn flour, Robb's biscuits.	4	
Emily Bradford .	25	12			

NAME.	AGE IN MONTHS.	WHEN WEANED, IN MONTHS.	DIET.	AGE WHEN FED.	NO. IN FAMILY.	PARENTS.	OTHER POINTS.
Geo. Landray .	17	16	Robb's biscuits	3			
Louisa Albans .	20	11	various solids	3	First	M. 26, F. 27	
Hy. Saunders .	8	Never breast	Flesh, Dr. Ridge's food	Birth	Second	M. 29, F. 32	
Florence Ellis .	24	<i>id.</i>	various solids	<i>id.</i>	Second	M. 31, F. 36	
Hy. Aldridge .	24	<i>id.</i>	various solids	<i>id.</i>	Third	M. 34, F. 31	
Thos. Kitchen .	12	<i>id.</i>	various solids	<i>id.</i>	Fifth	M. 28, F. 35	
Sarah Smith .	24	14	various solids	<i>id.</i>	Fourth	M. 31, F. 36	Mother rickety
Mary Rodham .	24	Never breast	Boiled bread	<i>id.</i>	Second	M. 25, F. 26	
Melinda Bear .	24	Never breast	Bread, milk, broth	Birth	Ninth	M. 35, F. 34	
John Wilks .	13	16	Bread & milk	Birth	First	M. 22, F. 23	
Alice Reeves .	15	11	<i>id.</i>	Birth	First	M. 28, F. 31	Measles at 13 m.
Edith Church .	17	Never breast	Nursery biscuits	3	Second	M. 31, F. 33	
Joseph Holt .	24	<i>id.</i>	...	Birth	Second		
Chas. Dudley .	24	<i>id.</i>	...	Birth	First	M. 23, F. 25	
Thos. Foy .	11	<i>id.</i>	Bread & milk	3	First	M. 22, F. 25	
James Rowe .	6	<i>id.</i>	Robb's biscuits	Birth	First	M. 24, F. 30	
Ernest Vanston	9	<i>id.</i>	various solids	Birth	First	M. 26, F. 24	
Wm. Rickwood	14	15	Bread	Birth	Fifth	M. 32, F. 33	
Flor. Greening.	15	Never breast	Bread, eggs, flesh, Robb's biscuits	...	Second	M. 25, F. 25	
Wm. Rea .	7	<i>id.</i>	Boiled bread				
Christina Jones	13	<i>id.</i>	Arrow-root	Birth	First		

In the columns of this Table which point to cause, improper feeding is the most prominent feature. The child is suckled too long or fed too soon. Bad air, want of cleanliness, ill-nourished parents, may no doubt be presumed in some of the cases, but by no means in all, nor even in a majority, for the out-patients of the Children's Hospital in Great Ormond Street are often better to do than those of other hospitals. Rickets is, moreover, often to be observed in the children of the wealthy. I examined, while making these observations, the eldest son of a peer. He had enlarged wrists, beads on his ribs, and too few teeth for his age. He had been early given farinaceous food. His mother was a young healthy woman, his father about forty years of age. The Table shows that rickets has no direct relation to the position of a child in a family. Of forty-two examples chosen at random, in which I ascertained this point, more of the children were first born than of any other year, and twenty-three, or more than half, were first or second children. Three only of the children were twins. In thirty-eight cases in which the age of the mother was noted, it was found in twenty-six to be between twenty and thirty, while where the father's age was also ascertained, it showed no disproportion. Both were usually in the prime of life. The enquiry was always made whether, before its rickets, the child had had any acute disease. In one case whooping cough, in three measles, in one, scarlet fever had attacked the child before the first symptoms which could be referred to rickets. In one case, eclampsia nutans had existed almost from birth. In all these cases, there was also a history of improper feeding. Rickets in the mother was

looked for, and sometimes, but not often, found. It must be borne in mind that its traces diminish with growth ; but since the ignorance of the mother is often due to the ignorance of the grandmother, this circumstance may as well point to bad management in two generations as to heredity. In a few cases the mothers were scrofulous ; in not one phthisical, nor were there instances of any other specific constitution in the parents. Most of the patients were natives of London, but a few were born in the country. I once attended a well-marked case of rickets in the townland of Ballywatermoy\* in Ireland, and I have seen children with it in the country parts of England, of Provence, of Guienne and of Languedoc.

The cause of rickets, then, is not to be found in the wealth, the poverty, the nationality, the age, the diathesis of the parents. Nor can it be considered a result of previous acute disease in the children, nor of inherited disease. But in the vast proportion of cases, there is a distinct account of improper feeding. In some the child never had the breast, and was fed from birth on a variety of foods ; in others it was given food at an early age, and suckled as well. In a third set of cases suckling was continued past the proper limit.

I have not minutely examined the properties of the various artificial foods, of the bread, and of the arrow-

\* Co. Antrim. The child's ancestors came from the Lowlands of Scotland. Its grandfather, a skilful old gardener, took pride in recollecting this fact ; for he once said to me, speaking of his family, which has probably ploughed Irish soil for over two hundred years, " Nine generations and not one Irishman." Those who think rickets a peculiarly English disease will consider important this mention of the unmingled descent of the family of Wm. Hamilton, gardener, of Dunminning.

root, which are the chief foods given, because I believe the right principle to be that, before eight months, human milk, or failing that, beasts' milk, is the only wholesome nourishment for a child. After eight months or nine, weaning should take place, and the milk ceases to be anything but a starvation diet.

I will add an argument from animals. Dr. Harris\* had, a few years ago, some beagle pups which were fed from soon after birth on dog biscuits. Their legs were noticed to become bent and their joints enlarged. I felt well-marked beads on their ribs. They were given cod-liver oil, and in a short time ceased to show any signs of rickets.

In the summer of 1874 I took a young hen-harrier from its nest in the heather on Mathair Sliabh, a mountain of Tipperary. I brought the bird to London, and had to feed it on beef, with now and then a bird. The natural diet of this kind of bird of prey includes many insects, and possibly other elements of which we are ignorant. I hoped to make a pet of the harrier, but it ceased to thrive. It did not emaciate, but it became feeble. Its leg bones were soft, and after death could be slightly bent. During life they felt as if a very slight pressure would produce a greenstick fracture.

To sum up, I believe the cause of rickets to be improper feeding, because this is the prominent feature of the Table of two hundred cases, and because similar feeding produced similar results in Dr. Harris's beagles and in my hen-harrier.

The cause thus determined, the first point in the treatment of rickets is the regulation of the diet. If past

\* Of Gonville and Caius College.

eight months the child must be weaned. If younger, and fed on solids, it must either be given a nurse or be fed on cow's milk blended with a little water. Condensed or preserved milk may sometimes be a satisfactory substitute for cow's milk, but most of that bought by the poor of London is not a wholesome food.

It may be taken as generally agreed that cod-liver oil is almost a specific for rickets. It disagrees with a small proportion of patients. Out of the two hundred in Table IV., fourteen could not take it. Decoction of bark is perhaps the best remedy for these. If the child has to be weaned, it may be given decoction of bark for a week and then cod-liver oil.

The treatment of rickets, then, is to give cod-liver oil, and to regulate the diet. While the child is under treatment, a variety of grave complications may occur, or one of these may be the immediate cause of its being brought to the physician. Coughs, vomiting, diarrhoea, eczema, strophulus, laryngismus stridulus; these are the chief complications. One often sees cough mixtures given for the first, sedatives for the second, astringents for the third, local applications for the skin affections, and bromide of potassium for the laryngismus. Of the cough it may be said that while rickety children are especially prone to it, if there be no wasting, the child is rarely in danger. Where the diet ordered is the only food given, the vomiting may be the result of too frequent feeding, or of pre-existing gastric catarrh. In either case the first point is to feed very slowly, and in very small quantities, almost drop by drop if necessary. This labour is usually repaid by cessation of the vomiting. The diarrhoea is often prolonged and severe. If there

are irritating substances actually in the intestine, they are beneficially cleared out. It takes longer than would be supposed for an infant to get rid of a stomachful of arrowroot. If there be no irritating substance, the diarrhœa is due to a catarrh incidental to the rickety condition, and perhaps brought on by some slight external chill. The skin diseases mentioned above may be produced in children not rickety by some irritating meal. In the irritable condition of the alimentary canal, which accompanies rickets, it is to be expected that they should often appear. Where scabs are formed, of course they should be poulticed off, and simple ointment applied. This is a mechanical necessity, just as splints are to the straightening of bent legs. Laryngismus stridulus differs from the five preceding disorders in being of a spasmodic nature. It has been much written on, and its clinical features are admirably described in Dr. J. Clarke's book on the Diseases of Children,\* but neither he nor any of its other describers seem to recognise sufficiently its constant relation to rickets. I have seen many cases, and never one in which the child was not rickety. It is the nervous disorder of the rickety constitution, just as chorea is the nervous disorder of the rheumatic constitution.

It has been shown that rickets arises from digestive disturbance. It follows that the more rest the stomach gets the better. But astringents and gastric sedatives oppose one powerful action by another; the same may be said of drugs given to act remotely on the skin, as arsenic. All such then tend to increase rather than to diminish the rickety condition, and while the child

\* Commentaries on some of the most Important Diseases of Children. London, 1815, p. 86.

remains rickety, the least exciting cause will bring back the diarrhoea which the astringent has checked. Anti-spasmodics and nervine tonics are given in neuroses, because, since the cause of the disturbance of the nervous system is unknown, we hope to give relief by immediately attacking the nervous system. It is like plugging because an artery cannot be found to be tied. It acts for the time, and sometimes for good, but it is confessedly a make-shift method. How the connexion exists we do not know, but since it is clear that the laryngismus stridulus depends on the rickets, it is surely the best method to treat the general condition and so cure not one attack only, but also all tendency to future attacks.

Cod-liver oil is the best known remedy for rickets, and I have again and again been astonished at the certainty with which the complications disappeared without special treatment. Where the cod-liver oil had been stopped to treat the cough or the enteritis, recovery has always flagged, and relapse been frequent.

I can honestly say that I started and continued in a long course of observation of this disease with no pre-conceived hypothesis, and that several hundred cases have brought me to the conclusion that rickets is a constitutional condition due to improper feeding, and that in treating its complications the treatment should be general and not symptomatic.

THE END.

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