University of Edinburgh

Thesis

presented for the Degree of M. D.

by

Hugh Ernest Fraser

M.A.(Edin.) M.B., C.M.(Edin.)

April. 1897.

Subject:—

"Chlorosis,

"The Anaemia of Adolescence:

"Its Symptoms, Causation, Nature & Treatment."

"with a Record & Analysis

of some Clinical Cases.

Table of Contents.

The term Chlorosis has been employed in so many different senses by writers, that, in order to keep my meaning clear, it is well here to define it provisionally as a disease which occurs in young adults, chiefly about the age of puberty, determined most often by actual loss of blood or insufficient nourishment, & always characterised by diminution of the Haemoglobin contained in the red blood corpuscles. To thus limit the meaning is necessary when one considers that the term has been used to express any anaemic condition from oligocythaemia to oligochromaemia, due to any cause.

The disease has been often limited to females, but this I think is an incorrect view to take of it; undoubtedly however a very large proportion of the cases occur in females. There is a type of the disease, which must, on anatomical grounds, be considered as peculiar to females (vide postea p 51) but such cases are exceptional.

The word Chlorosis is derived from (Gr.) χλωρός = green — the underlying

idea, being the colour of the skin in patients suffering from the disease – a "greenish-yellow" pallor. This tint is more observable in persons whose complexion is dark, in whom also I find the disease to be more common.

The connection between the disease and abnormalities of the sexual functions early attracted attention, hence the terms Morbus virgineus, Pallor virginum, Foedus virginum color, Febris virginea, – which one meets with in the writings of the older physicians. To unsatisfied sexual desire many writers ascribed a causal influence, hence Icterus amantium, Febris amatoria &c. &c.

Hoffmann (Dissertatio de genuina chlorosis indole, origine, & curatione, 1731) was the first to give a description of chlorosis as a separate disease, and since then it has usually been described as one of the idiopathic anaemias. The blood was first examined by Foedisch in 1832, × after him by others including Johann Duncan in 1867, who pointed out the lack of Haemoglobin was the important pathologi-

-cal factor (Sitzungsberichte der Academie der Wissenschaften zu Wien, 1867 Bd. 55, S. 416ff.) Certain cases were put on a sound pathological basis by Virchow in 1872, by the publication of his work, - "Ueber die Chlorose "und die damit zusammenhängenden Anomalien im Gefässapparate u.s.w."; and during the last 25 years the invention of accurate instruments for estimating the number of blood corpuscles, & the amount of Haemoglobin, has permitted a diagnosis to be made more easily, & exactly, than was previously possible.

The advance in our knowledge of the actual causation of all cases of what is clinically recognised as chlorosis has been by no means so great, & no one theory to account for the observed facts, out of the many put forward, can yet be said to be wholly satisfactory.

It has been alleged that chlorosis is more common in modern times than formerly, (Hirsch & Huss, - quoted by Immermann, in von Ziemssen's Cyclopaedia of the Practice of Medicine Vol. XVI, English Translation

1877), and if that be so, – as is likely, considering the large number of young persons who suffer – some causative influence may be attributed to the results of modern civilisation, which tend, on the one hand, to keep alive persons who would not survive under less artificial circumstances, and, on the other, to reduce persons naturally above the average in health, to a position below par, owing to the high pressure at which they are obliged to live.

As to the geographical distribution of the disease, it is hard to find data which one may regard as trustworthy, & this is likely to continue to be so, until all are agreed as to the disease connoted by the word Chlorosis. Immermann (l.c. p. 499) says the disease is almost pandemic in Northern Europe & not at all rare in Southern Europe, while in non-European countries it is prevalent, "here & there, independently of other more special forms of anaemia – e.g. malarial cachexia, geophagy, or anchylostoma-disease, &c." Hirsch (Geographische Pathologie, 1860) is of the same

opinion, and he emphasises the necessity of receiving with caution reports as to the prevalence of the disease in tropical regions, pointing out that some writers use the term as synonymous with anaemia E.g. malarial chlorosis as meaning malarial anaemia.

Chlorosis differs from other forms of anaemia in certain points, which are however not essential – E.g. its frequent occurrence in females, its coincidence with puberty & the early years of sexual life, its association with anomalies in the development of the vascular or of the genital apparatus. These last are not common, and apart from them, its transitory nature under treatment with Iron is well marked.

In describing the disease, I shall endeavour to follow a definite plan, viz: first to consider the morbid anatomy, secondly the signs & symptoms during life thirdly the causes which may & do lead to it, fourthly the nature of the disease & some of the hypotheses which have been advanced to explain it, and lastly the treatment.

Morbid Anatomy.

I have had no opportunity of making a section, or of observing one when being made, and I am thus obliged to fall back on the descriptions of others.

According to Immermann, (l.c.), the body is usually well nourished but is pale, both externally & internally. Fat may be present in considerable amount, & is often of a paler colour than normal. Effusion into serous cavities is uncommon, and the blood is pale — a characteristic even more marked on microscopical examination. Its staining power is lessened, & on incinerating a small quantity of it & examining for Iron, the Iron is found to be reduced — indicating a diminution of Haemoglobin, — sometimes as low as 1/2 or 1/4 of the normal. In certain cases of the severer forms, there is a diminution in the calibre of the aorta (Virchow), which may be so small as barely to admit the tip of the little finger, whereas in ordinary cases it readily admits the thumb. The size of the aorta in such cases has been

compared to that of a normal iliac or carotid artery (Rokitansky). The coats of the vessels are abnormally thin but it is said that the vessels are not on this account more brittle or more readily torn than usual. Their elasticity is said to be increased. If this "hypoplasia" or congenital poorness of development be excessive, & if the body have been badly nourished, the vessels will be diminished in length as well as in breadth. These anomalies may be associated with deviations from the normal in the origin & distribution of the large vessels given off from the aorta, & this is chiefly so in regard to the descending thoracic aorta from which the intercostals branch out in an irregular fashion. There may also be a certain degree of irregularity in the abdominal aorta. Virchow draws attention to the wavy or trellis-work-like condition of the inner coat; which may be the seat of fatty change, often patchy in its arrangement, & most marked near the commencement of the ascending aorta, but may be seen also in the descending aorta. The

fatty change may also be seen in the middle coat – usually only with the microscope, & it is analogous to the fatty change seen in the heart with which it is usually associated. The heart may be smaller than normal but more often it is unchanged. Dilatation & hypertrophy of the left ventricle may be present & Virchow says the hypertrophy is a true one in such cases as present a narrowing of the aorta. Sometimes the endocardium is affected with the fatty change (Gravitz – Klinische Pathologie des Blutes 1896). Whether these changes are due to a long existing chlorosis, or are developmental in character has not yet been determined, but Fränkel (quoted by Gravitz) says they are by no means to be invariably found, & certainly it is hard to imagine that they exist at all in cases which soon get well under suitable treatment. The Spleen is usually unaffected, as also the kidneys or suprarenal bodies. The thyroid may be enlarged even when no Exophthalmos, or other sign of Graves's Disease

be present, but probably this condition is concomitant. The genital system shows at times marked anomalies, at times no abnormality. The anomalies may consist of a poor development of the organs - the uterus infantile, pelvis ill-developed and also the pudenda, pubic hair, and breasts. (Stieda, Zeitschrift für Geburts-hülfe und Gynaäkologie Vol. 32. pt. 1, 1895). Hart & Barbour (Manual of Gynecology 2nd Ed. pp. 258 & 278) say that primary atrophy of the uterus occurs in chlorosis, and Mitchell Bruce (Quains Dicty. of Medicine, 1886) says the ovaries & uterus vary from the infantile type to one of immoderate development. Immermann (quoting Virchow) says there is no constant anatomical condition in the genitals of chlorotic women. Sometimes they are small & ill developed, at other times unduly large & vascular. These conditions, it is to be noted, do not have any constant relation to the degree of severity of the disease even when of the recurrent type which he associates with defective development of the

vascular system. The ovaries present wide limits of change in size, vascularity and richness in follicles. In the uterus there may be a striking want of proportion between the body and the portio vaginalis, the former being small and the latter relatively large. Virchow says in such cases the womb — in sympathy with the imperfectly developed ovaries may be actually too small for the reception and development of an ovum. Further enquiries are needed to determine how far the condition of the heart & sexual organs correspond — whether defective development of the former is always associated with defective development of the latter, & hypertrophy of the heart with abnormal size & vascularity of the parts of generation. Virchow seems inclined to think that such a correspondence does exist — at any rate he connects diversities in the functional activity of the sexual organs — especially amenorrhoea and menorrhagia, with differences in the condition of the heart, no less than

of the sexual organs themselves.

The bones maybe ill developed – but this is usually part of the general state of ill-development found in certain cases. The marrow of the bones is not so markedly changed as one would expect, & there apparently the formation of red blood corpuscles goes on with but little diminution of activity.

Symptomatology / Semeiology

1. Haemopoietic System.

Before going on to consider in detail the changes which occur in the Haemopoietic System, I shall refer shortly to the blood in health. The blood is an alkaline fluid of Sp. Gr. 1035 – 1075 – the alkalinity being due to the presence of Sodium phosphate & sodium bicarbonate, and is made up of serum in which are various formed elements. The latter are chiefly (1) "Red" cells – biconcave non-nucleated discs measuring about 8 μ in diameter (2) smaller red cells, sometimes nucleated. (3) Blood plates – small irregular flattened.

and (4) colourless cells - so called leucocytes.
1. The red blood corpuscles are the oxygen carriers of the body in virtue of the Haemoglobin they contain, which is able to form an unstable combination with Oxygen.
2. Small red corpuscles - probably young red blood corpuscles.
3. Blood plates. Their significance is much disputed, & so per speculative.
4. Leucocytes are wandering cells, and have the power of changing ~~their~~ shape under suitable stimuli, and of enclosing & absorbing foreign material: probably protective.

In examining the blood, I employed the following methods as regards enumeration of Corpuscles & estimation of Haemoglobin. The finger of the person whose blood was to be examined was carefully cleansed with soap & water, & after having been dried was washed with Ether. It was then pricked with the instrument provided for the purpose - Gowers's Haemacytometer being used - and the requisite amount of blood removed with the pipette - 5 mm^3.

& placed in a vessel containing 995 mm^3 of a solution of 26 grains Na_2SO_4 ~~in~~ in $\frac{3}{4}$ of Aq. Destillata. The mixture was freely agitated, & a drop of it examined on the divided slide under the microscope. The average of corpuscles lying in a number of squares per square is then taken, & multiplied by 100,000 which gives approximately the number of corpuscles p. mm^3.

The Haemoglobin is estimated by adding to a given quantity of blood - 20 mm^3 in a tube graduated so that 100 degrees = 2 cm^3, - distilled water until the colour of the mixture equals that of a standard colour in a similar tube. The amount of the mixture is then read off - giving the percentage of Haemoglobin. (Gowers's Method) Other methods of determining the Haemoglobin content are (1) the titration method as used by Preyer, Subbotin (Zeitschr. für Biologie, 1871, Bd. VII) Quincke (Virchow's Archiv, Bd. 54, 1872) (2) the spectrophotometric method as used by Lichtenstein (Untersuchungen über den Hb-Gehalt des Blutes, Leipzig, 1898) - (3) the method of drying the

blood & taking the Sp. Gr. of the Solids, (4) by means of Hénocque's Haematoscope, (5) Hedin's Haemotokrit, and (6) v. Fleischl's Haemometer. At best these methods are but approximate as regards results, but undoubtedly some give closer results than others - the result being that fair comparisons of the Hb-content of cases examined in this country where Gowers' instrument is commonly used, cannot be made with continental observations, as in France & Germany, the haematoscope & haemotokrit are more often employed. Biernacki - ("Untersuch. über die chemische "Blut-beschaffenheit bei pathologischen, "ins Besondere, anämischen Zuständen", Zeitschrift für klinische Medecin, Bd 24, 1894) says the diminution of Iron is at times only slightly capable of proof, at times not at all. This, however, is not a view held by many clinicians.

Here I would remark that it is probable Gowers' Haemoglobinometer is standardised too high for the blood of many persons even in health - in women I found it difficult

to reach 90% with their blood, while in the case of young men 95% was rare.

Mere pricking of the skin is sometimes insufficient to permit of a sufficient flow of blood & as pressure on the part is out of the question, a better method is that by which blood is drawn from a vein through a puncture by a fine hollow needle attached if necessary to a syringe. The amount of blood removed is in this way controlled with exactitude & the pain inflicted is less if anything than by the other means.

As to the best time for removal one must take care not to operate too soon after a meal, nor after sweating or diarrhoea.

In ascertaining the Sp.Gr. of the blood & of the serum, one may employ the following method. A drop of blood is introduced into a fluid of known Sp. Gr. in which it does not readily dissolve, as E.g. glycerine & varying proportions of water; the drop sinks, remains stationary or rises according as the fluid is of less, equal or greater density, & by ~~ascertaining~~ noting

the Sp.Gr. of the fluid, the Sp. Gr. of the blood is at once known. Similarly with regard to the Sp.Gr. of the serum, & of the R.B.C & other corpuscles - a suitable centrifugal apparatus having been used to separate the cells from the serum.

Here one may note that Siegl (Quoted by v. Jaksch, Klinische Diagnostik der inneren Krankheiten 1892 p. 6) says that the Sp. Gr. of the blood varies directly as the Hb-content, & accordingly any changes occurring in the Sp. Gr. can be at once determined if we know the Hb-content.

The difficulties in obtaining trustworthy results are to a large extent due to factors unconnected with any apparatus & may be summarised as follows :- (1) Variations in the composition of the blood during the day from such causes as the taking of food, (2) Variations in the density of the blood due to vasomotor changes, & the connection between lymph channels & the blood, (3) variations due to sex - females having

fewer corpuscles & less Hb than males (4) variations due to age – the cells being increased in number during the early days of life, decreasing during the early years & increasing again in adult life: (5) the inability to determine the total amount of blood in the body in health or disease: (6) difficulties dependent on individual peculiarities in observed or observer.

The following tables given by Gravitz (l. c.) will serve as a standard. Firstly as to the densities, the percentage of blood to serum under normal conditions is represented by the formula:

$$\frac{100(D_3 - D_1)}{D_3 - D_2}$$

where D_1 = Sp. Gr. of whole blood
D_2 = " " serum
D_3 = " " R.B.C.

and this gives an average of

D_1 = 1056
D_2 = 1030
D_3 = 1082

From examination of a large number

of cases the following "Tables of Normals" have been constructed

I The Whole Blood

Sp. Gr = 1055 – 1060

Dry Solids = 21 – 22 %

Hb Amount = 13 – 14 %

II Red Blood Corpuscles *

Number p. m m³ in Males – 5,000,000

Do Do Females – 4,500,000

III Colourless Corpuscles

Number p. m m³ – 5,000, to 10,000.

IV Serum

Sp. Gr. = 1020 – 1030

Dry Solids = 10 – 10.5 %

V Volume of R.B.C. in whole Blood

according to Arronet (Schmit – Zur Blutlehre, Leipzig 1892 is 39.9 – 52.9 Average 47.8 %: according to Hedin (Ein neuer Apparat zur Untersuchung des Blutes (Haematokrit) Skand.

* Graeber (Zur klin. Diagnostik der Blutkrankheiten: Arbeiten aus dem med. klin. Institute zu München, Leipzig, 1890, S209) gives the average number in 28 cases 4,482,000 (5,700,000 to 3,805,000) p. m m³ Reinert (Blutzahlungen, 1891) gives the number as found by many observers as generally below the average.

Archiv für Physiologie 1890) 48% for men & 43·3 for women: according to Gärtner (with a modified Haematokrit) and Römer (wiener klinische Wochenschrift 1892 No. 2) 42 to 48%, and according to Bleibtreu (Pflüger's Archiv Bd. 51, 1892 S 151) and Pfeiffer (Centralblatt für innere Medecin 1895 No. 4) 34·5 – 55·8% average 44·2%

In Chlorosis the alkalinity of the blood is by some – Graeber (quoted by Gravitz) said to be increased, by some – Leiber, Kraus & Rumpf (quoted by Gravitz) said to occasionally increased, occasionally normal, and by v. Jaksch (l. c) said to be diminished. Graeber laid great stress on this increased alkalinity & thought that to this disturbance of the plasma was due the alteration in the size, form & staining capacity of the R.B.C.

The Specific Gravity is diminished as also the number of Red Blood Corpuscles in most cases. 65% of my cases show a diminution of corpuscles. Invariably the amount of Haemoglobin is

reduced – even so low as 30%. It has been often observed that even after cure it is difficult to show an increase of Hb beyond 75–80% & in no one of my cases could the blood be got to show a higher percentage than 68 – according – I mean, to Gowers's instrument. That the mere diminution of Hb is an efficient criterion of the severity of the disease is doubtful, but that it is constantly present is open to no doubt. When the diminution is below a certain point, with or without a slight reduction of R. B. C., in a young person shortly after the age of sexual maturity, in whom are absent the signs of ordinary disease and in whom by experiment we find a cure is readily effected by adding the wanting constituent to the blood viz Iron, the condition may be diagnosed as Chlorosis. If the reduction of cells be great, the proportion of Hb per cell may be normal or nearly so, & were it not for the eminence of the observers, the diagnosis of Chlorosis, with such might be doubted. Cases with

great reduction in the number of cells have been reported by Laache (Die Anämie 1863) 2,440,000 p. mm³ (48%) Copland, 2,090,000 p. mm³ (41%) Sowers 26% Hayem 18.7% — all quoted by Mackenzie (Lancet I. 1891 p. 73) while one of my cases (VI) shewed Corpuscles 2,214,800 p. c mm & Hb 40%

Stockman (British Medical Journal I/93 p 944) explains the fact of our inability to reach a normal percentage of Hb after treatment of Chlorotics with Iron, by thinking that the large numbers of R.B.C formed during the disease which are deficient in Iron, only die out slowly, & a long time elapses before they are replaced by newly formed corpuscles rich in Iron. This is a serviceable hypothesis & will suffice until we are able to get a more satisfactory one.

As to abnormally large cells — described by Hayem as "chlorotic R.B.C." they have been seen occasionally by me.

Leucocytes, as observed in 6 of my

cases shewed no change either absolute or relative. Graeber says they are not increased except where complications exist.

Blood plates, say Graeber, v. Limbeck, and Gravitz (loc. cit), are increased in number, & the last adds, in no disease so greatly as in chlorosis. In my cases they were certainly increased.

A notable feature in the blood of chlorotics is the change in shape of the red cells in many cases - a condition which has been termed poikilocytosis. This appeared in about half of my cases - the cells being pear shaped, dumb-bell shaped, sometimes nucleated oval, &c. Gravitz (l.c) thinks the change not so common as in other forms of primary anaemia - & this is also my opinion.

Coagulation of blood in chlorosis is certainly more rapid than under normal conditions.

The Blood-serum is reduced in albumin more or less, & Biernacki (l.c.) lays far more stress on the diminution

of albumin than on the diminution of Hb. Becquerel (quoted by Immermann l. c) thinks the albumin in the blood is increased at first owing to an accumulation of it taking place – the normal consumption of albumin being so much lessened, and it is not until the digestive organs have become impaired that the albumin begins to diminish.

Lloyd Jones (B. M. J. II/1893 p 670) and Stammerschlag* note that the density of the blood is lessened, as also Scholkoff (Spezielles Gewicht des Blutes: Dissertation. Bern, 1892) who showed it to be between 1040 + 1050.

The dry solids of the blood shew a diminution of 11·7% below the normal according to Stintzing + Gumprecht – Deutsch. Archiv für klin. Med. Bd. 52, 1894 S 235

Regeneration of the blood may be briefly considered here. It varies clinically between wide limits as to time,

* Ueber Hydrämie. Zeitschr. für klin. Med. Bd 21 1892 p 475)

depending on various external circumstances – surroundings, food, drugs &c. and internal – constitution, presence of other disease, results of previous disease &c. The R.B.C. increase while the abnormal forms – macro- & poikilocytes diminish in number. The Haemoglobin increases; but in the case of neither Hb nor R.B.C. to the normal, at least till a considerable time, varying in each case, has elapsed.

2. Nervous System.

There is often irritability of the nerve centres as shown by the occurrence of hysterical attacks & neuralgia. Other functional manifestations such as fainting palpitation of the heart, sleeplessness, depression of spirits, due to want of oxygen in the blood are frequently observed. Vasomotor changes are seen in the oedema, which may however be due to co-existing causes, and in flushing. Definite organic change is seen in the eye where varying degrees of papillitis

have been noted – the ratio being, according to Powers (Phonographic Record of Medical Teaching Vol. III p. 16) about one case in every 50. I can find no record of retinal haemorrhage in chlorosis. Saundby & Eales (Ophthalmic Review I p 303) give a much higher estimate than Powers's – about 1 in 10, while in addition 8% were doubtful. Williams (B. M. J. I/1884 p. 10) and Mackenzie (Ib. I/1885 p 328) record cases but give no note as to frequency. In the examination of over 30 cases in Inverness, as well as of others in Edinburgh, London & Berlin, I have not seen the condition once. A fundal change – probably merely concomitant, which I observed in one case, (No. X) was disseminated choroiditis.

Some observations have been recently made by Dickinson (B. M. J. I/1896 p 149) in regard to spontaneous thrombosis of the cerebral veins & sinuses in 3 cases, & he noted, in fatal cases, the remarkable severity of the headache – out of all proportion to the degree of anaemia

along with optic neuritis. Buzzard ~~Duckworth~~ (Ib.) mentions the case of a girl act. 18. who complained of severe neuralgia for a year, & who used to take screaming fits followed by loss of consciousness for several hours. At one time her right lower limb was paralysed. She had double optic neuritis. Her blood shewed the Hb to be 50% + when, under treatment with Iron, the Hb. had increased ~~to 80%~~ the optic neuritis disappeared. Buzzard ~~Duckworth~~ considered the case to be one of cerebral thrombosis. Duckworth (Ib.) mentions a fatal case of chlorosis in which post mort. the cause of death was found to be sinus thrombosis. According to Osler (Text-book of Medicine) in Chlorosis, Thrombosis is most often seen in the femoral vein. — sometimes in the longitudinal sinus. Vergely (Centralblatt für allgem. Path. N°5) quoted in Lancet I/1890 p 561 refers to venous & arterial thrombosis in the course of the disease, and he points out that it often arises early. He reports 16 cases of venous thrombosis in 9 of which it was

spontaneous; in one case the thrombus was in the iliac vein & attributable to distension of the sigmoid flexure. In 8 cases the thrombosis was symmetrical, in 4 the thigh was the seat of the plugged vein, in 7 the calf. Arterial thrombosis was also noted — in the pulmonary & in the Sylvian arteries. Mention is not made of any clotting in the cerebral sinuses. In the cases of arterial thrombosis - in the brain - no change could be demonstrated, under the microscope, in the blood vessel wall.

Murri (Lancet I/1895 p.211) is of opinion that the blood of chlorotics is "very prone to decompose" - hence the ~~tendency~~ to thrombosis. Sherrit in a discussion held in 1885 at the Clinical Society of London reports finding thrombi in the cerebral arteries. Bollinger (Münchener klin. Wochenschrift. 1887 p.19) gives anatomical details of a case which had not attracted much attention during life, & he considers the coagulability of the blood in such cases is due to fatty degeneration of the endothelium of the vessel

but this Murri cannot confirm. Kochel (Deutsches Archiv für. klin. Med. 1894 Vol. 55. S. 557) reports some cases of thrombosis in chlorotics. Murri, in his paper, says, "One can affirm that "the change from a country life to that "of a city was for her (the patient), as it is "for many like her, who have to go into "service, the first cause of the slight chlor- "-osis ..... Owing to the deficiency of "sleep, which these poor girls have to "undergo, the chlorosis became serious, "was followed by giddiness, faintness "loss of strength, increased headache & "finally by clotting, and with it oedema "turgescence, & softening of the cerebral "substance, after which ensued stupor, "slight fever, difficult breathing, slow "cerebration, convulsions, coma & death."

Immermann (l. c.) mentions that cerebral haemorrhage has sometimes been met with especially in cases where there is thinning of the walls of the vessels as well as changes in the heart – all of which may be primarily due to a congenital

condition. Hysteria, Chorea (also noted by Hollis (B.M.J I/1890 p 1239), the minor form of epilepsy, may be met with especially in cases where there is a predisposition to a neurotic condition being developed after puberty by concurrence of the chlorosis. Headache, toothache & backache, as also many other forms of neuralgia, occur, & disappear on the cure of the chlorosis. These last however are almost as common in simple anaemia, & so are only to a limited extend symptoms of chlorosis

Burton Fanning (B. M. J. I/1894 p1357) relates the case of a young girl, which had been diagnosed as cerebellar tumour. Patient was 18 years of age, without any history of syphilis, phthisis or serious previous illness. Menstruation had occurred 3 months before & for one month she had complained of severe headache & pain in the upper part of the body. Vomiting was frequent, there no relation to the ingestion of food. A feeling of "pins & needles" in both legs &

in the trunk as high as the axillae was complained of. There was no paralysis & the reflexes were normal. Double optic neuritis was present. A second case is also related by the same observers with similar symptoms, & both cases were cured by the administration of Iron & Aperients.

Mackenzie (B.M.J. I/1885 p 328) refers to a symptom which cases of chlorosis showed — pain in the neck. The absence of paralysis of any of the cranial nerves & of fever was opposed to a diagnosis of meningitis, she thinks the symptoms were probably due to increased cranial tension from oedema of the brain, which again was due to the condition of the blood.

Whether the Splanchnic nerves are involved in Chlorosis has not yet been satisfactorily shown, but Lloyd Jones (B.M.J. II/1893 p670) thinks it is likely they are from the frequency of haematemesis, with or without signs of gastric ulcer, caused by the vascular

dilatation. It has been assumed that involvement of these nerves may cause the constipation so often seen in chlorosis by interfering with innervation of the bloodvessels supplying the intestines.

Exophthalmic goitre has been noted as having been present along with Chlorosis (Mitchell Bruce in Quain's Dicty. of Medicine 1886), and Immermann (l.c) says he has observed cases - at all events similar to Graves's disease the symptoms of which disappeared when the chlorosis was cured. In view, however, of recent researches, the dependence of the disease upon some condition of the thyroid is rendered more than probable, & meantime we must suspend any judgment as to the causal connection of Graves's disease with Chlorosis.

My own experience of nervous phenomena in Chlorosis - apart from functional or subjective symptoms is limited to the case already mentioned (X) along with the neuro-vascular signs

recorded in case VIII, in which were noticed pallor of the fundus & dilatation of the fundal veins, in addition to the other signs & symptoms. This has been observed in other cases by Hollis (B.M.J. I/1890 p 1239).

3. Circulatory System.

Consideration of the symptoms referable to the circulatory system gives one at once a broad line of demarcation — (1) those referable to functional disturbance & (2) those referable to organic change in the heart & bloodvessels. Whether there are actual organic, but temporary, changes in the heart, corresponding to the symptoms usually referred to class (1) one has never an opportunity of finding out: in the permanent, & in the frequently relapsing type of the disease there is no doubt but that organic changes do exist.

An increase in the praecordial dulness, with apex displaced outwards, indicates dilatation, & this dilatation may be of the left ventricle - according to Broadbent (Pulse 1890) due to a certain extent

to arterial spasm. Stark (Archiv der Heilkunde, 1863 Bd IV S. 46) attributes it to the increased labour of propelling an increased amount of fluid, which owing to its diminished nutritive value is only able to supply what is required for the actual work of the heart. If any extra strain be put on the organ, there may be a sudden breakdown resulting in Syncope.

Immermann (l.c.) says the heart is sometimes hypertrophied especially at first owing to the exaltation in its activity causing an increase in the flow of nourishment, & Virchow thinks, so long as the blood vessels remain free from fatty change, the thinness of the arterial walls associated with their diminished calibre tends rather to increase than to impair their normal elasticity, & this increase in elasticity, combined with the hypertrophy of the left ventricle, - as shewn by the increased tension at the peripheral terminations of the vessels may cause rupture of the vessels and

extravasation of blood. This, he thinks throws light on the premature and excessive menstruation in chlorotic females — & thus a common enough symptom is brought into direct connection with the state of the heart and blood vessels. This, however, is scarcely borne out by clinical experience. Cases of heart & blood-vessel ill-development are rare, otherwise the disease would not be so often cured: hypertrophy of the heart with marked tension I have never observed — although I admit some observers have noted the latter condition in moderate cases (Mackenzie (l.c.)) If it do occur, the complete cycle of events would require to proceed rapidly, as the beneficial circle, established by increase in the cardiac activity, causing increase in the amount of the circulating blood & in the frequency with which it is propelled & consequently improved nutrition, would soon come to an end, if such a condition as chlorosis existed, & the result as regards the menorrhagia

would be its cessation. Menorrhagia would therefore never be a sign of chlorosis which had lasted any length of time – a state of matters which is not borne out by my experience.

The impulse of the heart varies as to strength & area – usually somewhat feeble & diffused.

The pulse is usually small and compressible, often rather quick even when the patient is at rest. It varies much in frequency, & in some of my cases remained over 100 for a considerable time. It is influenced by trivial causes e.g. position, movement, emotion. Sometimes the tension is increased – probably due to nervous action (Mackenzie l.c) while the very low tension observed at other times is thought to be due to organic change in the heart muscle.

Attacks of irregular heart action are common – probably due to the cardiac ganglia partaking of the general condition of "irritable weakness" of the nervous system. These attacks of palpitation

may leave the heart in an excitable state for a considerable time, & if they are frequent, a condition is induced which may cause irregularity of force, of frequency, & of rhythm. Subjective sensations - associated with these attacks - of oppression & heaving, are present in the chest.

Again during an attack murmurs may be heard - usually systolic & apical - which cannot be made out during the interval.

Persistent murmurs usually systolic, only very occasionally diastolic, can be heard on auscultation in some cases. Very frequently a systolic murmur can be heard in the pulmonary area, & in regard to it Coley (Practitioner I/1894 p 264) thinks it is not due to low pressure in the pulmonary artery from the facts (1) that it may co-exist with an accentuated second sound & (2) that if bronchitis appear in a chlorotic, the murmur may still be heard, although bronchitis tends to raise the pressure in

in the pulmonary artery. Mitral regurgitation is very common, but the causation of it is not always clear, & the diagnosis between cases due to chlorosis & cases due to valvular deformity can in some cases be only made by observing the effect of suitable treatment of the chlorosis. In some of Coley's cases murmurs were heard in the pulmonary area, at the apex, & at the angle of the scapula & when the chlorotic cases improved, the murmurs were found to be disappearing & that in the reverse order to that in which they made their appearance

In regard to my own observations I found that the systolic murmur was commonest slightly to the right of & upwards from the apex & heard loudest there. In a large proportion of the cases it disappeared entirely on the blood state improving. I met with no case of diastolic murmur.

An accompaniment at one time thought of great importance

is what is known as the Venous Hum (Fr. (Bruit de Diable) Germ. Sonnengeräusch) heard over the roots of the great vessels in the neck, on auscultation, & taking on very various characters as to sound - humming, whirring, churning, &c. &c. Most observers now are of opinion that it is of little importance, arising probably from the joint condition of blood and vessels. Bristowe (Pr. of Med) quoted by Bewley (Lancet I/1891 p 992) notes its frequency & thinks it characteristic: Gerhardt (Lehrbuch der Ausc. und Percus. 1890) considers it to be a sign of anaemia if heard when the head is held in a perfectly straight attitude. Fagge (Prin. & Pract. of Med. 1891) F. Taylor (Medicine) hold that these murmurs have no significance as regards diagnosis. Bewley (l.c.) gives statistics of 180 cases, & found that in 49.4% there was no hum. He notes that in about 50% of healthy persons a hum exists or can be produced by suitable pressure with the stethoscope. Apelt (Virchow's Archiv, Vol. 107,) thinks

after having investigated a large number of cases that while it is more frequently heard in anaemic states, it is not of the slightest diagnostic importance in individual cases, and this is the view of Rieger & Sainsbury (Lancet I/1892 pp. 740, 790) who say that by compressing the vein above, one can cause the bruit to disappear. Immermann (l.c.) thinks that it proves "that in chlorosis no less than "in anaemia the total quantity of blood "in the body may be reduced, & the venous "system underfilled in consequence. It "is not always present in chlorosis, "& there is no doubt but that sometimes "hypalbuminosis & polyaemia are pre- "sent in that disease." To this I am not inclined to assent, but whatever its significance is, it is as yet unproved that it is pathognomonic of anything more than a disproportion between the calibre of the vein at its entrance to the thorax and immediately before. A bruit can be produced artificially in any person by suitable pressure — the

conditions necessary for its production being a certain fluid in motion, an indistensible passage from one cavity into a larger. There are present in cases of anaemia where the altered blood passes from the jugular vein above the level of the clavicle where there are firm fibrous attachments around the vein, to a wider part below that level.

As to effusions, they are not common in chlorosis, while the only form of anasarca seen in ordinary cases is oedema of the feet & legs - most often just around the ankles - which usually disappears when the patient is put to bed: in such cases the cause is probably cardiac feebleness. This view however is controverted by Dickinson (Lancet II/1895 p 258) who regards it as analogous to that of renal disease - dependent on the non-elimination of certain toxic bodies. This however is meantime purely hypothetical.

4. Alimentary System.

Disturbances of Digestion are common – anorexia, vomiting, nausea, fulness flatulence, heartburn – while the stomach itself may be dilated & even dislocated – the condition known as gastroptosis. Constipation is not in-variable, but is very common & by Clark & others supposed to be causal. Appetite is often capricious, & patients may have unusual cravings (picae) – for earth, chalk, cloves, tea, acids e.g. Acute pain at the heart is frequent & should make one suspect gastric ulcer, but although this is not uncommon, what is usually found to be the cause of the pain is a nervous condition, disappearing on the cure of the chlorosis. The pain may occur after food, but it is also present when the stomach is empty e.g. in the morning before breakfast, which meal may relieve it. The presence of gastric ulcer may be due to the connection of chlorosis with imperfections of the vas-cular apparatus which may be present

in the stomach, and lead to the formation of a thrombus & subsequently an ulcer. The degeneration renders the vessel walls unduly fragile – this allows extravasation to take place followed by circumscribed sloughing of the mucous membrane. The bleeding may be but small in amount or it may be large. It may be vomited or it may be retained this last is likely to be the case when there is a general vascular defect – the individual haemorrhages being small & soft repeated. Latent haemorrhages in the stomach & bowels undoubtedly more frequently occur than is generally believed & v. Hoselin's researches go to support this view – he having found an increased amount of Iron in the faeces of chlorotic women (Münchener med. Wochenschrift. Abt. 8, 1890 (quoted in the Annual of the Universal Medical Sciences 1891))

To determine the connection between affections of the stomach & these not infrequent cases of chlorosis in which

the leading symptoms are of a gastric character. Pick made some observations recorded in the Wiener medicinische Wochenschrift (quoted in Lancet I/1892 p 439), & found that in all cases there was an "atonic" condition of the stomach (i.e. gastric insufficiency of Martin) which had not digested the food taken on the previous day, although the patient was fasting at the time of observation.

Osswald (of Riegel's Klinik) (Münch. med. Wochenschr. July 3 & 10/1894 - quoted in B.M.J. 2/1894) noted the amount of free HCl present after a test meal, containing a certain amount of albuminoids & found it to be less than one containing a larger proportion. These results, however were by no means uniform, but invariably he found free HCl. The motor power of the stomach seemed to be efficient

Over one half of Stockmann's recorded cases (B.M.J. II/95 p. 1473) were constipated & dyspeptic - & as these conditions lead to an inadequate consumption of food & therefore of Iron, their causal

influence - though indirect is to be recog-
-nised as requiring immediate alleviation.

As to the results of ingesting insuf-
-ficient food, Renient states that during
inanition the corpuscles fall from the
beginning - if fluids be given (die Zahlung-
-en der Blutkörperchen, 1891). Vierordt
during the hibernation of a squirrel
observed its red corpuscles fall from
7,748,000 p mm^3 to 2,355,000. Quin-
-quaud found a large fall of Hb in lunat-
-ics who refused food. Piorry relates
the case of a man who committed
suicide by eating less + less each day
- dying ultimately after 2 months,
during which time he developed
all the signs of anaemia. Quality
as well as quantity of food is of importance
as regards the supply of Iron. Verdeil
(Annales de Chimie et de Pharmacie
69. 89. 1849) found that a dog fed for
18 days on flesh had 12.75% Iron
in its blood while one fed for 20 days
on bread had only 8.65%. Stockman's

own analyses of the amount of Iron in different articles of food (Journal of Physiology l.c.) shewed very varied results. Two analyses of one lb of undried bread yielded 1·7 and 2·7 mgrs (1/38th to 1/24 grain): one pint of milk yielded 2·2 mgrs (1/30 gr) & one lb beefsteak 18 mgrs (2/7 gr) of Iron. Considering these results, one notes that the amount of food ingested in cases of chlorosis in general is too small to supply sufficient Iron for regeneration of the Hb of the blood, & unless the Iron be supplied from some other source, anaemia will ultimately occur.

The condition and relations of the stomach in Chlorosis, after distending it to its utmost capacity by artificial means, have been investigated by Meinert (Verhandlungen der Xten Versammlung der Gesellschaft für Kinderheilkunde in Nürnberg 1893 ~~XIII~~. S. 43 & 44 — quoted in B.M.J. Epitome I/1894 p 45), & he found the organ much displaced downwards — the condition termed 'gastroptosis' by Glénard.

It is very common in women: Meinert thinks it always precedes chlorosis & with few exceptions persists after the chlorosis has been improved. It is most often due to mechanical compression of the lower part of the thorax, but also occurs in those who have enlarged livers, or small or malformed chests. In young girls it occurs most often when they begin to wear corsets, & Meinert thinks 6 months of a tight corset will cause its appearance. He considers the blood state a mere symptom & it should be treated as such, — the fons & origo mali being the gastric condition; the anatomical reason being a stretching of the nerve fibres extending from the solar plexus along the lesser curvature of the organ.

In my cases I enquired into the question of thoracic pressure & in three cases — the only 3 which occurred in "the better classes" (XIII, XVI + XVII) it was admitted that compression had been employed for aesthetic reasons. The stomach was, however, not markedly out of

place, although gastric symptoms were present. The removal of the corset made no difference in the general condition & it was not until Iron was given that improvement occurred. No doubt the use of too tight a corset may conduce indirectly to the production of chlorosis, by preventing the wearer supplying herself with sufficient food & so with sufficient Iron, but directly I do not think the connection between tight-lacing & chlorosis exists.

5. Urinary System.

The urine is usually normal in amount, reaction, pale in colour, of low Sp. Gr. and contains a diminished amount of urea and uric acid. The pallor is probably due to a diminished R. B. C. destruction & the lessened urea to a diminished metabolism of nitrogenous tissue. Hollis (B. M. J. I/1890 p 1239) says in some cases he has noticed a faint trace of albumen which disappeared on rest. In none of my cases was there a trace: nor was sugar found

Herschell (Pract. I/1893 p 356) makes an interesting observation in regard to the urine of 3 chlorotics in whom there was faecal retention & in whom treatment by Iron & purgatives was ineffectual. In the urine was found a distinct chromogen, the nature of which was uncertain but probably was a derivative of skatol, as it became red on the addition of nitrous-nitric acid. Large injections were given with the result of dislodging large scybalous masses, & thereafter treatment with Iron was successful. In these cases, therefore, absorption of faecal derivatives appeared to have been taking place, the mere presence of the hardened faeces in the bowel preventing the action of the Iron.

6. Reproductive System.

Anatomical changes have already been referred to, & the symptoms that are dependent, in some cases, at all events, on these changes, is more than likely. If the uterus & adnexa are imperfect, or late at

arriving at maturity, & these conditions coexist with defective blood vessels and blood, symptoms may occur which can only be explained by the assumption of the existence of such anatomical changes. The Symptoms are mostly referable to the establishment of menstruation & its continuance or non-continuance. The latter is especially common, while the former is less common as a flow regular in time & normal in amount; while in some cases we have profuse menstruation, in others scanty.

There is probably some intimate connection between the occurrence of puberty & chlorosis — the most frequent onset of the disease being between the ages of 14 & 24. Niemeyer (Text-book of Pract. Medicine — American Translation 1876 Vol 2 p 743) says:- "Chlorosis attacks "all young girls without exception in "whom the menses have appeared in the "12th or 13th year, & before the development "of the breasts & pubes." This statement is hard to criticise as one rarely meets

with cases which fulfil these conditions. The earliest time at which menstruation occurred in my cases was during the 14th year, and I have been unable to find that in countries where menstruation is observed several years earlier has it been noted that Chlorosis is commoner than with us. Hirsch (l.c.) says Chlorosis was uncommon in the middle ages, & yet no doubt menstruation occurred in anomalous ways then as now. I have observed that where there is general poor development of breasts, pubes, &c, menstruation has usually been delayed, although the chlorotic condition had previously supervened.

What the causation of the menstrual irregularities is, has been much discussed, & I think in some cases they are due to developmental disproportion (i.e. to the same cause as the Chlorosis), while in others they appear to be secondary to the disorder. Immermann (l.c.) considers premature excitement of the imagination along with

the precocity of bodily development, often met to be found in town-bred girls than in those living in the country, has a causal connection with abnormal menstruation. He thinks chlorosis retards menstruation, while Stephenson (Transactions of the London Obstetrical Society 1884) is of an opposites opinion. The latter believes that there is a predisposition in certain persons to Chlorosis & in such there is a hastening of the age at which menstruation first appears.

The causation of the amenorrhoea or scanty menstruation may be looked at from the following point of view — by assuming the existence of a nerve centre controlling normal menstruation, which in diseased conditions is "thrown "out of gear". Its existence Christopher Martin ("The nerve theory of menstruation" 1893) has shewn to be highly probable, both on physiological & anatomical grounds. The rhythmic activity of the centre may directly influence variation in the bodily metabolism — e.g. temperature & excretion of urea

while the connection between this centre & the sympathetic nerves in the pelvis – most of which are vaso-dilators – would account for many local manifestations unintelligible at present e.g. metrorrhagia. Except on improbable hypotheses. The centre may be supposed to be normally stimulated by healthy blood, & if any deviation from health occur, especially in the blood, stimulation is not effected, & menstruation does not occur.

Martin elaborates Gaskell's theory holding of anabolic & katabolic nerves – that during the intermenstrual periods the nerves in action are anabolic, and if impregnation do not occur, the katabolic nerves come into play & menstruation occurs. "The actively growing cells of "the endometrium undergo a rapid destructive "metabolism, the fabric of the half "formed decidua tumbles to pieces, the "turgid capillaries burst & pour out the "menstrual flow, which sweeps away "the useless tissue débris." After this

the anabolic nerves assert their sway & so the cycle goes on.

Applying this to chlorosis, one may say the general metabolism is feeble, the anabolic nerves act only with difficulty or are unsuccessful in constructing, & the katabolic nerves have nothing to destroy or are unstimulated to action. When the blood condition improves, the centre is normally stimulated & anabolism & katabolism occur – in other words, the premenstrual, and menstrual changes occur in the genital organs.

Besides menstrual anomalies, the discharge of a creamy fluid usually in small quantity from the vagina is a common complaint, & it takes place most often in those who are amenorrhoeic. It has no diagnostic importance & disappears on the cure of the general condition.

7. Integumentary System

There is marked pallor of the skin, mucous membranes, and subcutaneous tissue, which is due chiefly to the lack

of Hb in the blood, as well as to some extent in individual cases, to the particular arrangement of blood vessels in the skin, to the delicateness of the skin and as Alston suggests (B. M. J. I/1893 p 1453) to the constriction of arterioles in the skin.

Erythema nodosum has been sometimes observed.

Oedema has already been referred to under the Circulatory System.

8. Respiratory System.

Breathing is often accelerated & there may be slight cough - dependent on abnormal sensibility of the respiratory centres & of the larynx & trachea. The accelerated breathing may be due to a certain extent to the want of Oxygen in the blood, while that coming on after exertion is cardiac. In many cases there is along with the dyspnoea pallor rather than lividity - the reason for which is not apparent.

9. Locomotory System.

Rheumatic pains are sometimes

complained of, and the associated conditions of Tonsillitis, Chorea, and Erythema Nodosum are sometimes found (Hollis l. c.)

Etiology

The causation of ordinary anaemia is in most cases obvious: in chlorosis it is obscure, & in considering the subject we may divide the causes into (1) predisposing — i.e. persons in whom there exist are more prone to the disease than others, and (2) exciting. Certain conditions may exist which may serve without special exciting cause to gradually modify the constitution that after a time the disease appears. In other cases the predisposing causes are not sufficient to produce the disease ~~xxxxxx~~ unless augmented by others of a a more or less accidental kind which serve to mark the commencement of the disease more or less clearly in the patients' mind.

a. Predisposing Causes.

I. Sex. The Disease is only very occasionally

met with in males. All cases of obscure anaemia have been included in the term Chlorosis, but to take for granted that true Chlorosis occurs in the male we must postulate (1) the absence or inadequacy of the usual causes of symptomatic or other idopathic anaemia: (2) the presence in a more or less distinct form of the peculiar conditions that promote the origin in females, modified by anatomical & physiological considerations: (3) agreement of the general symptoms with those acknowledged to be characteristic of chlorosis: and (4) curability of the disease by Iron.

II Age. Be it here remarked that no combination of other causes is sufficient to produce the disease if these — I & II — be absent. — Chlorosis is chiefly met with in the period from the 14th to the 26th year — during sexual evolution. Before then the disease is rare, & after it have once occurred, relapses are common. From 18 to 25 years of age the Hb is 8% less than from 25–45 (Lichtenstern — quoted

by Stockman – B.M.J. II/1895 p.1473, and from 15 to 28 the number of corpuscles is less than at other ages. Young women have normally 10% fewer corpuscles than men & 8–10% less Hb while the water is 4–5% more – & this may be one reason why the disease attacks women more frequently.

It is difficult to make out whether cases of anaemia occurring later than the 28th year are cases of chlorosis – primary or relapses – statistics on this point are unreliable. Niemeyer (Lehrbuch der spez. Pathologie und Therapie VIIIte Aufl. Berlin II. 836) insists strongly on the rarity of a first attack after 24, & cautions us against ascribing obscure forms of what may be merely symptomatic anaemia to chlorosis.

III. Inherited tendency must be admitted in some cases, – a cause which I think has been neglected by some observers. On enquiry, I have found in several cases, evidence of the disease being inherited, while in others, some other member or members suffered

in a similar way – shewing that something more that individual peculiarity had to do with the production of the disease – although it may be said that such cases are due to the influence of similar causes & general similar environment. Stephenson (l.c.) believes in the existence of a diathesis which predisposes to Chlorosis, but whether this be inherited or acquired he does not discuss. These remarks do not refer to cases where there is congenital maldevelopment, which must be considered apart from the readily curable cases where only functional changes exist.

Many chlorotics come of large families – being due according to Jones (B.M.J. II/1893 p. 67) to the fall in the Sp. Gr. of the blood at puberty which results in tissue saving & so increased fertility.

IV. Constitution & Habit of Body. Those who have been delicate from childhood are more liable to chlorosis. It is said to be more common in blondes than in brunettes (Windenlich – Handbuch der Path u. Therap.

Bd IV 1856. S 529) and according to Lloyd Jones (B.M.J. 2/1893 p 670) in such blondes especially as have a low Hb. Gr. of blood.

VI Conditions incidental to modern Social life - e.g. neglect of hygienic principles in the upbringing of women, the employment of young growing girls in unsuitable occupations. Immermann (l.c.) says chlorosis is more common in towns and among the educated classes. Want of exercise, badly ventilated rooms, premature & one-sided cultivation of the intellectual faculties & the emotional nature at the expense of the body all contribute to cause the disease in such. That it is always the case, he does not believe, for the malady is not at all uncommon in peasant girls otherwise robust who are not by any means sentimental & whose labours in the field & garden cannot leave much leisure for morbid thought.

So far as my experience goes, I think the predisposition lies in favour of the working class girl. She has a life of hard work from the time she is able to take

charge of the baby, her surroundings are unhealthy often, her food indifferent sic, at a time when her organism undergoes the profound changes of puberty, she be unable from her environment to get sufficient ✗ Iron from her food to replace that lost in the menstrual flow, the result is easily foreseen, and if, from her previous mode of living, she have not stored up in her liver sufficient Iron to supply what is wanted, while more is being collected, the onset of the chlorosis is hastened.

VII Atmospheric Conditions are said to have an influence (Hollis, B.M.J. I/1890 p. 1239) – the disease being more common in winter than in summer – an effect of want of sunshine & low temperature. This I have not been able to prove, satisfactorily to myself, from my own cases.

b. Exciting Causes

I. Menstrual loss. – This may be the cause of anaemia by being absolutely too great as in menorrhagia or relatively so, as

when a comparatively small loss is sufficient to make itself adversely felt on a weak organism. Immermann (l.c.) says, "Foremost in the ætiology (of chlorosis) is the first "onset of the catamenia", and again, "The "earlier menstruation occurs, the likelier "is it to bring on chlorosis."

II. Alteration in the patient's mode of life e.g. girls coming from the country to live in the town with its disadvantages of want of fresh air & exercise, of late hours, of hard work, & insufficient sleep, & with its altered general hygienic conditions. Thus we find the disease so common in domestic servants.

III Intercurrent or previous disease, especially such as have been the cause of blood loss e.g. gastric ulcer with haemorrhage.

IV. Insufficient & unsuitable food — so that too little Iron is taken into the System.

V Moral influences in certain cases where the predisposition is marked, cannot be overlooked. Depressing emotions of great intensity although of short duration, as

well as protracted melancholy resulting from disappointed love, home sickness &c. seem occasionally to determine an outbreak of chlorosis

The personal element, however, is difficult to eliminate – susceptibility to the various emotions being so dependent on inheritance, on Education, & on social conditions that it is almost impossible in any particular case to assign correct values to the predisposing & exciting causes.

Nature of the Disease

Chlorosis is probably due to want of power to produce R.B.C. in sufficient number, and want of iron to supply those which have been produced with Hb. The latter may be regarded as the essential factor, as when iron is supplied the blood-corpuscle-manufacturing power is stimulated, and corpuscles produced which are rich in Haemoglobin.

From what has gone before, it will be seen that I think we must admit

to our classification two forms of the disease — (1) one in which various developmental peculiarities hold a prominent place & which does not attract much attention till puberty occurs, & which is more or less cured by giving iron: and (2) one which is especially marked by functional changes & which is readily cured by placing the patient in a suitable environment & by administering iron.

Chlorosis occurs vastly more frequently in the female than in the male, & that is due to many causes — (1) the R.B.C. production is less active in the female; (2) the percentage of Hb. is less and also the total number of corpuscles: (3) at the period of life at which the disease most often develops, the female is exposed to conditions which may readily lead to a disproportion between the demand for & the supply of R.B.C. or functionally active Hb, for while the body as a whole is still growing rapidly, the genital organs maturing, &

the vascular system extending both in length & breadth, menstruation sets in, & directly diminishes the number of corpuscles. Up to this time the blood forming organs have been able to perform their function, but if, for any reason, their energy become impaired, the provision of R.B.C. and Hb may run short. An important cause, however, apart from defective food supply or blood loss, is the intensity of the original impulse to the continued formation of R.B.C. implanted in the organism at the moment of conception, & which, one must assume, continues to have some influence on the blood forming apparatus during the life of the individual. When this is relatively feeble, the predisposition to chlorosis is unavoidable. It may remain wholly latent or may break out as soon as certain conditions arise. Again, the vessels and their contents are both derived from the same embryonic tissue, viz. the mesoblast. The blood corpuscles are the representatives of the original contents of the blood spaces

in the embryo, and are moreover related to the elements of the general connective tissue of the body* which is also derived from the mesoblast, Now, if the defective developmental energy extend not only to the vessels & their contents but also to the general mesoblastic tissues, an intelligible explanation is found of the extensive mal-development of the body which is occasionally found associated with vascular defects and a blood disorder like chlorosis.

With regard to the occurrence of the disease in males, one must admit it both on à-priori grounds and from the experience of trustworthy observers. One cannot go so far yet as to differentiate forms of chlorosis in the male, for so far as I have been able to discover no cases have been examined p. m. & a sufficient number of cases have not yet been seen during life, from which to make anything but a wide generalisation. That the essential blood condition

* – in particular the genital organs, bones & muscles

is the same both in females & males when attacked by the disease is probable: the secondary symptoms are identical, & the curability of the disease by the same remedies undoubted.

Martin (B. M. J. II/1894 p 123) gives notes of six cases which he regards as cases of true chlorosis in the male. Eichhorst only admitted its occurrence in effeminate males or in such as are employed in effeminate occupations such as tailoring. Martin does not believe in Lloyd Jones test founded on the estimation of the Sp. Gr. of the blood, & only admits such cases to his category of Chlorotics as conformed to the Hb. test.

Fox (Observations on Chlorosis. 1839) thinks the causes independent of sex.

Hicks (Med. Times & Gaz. I/1877/p 332) says the anaemia of puberty is common in both sexes, but more often seen in females, probably because of the rapid demand then on the system in them compared with males in whom puberty is gradual. He thinks the stoppage of the menses

is advantageous to the patient.

Ball (B.M.J. II/1880 p 742) gives notes of a case of chlorosis in the male in which probably some con-genital vascular defect existed. Treat-ment by Iron was of no avail.

So often & so earnestly has chlorosis been investigated from many points of view, it might be fairly expected that its pathology would rest on a somewhat firm basis, but it is not so. Our know-ledge of the significance of observed facts upon which most are agreed, is yet but small, & so the treatment is to a great Extent empirical. We do not know why it is necessary that large doses of inorganic Iron should be taken in order to effect a speedy cure, considering that the total amount necessary for the actual regeneration of the blood is but a fraction of a grain. Many theories have been advanced to explain the disease in whole or in part, & here I shall consider but a few of them.

Some writers go so far as to make

up a series of chloroses according to the system which is most markedly affected in addition to the blood condition (Potain - Journal de Médecine de Paris 14·4·95), but such a purely clinical classification can scarcely be recognised from a pathological standpoint.

Abnormal stimulation of the vaso motor system producing changes in the velocity of the blood & secondarily in its chemical action - a disintegrating influence, the nerves themselves being reflexly stimulated by the developing genital organs, is the theory of Murri (Policlinico, Mai 1894) To this I would say that in what I hold to be chlorosis we have no evidence of excessive blood disintegration: in it there is defective haemogenesis and that only to a limited extent.

The intestinal theory of chlorosis has found many supporters in recent years. The general cycle of events is:- Constipation exists (causation immaterial): sets up decomposition, the products of which

may be absorbed so causing haemolysis or general toxaemia, or they may prevent the food iron from being absorbed or assimilated — the result in all cases being the same — chlorosis.

Duclos (Rév. générale de clin. & ther 1887) & (B.M.J. 15 Feb 1890) says where the constipation is not very marked, the disease is due to the great activity of the putrid decomposition & therefor iron to form a sulphide, carbonates of soda, lime & magnesia, & antiseptics like Charcoal, naphthol & the nascent sulphur of hyposulphite of soda are indicated.

Clark (Lancet II/1887 p 1003) gave it as his opinion that constipation was the cause of the disease by producing an auto-intoxication, & Bouchard (Leçons sur les auto-intoxications dans les Maladies, 1887, & Nothnagel (wiener med. Presse 1891 N° 51) agree, & are of opinion that the proper treatment is purgation. Forchheimer (Amer. Journal of the Medical Sciences 1893 p 255) thinks the essential condition in causing the disease to be the

state of the bowel tract, as there takes place the chief building up of Hb.

Opposed to them are many, both on theoretical & practical grounds, & here it may be stated that ~~#~~ the assertion that constipation is always present is scarcely borne out by facts. Many persons are obstinately constipated and are not chlorotic while many undoubted chlorotics do not suffer from constipation. V. Noorden (Lehrbuch der Path. des Stoffwechsels, and Berliner klin. Wochenschr. 8 & 9, 1895) says – in reference to the allegation of excessive haemolysis – if the blood be excessively destroyed, there is an increase in the excretion of biliary & allied pigments, while there is no evidence of concomitant biliary stagnation, & conversely. In chlorosis there is not only no biliary stagnation, but also no increase of excreted pigments, so the poverty of the blood in cells is probably due to deficient blood formation. Lipman-Wulf (V. Noorden's Beitrage zum Lehrbuch vom Stoffwechsel Heft I 1892) and Rathers (Zeitschr.

für phys. Chemie 18/93) question the Exis:tence of abnormal putrefaction in the bowel as in chlorosis the products of such decomposition (skatol, phenol &c) are diminished in the urine.

The action of such decomposition products – if they exist – on the food iron will be considered further on.

Alston, as already mentioned under Nervous System, considers the vaso-motor contraction of the intestinal blood vessels possible, and he thinks this may prevent absorption of iron. Lloyd Jones (B.M.J. ii/1893 p670) inclines to attribute to some unknown disturbance of the sympathetic a causal influence – & this is not always limited to the intestines as is shown by the gastric symptoms. Meinert (~~xxxxx~~ l.c.) & Krüger (St. Petersburg med. Wochenschr. 1892 No 52 are of opinion that the abdominal sympathetic is primarily at fault – the latter supposing a stimulation of the splenic activity to occur which disturbs the normal balance in the functions of the spleen & the destruction of Hb.

occurs with more vigour than the manufacture of cells. This, however, I take it, requires further proof, before it can be accepted

Haig (B.M.J. II/1894 p 113) attributes chlorosis to the non-excretion of uric acid. The "blood-decimal" ($\frac{\text{Hb percentage}}{\text{Cell percentage}}$) fluctuates from day to day the says increase of uric acid is always accompanied by a fall in the value of the blood-decimal. Iron cures by clearing the blood of uric acid, & by administering uric acid, you can undo the work of the iron. If from any cause, the iron fail to clear the blood of uric acid, other drugs must be given to effect the same object such as Iodide of Mercury, or Salicylate of Soda. The causation of the condition is the increase in metabolism from puberty till the 18th year of a girls' life, causing the blood to be less alkaline & so rendering it a bad solvent of uric acid which is retained in the body. When metabolism has fallen i.e. after about the 18th year, the

blood becomes more alkaline, thus dissolving the uric acid which was stored up before - the result being chlorosis, from the passage of such large quantities of uric acid through the blood. Again, at this time menstruation sets in & this either upsets digestion or causes the girl to keep quiet for several days, so still further flooding the blood with uric acid & causing further trouble.

On the Continent especially there is a firm belief in the causation of Chlorosis by a want of Manganese in the blood on the supposition that it ~~is~~ is a normal inorganic constituent of the blood; ~~as~~ a remedy it is at present included in the Phar. Germ. - According to Stockman (l.c) its use goes back to 1822. In 1838 Kügler observed that 'scrofula' among manganese workers was rare In 1849 it was brought prominently to the front by Hannon (Etudes sur le Manganèse &c Bruxelles 1849), who held that it was a normal constituent of the blood was contained in the corpuscles where its function

is to assist in the process of oxidation. Results from its use are said by Hannon to be favourable, and Broadbent, Ruehle & Archer agree: while Loomis (Med. Record 3 June 1893 p 695) asserts that not only is it found in the blood but quantitatively it is more active than iron, & he has had very good results. ~~xxx~~ Then, last results were attained, however, by a combination of iron and manganese, & so are fallacious as to conclusions. Stockman says Glénard in 1854 examined the blood of healthy persons & found but a trace of manganese - probably present owing ~~xxx~~ to the accidental ingestion of certain vegetable foods: and in the blood of a manganese worker he found none. Its salts are not absorbed, & Stockman has never seen any good results from its use. I have never used it by itself, but combined with iron in the form of Liq. Manganes-Ferri Peptonat. I have given it in a few cases. The result of these cases was a quick & permanent return to health - probably due

to the ease with which an organic preparation of iron like the Peptonate is absorbed.

Lauder (B.M.J. 1885 – quoted by Stockman l.c) suggested that the Hb was deficient in the digestive juices, & prevented the iron being absorbed from the food.

Stockman (B.M.J. II/95 p 1473) deems the important conditions to be want of iron in the form of Hb due chiefly to blood loss & insufficient food. He gives statistics as to the amount of iron found in the liver & spleen, in the body of a girl who died from gastric ulcer & its consequences & it was much reduced; in cases of profuse menstruation the blood very soon loses iron: "Becquerel & Rodier reckon "that the iron in 100 g blood is 0.0036 & "Pelouze 0.054 i.e. a mean of 45 mgr "in 100 cc blood. During menstruation the "average loss is 3 to 6 ounces i.e. 45 to "90 mgr i.e. as much as a healthy person "ingests in 5 to 10 days. Reckoning that "5 or 6 mgr are excreted in other ways

(– which by the way is over twice as much as has been Calculated by Colosanti & Incoangeli (Rif. Med. 6.I.94 – quoted in Epitome B.M.J. 24 March 1894 p 48 – their daily average being 2.3 mgr. —)
"we are left with only 3 or 4 mgr to "make good the loss of iron contained "in the shed blood". Gowers (Lancet I/78 p.673) estimates the loss of corpuscles in a chlorotic girl during menstruation at 10 – 20 % of the total number.

Blood loss itself, however produced, will cause chlorosis in suitable circumstances, & probably is one of the common modes of its appearance.

Many cases of mild Chlorosis probably recover on the iron contained in the food & may never be troubled again, while others have a constant tendency to relapse. This may be supposed to be due to incomplete recovery, & the persistence of the causes that lead to the disease in the first instance. Others again show this relapsing tendency even when they have been treated for the disease & it is likely this is due to

either their leaving off treatment before a cure is effected, or the existence of some developmental defect. In the latter case improvement is success but owing to the condition of the body even that is not always to be attained.

Murri (Policlinico 12. 1894 - quoted B.M.J. ii/1894, 161) suggests the possibility of diagnosing Chlorosis before the advent of puberty in certain cases which have a low Sp. Gr. of blood, with general defective nutrition, and readily distensible blood vessels - which gives rise to great instability of intravascular pressure; and under suitable conditions - such as the changes which occur about puberty, chlorosis is likely to occur in them.

The "cold & livid condition of the skin" proves a contraction of the vessels to be present - says Scholz (Bremen) (Lancet i/1890 p 210) & this vascular contraction he regards as the primary condition - the blood change being merely secondary. The chief change in the blood is an increase of the watery constituents

and with these facts before him he considers the proper treatment to be friction of the skin & hot baths, along with blood-letting which he says he has seen followed with benefit.

The theory that chlorosis is due to an intoxication which is dispelled on the establishment of the menses has been advocated by Pfillmann and Etienne (Semaine Médicale 19 Aug 1896 - quoted B.M.J. 12 Sept 1896 - Epitome p 43) They consider that the ovary may be regarded (1) as a gland having an internal secretion viz. the ovum (2) as a gland having a function of eliminating organic toxins by means of the menstrual fluid & (3) as a gland with an internal secretion like the testis having some unknown but important function in regard to general nutrition. These views have received some support from Lloyd Jones; who inclines towards the toxin elimination theory.

Charrin (Méd. Mod. 11 Jan 1896 - quoted B.M.J. I/1896 Epitome p 43)

is also in favour of the idea that chlorosis is a toxaemia, - "a menstrual auto-intoxi-:cation" - and is the result, not the cause of the amenorrhoea. He thinks the toxicity is at a maximum just before a period & by menstruation, a true excretion, a purging of waste products takes place. Wet nurses, he says, who menstruate during lactation are apt, during the days preceding the menstrual flow, to cause their sucklings to suffer from diarrhoea, cutaneous eruptions, while they themselves often are feverish & feel ill. In young girls, who from developmental defects or retardation, do not menstruate, waste products accumulate and the phenomena of chlorosis develop

The view that Chlorosis is an infectious disease is held by Clement (Centralblatt für Gynäkologie 1895 № 40) whose conclusions are founded on analogy. Eight young girls, he says, in the same village became chlorotic successively fever being the initial symptom. En-

-largement of the spleen was constant, & complications were phlegmasia alba, pericarditis & pleurisy — which he thinks could hardly have been explained by disturbance of the haemopoietic System alone.

Most of the above mentioned theories agree in two important points (1) that reduction of the Haemoglobin of the blood is the essential feature and (2) that iron suitably administered will cure the disease. As to the manner in which the reduction is produced, as also the mode of action of iron, the explanations are many & diverse.

Let us look for a moment at Chlorosis due to lack of Hb. This insufficiency may be produced (1) by direct loss of blood; (2) by destruction of blood; (3) by non-absorption of food-iron -which in turn may be due to (a) Copro-stasis: (b) Toxins in blood: (c) Neuro-vascular conditions of the bowel: (4) by non-assimila-tion of absorbed iron usually through

interference with the functions of the liver.

Direct loss of blood, and haemo-lysis as factors causing want of haemo-globin have been already discussed some what in detail, and now I shall look for a little at the non-absorption view, including the manner in which iron has been supposed to cure when administered.

Coppola (quoted by Stockman B.M.J. 1/1893 p 881) considers iron to be directly absorbed - basing his conclusions on the results of feeding fowls on an iron-free diet, & thereafter adding inorganic iron. By others it has been supposed that in chlorosis the intestine is so atonic as to be unable to absorb the food-iron from what has been ingested, although more than is required to make up the deficiency in the blood is present in the food; and that when inorganic iron is taken stimulation occurs, & absorption takes places, & soon a sufficiency is collected from the dietary. It is said there is no

increase in the iron in the urine after iron is given per os, & so it is thought that it does not circulate in the blood. Iron is not excreted in the bile if given hypo-dermically, it is excreted by the intes-tinal canal. Robert experimented with Manganese to avoid the fallacy of the physiological presence of Iron & found it was not absorbed & so he concluded Iron was not.

When Iron is taken by the mouth - if Ferric - it is changed into a Ferrous salt and in the intestine it is probably converted into a large number of com-binations which are absorbable. From there it reaches the liver (MacAllum Journal of Physiology 1, 1890, 268) where it is changed into an albuminous compound - the preceder of Haemoglobin. Absorption at the best is but a slow process, & therefore treatment to be effective must last over a considerable.

Bunge - at the Congress für innere Medecin at Munich - 1894 - advanced the theory that only complex iron compounds

such as exist in nucleo-albumin, which are somewhat similar to Haemoglobin in composition are absorbed by the intestine, and as the absorption of these is interfered with in chlorosis by increased decomposition, too little iron reaches the blood. He admits that inorganic iron can cure chlorosis but this it does by combining with intestinal Hydrogen Sulphide & alkaline sulphides — producing iron sulphide which cannot be absorbed, but which protects the organic iron & permitting of its absorption. In order that a cure may be effected large doses of iron are requires as the sulphides are usually present in large amount. On Landers authority he states that Hydrochloric acid will cure chlorosis — in virtue of its being an antiseptic & preventing the formation of sulphuretted hydrogen.

Reinert (Wiener med. Blätter 25.4.95) says Bunge's conclusions are illogical inasmuch as the experiments were made on healthy animals & no proper inferences can be drawn by comparing

such results with clinical experience in chlorotics. Apart from this, however it has to be noted that the mere absorption of the sulphides is not the only power which iron possesses in process of curing chlorosis. Bismuth salts e.g. combine equally well with sulphides yet do not cure chlorosis, & Bunge is certainly wrong in saying that iron sulphide will not cure the disease, & that too in face of the fact that it is a non-astringent preparation of iron & so cannot cure by stimulating the intestine. To obviate the objection that iron sulphide does not enter the bowel as such (but probably as the chloride (proto-)) Stockman (l.c) gave it in keratin capsules, so that it entered the bowel as such and as such cured chlorosis. To Bunge's assertion that large doses of iron are necessary to effect a cure one may say that it has over & over again been shown that small doses are sufficient — in Stockman's cases, Ferrum Redact. 1/4 - 1/2 gr — doses far too small to have any effect on the sulphuretted hydrogen

Iron in chlorosis plays some special part, which has not been explained yet, over & above the mere passing of a certain amount of it into the blood. In traumatic anaemia patients are able to renew the lost iron from the food - why not so in cases of marked chlorosis? The previous condition of the patients may have something to do with it - rendering the effect of blood loss scarcely comparable - in the one case feeble with organs below par - in the other not necessarily so. It has been said that a traumatic haemorrhage may be the starting point of a chlorosis - if so, I have come across no example of it, in my own experience or in literature — when the patient was previously well.

Iron may be given subcutaneously & as Stockman (l. c.) remarks, the fact of it curing anaemia when so given is evidence in favour of the absorption theory. When it is so administered there can, he says, be no question of inorganic iron stimulating the intestine or combining with Sulphides. The latter no

doubt is true, but as to the former it is not so easy to agree to it. It has been shown that a large proportion of the iron salt given subcutaneously is excreted in some form by the intestine & if so — provided the excretion take place high up in the intestinal tract & so stimulate to increased absorption lower down. This Stockman thinks unlikely as the amount excreted is probably small. As to it use as a method of treating chlorosis, I am of opinion that it is slow, and unsatisfactory while the pain it occasions the patient is sometimes an insuperable obstacle to its employment.

Non-absorption of iron due to coprostasis as a theory must be tested by the ordinary rules of logic: in other words, if the cause be removed, the result will be that absorption will occur & the disease be cured. To remove the cause, one has the plain course of establishing regular daily alvine Evacuations to be adopted — by means of purgatives. This, however, will not cure chlorosis by itself.

& rarely do we find a coprostasis-theory supporter advocating such measures. Indeed one may say invariably do their purgative mixtures contain iron E.g. Clark's mixture contains in addition to Magnesium Sulphate, a considerable amount of Iron Sulphate — a combi-nation which would suit many chlorotics admirably. I need not mention more than the facts already alluded to — that many chlorotics have no constipation, while many constipated persons have no chlorosis — both in favour of a dissoci-ation of chlorosis & constipation as effect & cause.

Non-absorption of iron due to the presence of toxins in the ~~bowel~~ bowel secondary to coprostasis or otherwise is rationally treated by giving antiseptics & if these fail, the theory falls to the ground. Townsend (Boston Med. & Surg. Journal 28 May 1896) gives results of the treatment of 30 cases of chlorosis with β-Naphthol, which were not encouraging, but when iron was added cures were effected in every case

Bunge thought the absence or deficiency of hydrochloric acid permitted decomposition to go on. But Lauder's views as to its being deficient are directly traversed by Oswald (l. c.) who advises alkaline treatment to get rid of the free acid! Stockman treated some cases with hydrochloric acid, as also did Hale White (Guy's Hospital Report, 1891) + neither found any marked improvement. It is improbable therefore that excessive decomposition goes on in the bowels of chlorotics, + so it is not the cause, directly or indirectly of the disease.

The theory that the non-absorption of iron is due to the presence of toxins in the blood is meantime merely a theory, Haig's views are the first form of it, + in regard to them, I would point out that girls frequently become chlorotic before their 18th year - the time when Haig supposes the stored-up uric acid to become dissolved + flood the blood, so causing chlorosis in some manner which he does not explain. If the presence

of urates in the blood causes chlorosis – a form of anaemia, why does not anaemia appear oftener in persons in whom we know an excess of urates is present viz. in the Gouty? He says iron 'clears the blood' of uric acid & so is useful in treatment. He does not enlighten us further as to its action & I have never read of any chlorotic having been cured by Iodide of Mercury or Salicylate of Soda – which he suggests should be given "if iron fail." Another form of the toxin theory is given in the suggestions of Hillmann & Charrin. I have so far met with no confirmation of them. That menstruation is an adjuvant means of getting rid of waste products is possibly true, but that they cannot be eliminated through any other channels than the genital system, is too great an assumption to make without adducing some form of proof.

Clements view as to the infectious nature of the disease is founded on too few

observations so far has not been confirmed. Some of the supporters of the theory that a toxin exists in the blood have treated the disease in a manner which we must recognise as indicative of their having the courage of their opinions although it is somewhat heroic; & that is what has already been referred to as a treatment of such cases as were supposed to have a "plethora of serum" (Scholz, l.c.) viz. blood letting. Wilhelmi treated some cases by venesection, taking 3-4 ounces of blood, & thereafter by heat in bed so as to induce copious sweating. He says the severer the case, the better the result, & specially mentions that the treatment is of no value in "hysterical or symptomatic a-"naemia" (Lancet II/1889 p 1302)

As to the neuro-vascular theory of the non-absorption of iron Lloyd Jones (B. M. J. II/1893 p 670) thinks some disturbance of the sympathetic exists which keeps the blood vessels dilated*. When iron, or nickel, or copper (as the arseniate) is given

* while Alston (l.c) thinks the opposite condition the cause of its non-absorption

a contraction of the vessels is brought about and the food iron allowed to be absorbed. At the same time it is well to give cardiac & vascular tonics. In the meantime one can only say that such a theory has but little to support it; it has yet to be proved that iron acts as Jones suggests.

The rationale of the action of iron given by the mouth may, in conclusion be briefly summed up as follows. On reaching the stomach, it is converted into the protochloride - chiefly, & passing into the bowel is directly absorbed in various chemical combinations, but in small quantity, & eventually reaches the liver where further elaboration takes place & where it is stored up for use as may be required.

Chlorosis therefore is a disease which may be regarded in its ordinary uncomplicated form as a disorder of nutrition brought about by loss of blood iron or ingestion of an insufficient amount of iron in the food, at a time when

great demands are made on the general system, causing after a varying time a certain loss of power in forming red blood corpuscles as well as many other changes in the various systems of the body, and in such cases eminently curable by the administration of iron. Complicated cases have to be treated each according to its requirements, and where organic developmental changes are present, care must be taken to place them by themselves, when one is considering them from a therapeutic point of view.

Diagnosis.

The Diagnosis is not difficult, if one pay attention to the positive signs of the disease — age, sex, greenish pallor of the skin, the relatively good nutrition and the absence of the signs of other forms of anaemia. The main point, however, is the blood condition — the relatively great diminution of Hb in

comparison with the corpuscles. In symptomatic anaemia, the history & constitution of the patient assist in arriving at a correct conclusion while in pernicious anaemia the important signs are a diminution of corpuscles out of all proportion to the Hb., the lemon colour of the skin, the pyrexia, and the evidence of haemorrhages or of blood disintegration.

It is more difficult to differentiate between the forms of chlorosis, & it may be impossible. The following are signs which will give an indication of the probable presence of vascular changes - (a) general imperfect development: (b) delay in the arrival of the genitals, at functional maturity: (c) premature or excessive menstruation, associated with signs of cardiac hypertrophy, which has nothing else, such as valvular mischief or renal disease to account for it: (d) a systolic murmur heard at the base.

Prognosis

In the vast majority of cases, the prognosis is favourable. The slighter forms of the disease tend to get well spontaneously & any case where no organic change exists will be cured by suitable treatment. The presence of vascular or other developmental anomalies in some cases renders the prognosis uncertain in such, and where their existence is clear, the prognosis is bad as regards complete recovery, although some improvement may be undoubtedly effected by treatment.

Treatment

According to the view taken of the pathology of the disease, the treatment has in the past varied from the adoption of simple hygienic measures to the administration of many & various drugs, bloodletting, sweating &c. From my standpoint the treatment resolves itself into, (1) treatment of cases where there is more or less marked organic change, & (2) treatment of cases which are functional in their

nature. In the former class treatment is at the best palliative or symptomatic while in the latter it is scientific & curative. We must pay attention to the state of the digestive tract particularly, and only when disturbances of its functions have disappeared can iron be given with the most satisfactory results. Diet, therefore, at first should be simple & nourishing but later, when stomach & bowels permit a full dietary should be prescribed. Rest in bed is not essential, but when there is weakness, it is a useful help.

General measures of hygiene, such as moderate exercise, provision of sufficient light & air, should not be neglected. While all excesses – late hours, excitement, too great exercise should be avoided. – Menorrhagia is a symptom which may require special treatment, & for it ergot & hydrastis are invaluable: On the other hand amenorrhoea should not be specially treated – in ordinary cases the absence of the menses is probably beneficial.

Iron requires to be given in all cases.

and the preparation to be used & the form in which it should be given should be determined to a great extent by the circumstances of each case. The most generally suitable preparations are the mild ones such as the freshly prepared carbonate (as in Pil. Ferri P.B.) and reduced iron. Preparations of organic iron such as Haemoferrum, the peptonmanganate, Residuum rubrum, I have found inferior to inorganic preparations. While the use of iron by hypodermic injection may be left out of account as a practical means of curing chlorosis. The drug must be taken steadily for at least three weeks or longer if necessary – the blood being tested from time to time – & continued in diminishing doses after the corpuscles have reached the normal & the Haemoglobin at least 70%.

Finis.

Addenda

Appendix No. I

Record of 17 Clinical Cases

Case I

Mary Robertson, aet. 24. Laundrymaid Inverness District Asylum: Complained of swelling of the feet, weary feeling at work, breathlessness on exertion, - present during the last 5 months. This is the second attack of a similar kind patient has had, the first being about 7 years ago, & was cured "by taking pills." Patient up till menstruation commenced was strong & healthy; then - her 15th year - it was profuse & regular for over six months when it began to be scantier & finally became irregular & stopped. Shortly thereafter the symptoms similar to the present condition came on & was treated therefor. In her 20th year she became pregnant & was delivered of a full time child, which she did not nurse: the menses returned a few months thereafter & regularly continued till 5 months ago when the flow gradually became less & ceased. Present surroundings & food very healthy, and

Case I (cont'd)

work, though pretty hard, is not excessive. Patient is one of a family of 12, all of whom were quite strong except a sister who was "bloodless" for a time. No history of similar trouble in mother. A brother died of "consumption"

Patient's height is 66½", then weight 130 lbs. General appearance pale & sallow, well developed & dark complexion. Temp. 101.5° F.

Haemopoietic System Examination of blood revealed micro- and poikilocytes, but no apparent increase of white corpuscles. Haemoglobin 33% Red Blood Corpuscles 2,856,000 per cubic millimeter

Alimentary System Appetite not good Feeling of fulness present after eating with occasional acid eructations No pain: nor constipation

Circulatory System Over base of heart is heard a soft blowing systolic murmur

Case I (contd)

Dulness nearly ½" to right of Sternum.
Respiratory System Breathing 20 per. min. Slight exertion causes dyspnoea
Integumentary System. Skin pale & cold at extremities. Covering of fat well preserved. Slight oedema round ankles.
Urinary System - Urine - colour pale straw: tests for albumin sugar negative. Urea - 300 gr in 24 hrs.
Reproductive System. Catamenia suspended. No abnormality of pelvis Breasts, pubic & axillary hair well developed.

Treatment

In a week temperature was normal, & patient was then put on a mixture containing Ferri sulph. Exsicc. 5gr. t. i. d. In 5 days the weight rose 2 lbs, the Hb to 35% and the R. B. Corpuscles numbered 2,600,000. At end of second week Hb 45%, R.B.C. 2,800,000 weight 135 lbs. At end of 3rd week Hb 50% R.B.C. 3,000,000 & weight 140 lbs. Patient was now allowed up

Case I (cont'd)

At end of 4th week 142 lbs Hb 65% & RBC 3,150,000. She then went home & did not return to hospital, though asked to do so, for further observation. Said she then felt well & strong.

Case II

Charlotte Fraser, act. 18, Tweed Mill-worker 59 Huntly St. Inverness, complained of shortness of breath, palpitation & amenorrhoea – present about 6 months. Began to menstruate at about 14 years of age was regular till about a year ago the flow having been getting less & less for a few months before then. Has always had good food, but latterly has felt disinclined to take it. Bowels very irregular. In the mill, has got into the habit of chewing cloves, which she says relieves the feeling of distension in the stomach felt after taking food. Surroundings at home fair. No member of family of 8 members suffered from similar disease.

Height 65", weight 112 lbs: General appearance: well developed & nourished though pale. Temp. 98°.7

Haemopoietic System – Blood examination Hb. 40% R.B.C. 4,000,000 per cub. millimetre Some poikilocytes present.

Alimentary System.– Feeling of distension after food. Buccal mucous membrane

pale: tongue furred. Bowels irregular though no marked constipation present.

Circulatory System. – Dulness ½" to right of sternum. No murmurs. Venous hum at right side.

Respiratory System: – Breathing regular, 19 per min. Dyspnoea on exertion

Integumentary System – Skin pale + sallow. Fatty covering well preserved. No oedema.

Urinary System – Urine – pale straw colour. Tests for albumin & sugar negative.

Reproductive System. – Breasts &c well developed. Catamenia absent. Slight leucorrhoea present.

Treatment

Patient was put on a purgative mixture containing Ferri Sulph. exsicc. 5 grs t.i.d with the following result:–

End of Week	Red Bl. Corps	Hb %age	Weight
1st	4,000,000	45%	—
2nd	4,001,000	52%	119½ lbs
3rd	4,000,000	58%	122 lbs
4th	4,002,000	63%	124 lbs
5th	4,062,000.	65%	125 lbs

Nearly all symptoms disappeared: Menses returned 8 wks after.

Case III

Thomasina Maclean, aet. 16. Tweed hill worker, 16 Nelson St. Inverness. Complained of shortness of breath, indigestion & amenorrhoea for the last 6 months. Was strong up till her 15th year when menstruation commenced which lasted about 6 months. She felt herself then less able for work owing to the dyspnoea even slight exertion caused. Temp. normal Surroundings at home - indifferent: work somewhat exacting. Has no brothers nor sisters, does not know if mother ever similarly affected. Height 66", weight 115 lbs. General appearance dark & sallow, somewhat heavy: well proportioned

Haemopoietic System - Hb 55% R.B.C. 3.500,000 p. mm³. Few poikilocytes or microcytes.

Alimentary System - Buccal Mucous membrane pale: tongue very foul & teeth much decayed. Appetite poor & after eating she complains of fulness - lasting 4 or 5 hrs - with occasional acid eructation. No constipation

Circulatory System - Right margin of heart ¼" to Right of sternum. Systolic apex

Case III (contd)

murmur heard all over praecordia - loudest toward base. Venous hum well marked on both sides of neck.

Respiratory System. - Breathing 17 p. min. Dyspnoea on exertion

Integumentary System. Skin dark & pale No oedema.

Urinary System. Urine pale: no albumin nor sugar. Urea diminished.

Reproductive System. - Catamenia suspended. Breasts &c. well developed.

Nervous System. - Complains of neuralgia & headache - probably due to carious teeth.

Treatment

Ferri Sulph. Exsicc. gr 3 t. i. d in pill with following results: -

End of week	RB Corpuscles	Hb.
1.	3.560,000 p. mm^3	60 %
2.	3.550.000	60 %
3.	3.570,000	63 %
4.	3.700,000	65 %
5.	3.790,000	68 %

Case IV

Helen Deans. aet 18, Tweed Mill-worker 22 Muirtown St. Inverness, complained of breathlessness & amenorrhoea lasting 2 years. Was quite well up to her 15th year when menstruation began, which was profuse for a time gradually becoming scanty till it stopped. About this time she "went off" her food & found herself breathless on attempting any work. Has always had a fairly comfortable home & good food, but the surroundings are by no means hygienic. At the mill she used to eat dry tea. Is one of a family of 9 but is the only member troubled thus. Mother when a girl had a similar attack Height 63" weight 112 lbs. General appearance heavy till proportioned: fair. Temp. normal.

Haemopoietic System — Hb 50% R.B.C. 3,600,000 p. mm^3. No poikilocytes nor microcytes.

Alimentary System. — Buccal mucous membrane pale, tongue furred & teeth bad. Has no great appetite or fanciful about—

Case IV (contd)

diet. Has a feeling of weight after food with slight pain. Constipation marked.

Circulatory System Right side of Heart not beyond Right of Sternum. No murmurs. Venous hum above both clavicles.

Respiratory System:- Breathing 18. Dyspnoea on exertion.

Integumentary System:- Skin not very pale but muddy + disfigured with acne. Slight oedema of ankles

Urinary System:- Urine pale: + trace of albumin + sugar. Urea diminished.

Nervous System:- Has headache: is depressed in spirits.

Reproductive System. Catamenia absent. Breasts &c badly developed: leucorrhoea present.

Treatment

A mixture containing Ferri Sulph Exsic. gr 5 Magnes Sulph ʒi, Acid Sulph Dil 10 m + Quinine Sulph gr ½ + t. i. d was given.

At end of 3rd week Hb. was 65% & R.B.C. 4,000,000, p m m³. - During the following year I saw this patient several times; menstruation had never properly returned, but she felt very much better herself.

Case V

Alice Bertha Churchard, aet 19. Nurse-maid. Stronie Lodge, Inverness, complained of breathlessness, pain over region of heart & amenorrhoea — present for 7 months. Commenced by feeling of uneasiness after food with breathlessness on going upstairs. Menstruation was regular from her 15th year, & never profuse. Owing to the discomfort caused by taking food, has not been able to take sufficient quantities for over a year. Surroundings healthy. Is the 5th member of a family of 6 & no other nor mother has had this complaint.
Height 61 inches. Weight 96 lbs. General appearance - small but well made dark girl.
Temp. normal
Haemopoietic System. - R.B.C. 3,050,000 p/mm^3
Hb. 40%: no poikilocytes
Alimentary System. - Buccal mucous membrane pale
Appetite fair but afraid to take food owing to pain it causes. Constipation marked
Circulatory System. - No evidence of dilatation: no murmurs: Venous hum over R. clavicle
Respiratory System. - Breathing 19. Dyspnoea present

Case V (contd)

on exertion.

Integumentary System. Complexion dark & clear - with greenish yellow pallor; oedema at ankles.

Urinary System. - Pale, albumin-sugar-free urine.

Reproductive System. - Mammae & well developed. Catamenia absent No leucorrhoea.

Nervous System. Headache frequent.

Treatment

Gastric Condition attended to first by Bismuth. Subnit. gr 20 t.i.d along with Liq. Magnes. Carbonatis & Milk in Equal parts - the latter being given in addition in ℥ii doses every hour. This gave relief after a few days & she was put on Blaud's Pill gr 5 - 2 t.i.d. gradually increased to 3 t.i.d. In 3 weeks the R.B.C. numbered 4,000,000 & the Hb 60%.

Case VI

Elizabeth Douglas, aet. 19. 11 Muirtown St. Inverness. Tweed mill-Worker. complained of Breathlessness, pain after food and amenorrhoea, present 14 months. Menstruation commenced at 15½ + was regular + not profuse for 18 months when it began to get less in amount + finally it stopped. About then, she began to feel uneasiness after food + to relieve hunger she took to eating dry tea at her work. Used also to drink a good deal of tea at home. Home fairly comfortable, + food good but without variety. Three in family - no other except herself being troubled with this complaint. Height 63½" weight 114 lbs. Is not well developed + has a somewhat slouching gait. Temp. 100°F.

Haemopoietic System. - R.B.C. 2.214.800 p. m m^3 Hb. 40% Poikilocytes numerous.

Circulatory System. - Heart's action feeble + extremities cold. Right border ½" beyond right of sternum. No murmurs. Venous hum above both clavicles.

Alimentary System. Mucous membrane of

Case VI (Contd)

mouth pale. Appetite poor & capricious
Slight pain & fulness after food. Constipation
present.

Respiratory System:- Breathg 18 per min, Dyspnoea marked on Exertion.

Integumentary System:- Skin fair & not clear, nor very pale. Oedema of ankles present.

Urinary System:- Urine pale, free from albumen & sugar.

Reproductive System. Catamenia suppressed
Breasts &c not well developed. Leucorrhoea
present.

Nervous System. Is somewhat depressed & fanciful. Headache present often

Treatment

The temperature remained 100° at night for a fortnight & thereafter was subnormal, with an occasional rise to 100° at night
Patient was first put on Milk diet & on 3rd day after first observation 6 m of a 10 % solution (aqueous) of Ferri & Ammon. Citras were injected between the scapulae & 9 m next day. The local reaction prevented any injection for the next 2 days. On

Case VI (contd)

the 7th day, 10 m of a 5% solution were injected into the right arm. On Examination the corpuscles numbered, 2,225,000 p mm^3 & the Hb 44%. Every day during the next week the same amount was injected, — the diet including now beef tea & milk pudding. Cascara Sagr. Ext. liq. ℥i with 5 m Tr. Belladonnae was given for the constipation. During the 3rd week 10 m of the 5% solution were injected for 3 days & 10 m of a 15% solution for 3 days & then the blood was again examined the R.B.C. numbering 2,900,000 & the Hb 48%. To the diet were now added, fish, chicken &c During the 4th week 10 m of the 15% solution were injected every 2nd day & at the end the corpuscles were 3,100,000 & the Hb 50% During the last week of observation, the injections were stopped & Sol. Bland, 3 t. i. d given with the result that the Hb increased to 60% & the R.B.C. to 3,500,000 p mm^3. She then felt well & went to the country before beginning work again

Case VII

Christina MacIver, aet 18, Domestic Servant, 8 Albert Place, Inverness, complained of inability to work, breathlessness & palpitation, present 6 months. Has been well always till this present illness began which came on very gradually. Has always had good food, but does not eat much, & is fond of tea. Surroundings comfortable. Is one of a family of 7, & one elder sister suffered about the same age ~~of~~ from a similar trouble. She is not aware if mother so troubled when young. Height 62 inches weight 94 lbs. Dark & small, though not ill-developed. General appearance dull. Temp 99°.2

Haemopoietic System:- R.B.C. 3,560,000 p. mm³, Hb. 33%
No poikilocytes.

Alimentary System:- Mucous membrane of mouth pale. Appetite fair, but owing to disagreeable sensations after food does not take much food. Constipation not marked.

Circulatory System:- No evidence of dilatation of heart. Systolic bruit at base in aortic area of soft character. Venous hum on right side.

Respiratory System:- Breathing 17 per minute

Case VII (contd)

Dyspnoea on exertion.

Integumentary System.- Skin sallow: no emaciation. Slight oedema round ankles at night.

Urinary System. Urine pale: no albumin nor sugar

Reproductive System. Menstruation present: has been always regular since onset at 15.5 years.*

Nervous System.- Mental powers dull; spirits depressed. (*Breasts &c fairly developed.)

Treatment

For first week was kept in bed & given Milk & Mild purgatives & an acid & bitter tonic. Afterwards diet increased by Beef-tea.- Eggs &c. After 10 days Hb. & R.B.C. were unchanged in amount and number. Was then put on Ferri Sulph Exsicc. gr 5 with ʒj Magnes. Sulph. & thereafter improvement was rapid; so that by the end of 3 weeks R.B.C. numbered 4,200,000 per c.mm. & Hb. 60%.

Case VIII

Catherine Mackintosh, aet. 16, Domestic servant, 8 Shor Lane, Inverness, complained of breathlessness, palpitation of heart, lassitude & amenorrhoea. Has never been very strong so does not remember when she began to feel ill but it was at least 6 months ago. Does not take much food & her surroundings are unhealthy. Is third youngest of a family of 7 – none of whom suffered from similar disease, nor did her mother. Is an ill-developed lanky girl: menstruation only occurred recently, was scanty, irregular for a few months & now is not very regular. Has never been excessive Temp. 98·6 F. Height 63½" weight 97 lbs.

Haemopoietic System. – Hb 60% R.B.C. 3,500,000 p. mm³ Some poikilocytes are present.

Alimentary System. – Lips & mucous membrane of mouth not very pale. Appetite fair, but fullness after eating occurs. Prevents much food being taken. Constipation present

Circulatory System. – No dilatation of heart. No murmur. Venous hum on right side.

Respiratory System. – Breathing 20 per min. Dyspnoea

Case VIII (contd)

present.

Integumentary System - Skin pale sallow, & fat well marked. About the time of the menstrual molimen for 4 months back she has had attacks of subcutaneous ecchymosis limited to the circumoral region 3/8" in depth measuring from junction of skin & mucous membrane. This is ushered in with a feeling of tingling, the parts become swollen & the coloration passes thro' all the changes of a subcutaneous effusion of blood - lasting in all about a week. Oedema of feet present

Urinary System. - Urine pale: no albumen nor sugar

Reproductive System. - Menstruation irregular & sometimes painful. Breasts &c badly developed.

Nervous System. - As above mentioned, tingling & feeling of heat coming on before discoloration of face, with severe headache. She is much concerned about herself.

Treatment

Ferrum Redactum & II was given along with Strychnine & Ergot - the two latter to be taken for a fortnight before each period was due. This has been so far successful in improving blood condition - R.B.C. now (April '97) being 3,560,000 p. m.m.^{3} & Hb 65% - as well as preventing ecchymotic attacks.

Case IX

Dolly Fraser aet. 18, Nurse-maid, Ballifeary Inverness, complained of bleathlessness on exertion and amenorrhoea, present for 9 months. Up to the age of 15, when menstruation began, had been well, & was fairly well for 3 months thereafter when it gradually ceased. For 6 months there was no discharge, & on its recurrence the flow was not scanty, but irregular - the periods varying - 4, 5, or 6 wks. At the time she was troubled with pain across stomach & back. At work was kept busy, & food was good & abundant, but she could not take much owing to the subsequent pain in the stomach. Surroundings healthy. Height 65½" weight 120 lbs. Is a tall fair well made girl: one of a family of 3 girls: one sister suffered from a similar complaint, but never heard that her mother did. Temp. 98·6

Haemopoietic System. - R.B.C. 3,108,000 p. c. m³ Hb 58%. No poikilocytes to be seen.

Alimentary System. - Mucous membrane of mouth pale, tongue furred. Has some fulness & slight pain occasionally after food. Constipation present.

Circulatory System. - No evidence of dilatation

Case IX (contd)

No murmurs. Venous hum present on both sides of neck.

Respiratory System:- Breathing 17. Slight dyspnoea on exertion.

Nervous System.- No symptom of disease.

Integumentary System:- Skin pale & delicate. Fat well retained. Oedema about ankles at night.

Urinary System.- Urine Pale: no albumin nor sugar

Reproductive System:- Catamenia absent. Breasts &c well developed.

Treatment

Ferri Pil. (B.P.) & As given in capsules. Still (April 1897) under observation. In one week blood improved – R.B.C. 3,200,000 p.mm^3 & Hb. 62%.

Case X

Christina Urquhart aet 22. Maryburgh Drigwall, complained of breathlessness, dimness of vision, + amenorrhoea ^ - present 18 months. For five years, has been more or less delicate, and of late the sight has been getting worse. Is one of a family of 5, none of whom have had any similar disorder. Has never had a great appetite; has always had plenty of good food: surroundings good. Height 67" weight 130 lbs. Is a well shaped girl of pale translucent appearance. Temp. 99°.7.

Haemopoietic System.- R.B.C. 3,500,000 p mm^3 Hb 60% Poikilocytes absent.

Alimentary System. Buccal mucous membrane pale: tongue foul, + complains of fulness after eating and flatulence. Constipation marked.

Circulatory System.- No dilatation ^ at of heart: no bruits: bruit on right side of neck.

Respiratory System.- Breathing 17 per. minute Dyspnoea on exertion.

Urinary System.- Urine Pale: no albumin nor sugar

Integumentary System.- Skin pale: fatty covering well marked: no oedema.

Nervous System.- In both eyes $V = \frac{6}{24}$

Case X (contd)

and ophthalmoscopically marked fundal changes are present - especially in right eye — distinct patches of choroidal inflammation.

Reproductive System: Menstruation in abeyance — formerly was very profuse. Slight leucorrhoea. Breasts are well developed.

Treatment

Rest + smoked glasses for eyes
Ferrum + Arsenic internally - Blaud's capsules.
In six weeks patient reported herself freer from the dyspnoea, but blood not examined.
Fundal changes in eyes about the same + no change in Vision.

Case XI

Flora Mackay, aet. 16. Tweed-Mill worker 5 Shor Lane, Inverness, complained of palpitation, fainting at her work, + amenorrhoea. About a year ago began to feel ill + to be unable to digest her food. Shortly thereafter the menses appeared: regular + not excessive for 4 months. The digestive troubles increased + constipation was very marked, + she was treated therefor, but as improvement resulted, she gave up taking the medicine ordered. Menstruation has not recurred. Habits as to food very irregular - being contented with "scraps of food" instead of a good meal" (sic - her mother). Home surroundings non-hygienic, + the factory work is somewhat exacting. Is 6th in a family of 10: no other member has suffered similarly nor has her mother.

Height. 66" Weight 112 lbs. Appearance fair with delicate fine skin: well developed for her age. Pallor well marked. Temp. 99

Haemopoietic System. - R.B.C. 3,290,000 per $m.m^3$ Hb 48%. Poikilocytes not seen.

Alimentary System. - Mucous lining of mouth pale. Tongue furred. Bowels constipated + teeth carious

Case XI (contd)

Has cravings for indigestible things, which she knows disagree with her, while of ordinary food she takes but little.

Circulatory System.- No evidence of Heart dilatation. No murmurs: Venous hum above right clavicle. Palpitation present especially after food.

Respiratory System.- Breathing 18 per min. Dyspnoea on even slight exertion.

Integumentary System:- Skin pale & delicate. Subcutaneous fat well preserved.

Urinary System.- Urine pale: no albumin nor sugar.

Reproductive System:- Catamenia suppressed. Breasts &c well developed.

Nervous System.- Has once or twice fainted at work. Neuralgia of face - probably due to bad teeth - present.

Treatment

Ferri & Ammon. Citras given in 5gr doses t.i.d. Reported herself much improved in 3 weeks when she went to the country, & has not yet returned (April 1897) Blood not examined, but appearance greatly improved. Bowels acted on with Cascara Sagr.

Case XII

Johan Macaskill, act. 17, Domestic Servant 8 Shoe Lane, Inverness, Complained of languor, palpitation & amenorrhoea, present about 18 months. Though never very strong, she has not had any severe illness. Menstruation occurred in her 15th year & shortly thereafter she went to work as a domestic servant, but before long returned home as she found the work too hard, & menstruation had ceased. Lately has had no appetite for food, which has always been plentiful, though coarse. General surroundings at home unhealthy. Is 4th member of a family of 8, one of whom suffered similarly at the age of 19. Mother was ill from same trouble when a girl.
Height 65½" weight 107 lbs. Is a fair poorly made girl, pale & heavy looking.
Temp. 99° F.
Haemopoietic System. - R.B.C. 3,110,000. p m m³.
Hb 52%. No poikilocytes.
Alimentary System. - Buccal mucous membrane pale: tongue furred. Eats but little food, as it causes discomfort & even pain

Case XII (contd)

sometimes. Has peculiar cravings, especially for raw whole rice.
Circulatory System. – Right border of heart slightly to right of sternum. Systolic murmur of soft quality heard all over praecordia, loudest at base, & venous hum well marked over both clavicles.
Respiratory System. – Breathing 19 per minute. Dyspnoea on exertion.
Integumentary System. – Skin pale & patient is not stout. No oedema at ankles.
Urinary System. – Pale urine: no albumin nor sugar
Reproductive System. Catamenia absent. No leucorrhoea. Breasts are ill developed
Nervous System. Nil.

Treatment

Reduced Iron gr 2 t.i.d. Milk diet gradually added to. Was sent to Convalescent Home after a fortnight & then blood state was Hb 60% R.B. Corpuscles 3,200,000 per mm^3.

Case XIII

Jane Fraser, aet. 16. Fort-Augustus, complained of palpitation of heart on ascending stairs, oedema of ankles at night + menorrhagia – present about 9 months. was well until menstruation occurred, which for a time was very profuse, + coming on every 3rd week. was at the time in Germany, + on returning after a 6 months stay there felt weak + unable for much exertion. Habits as to food-taking irregular + suffers from "indigestion". Surroundings + food at home good. Is 5th of a family of 7, none of whom suffered similarly nor did the mother. Height 63" weight 8 4 lbs. Is a fair, pale, thin but well proportioned girl with a delicate clear complexion. Temp. 99°7.

Haemopoietic System. – R.B.C. 3,000,000 p. m.m.^{3} Hb. 58%. No poikilocytes observed.

Alimentary System. – Has occasionally attacks of fulness + discomfort after eating. Constipation marked. Tongue furred.

Circulatory System. – No evidence of heart dilatation. Soft blowing systolic murmur at apex only, + venous hum above both clavicles.

Case XIII (contd)

Respiratory System:- Breathing 18 p. m. in. Dyspnoea on exertion.

Integumentary System.- Skin pale & delicate. Subcutaneous fat not well marked. Oedema of ankles present at bedtime.

Urinary System:- Urine pale: no albumin nor sugar

Reproductive System.- Catamenia present. Breasts are fairly well developed.

Nervous System.- Headache occasionally.

Treatment

Food given in small amount at regular intervals. Pil. Blaud gr 5 i T. i.d gradually increased to 3. After 3 weeks Hb. was 66% & R.B.C. 3,100,000. Felt well & was able to go about without discomfort.

Case XIV

Catherine Cameron, aet. 25, Nursery Maid 3 Celt St. Inverness complained of swelling of feet, breathlessness + amenorrhoea, present 3 months. Had been quite well up to her 20th year when she had an attack similar to the present one, for which she was medically treated + cured. Habits as to food somewhat irregular owing to uncomfortable feeling produced by eating. Surroundings good. Is one of a family of 5 girls, 2 of whom suffered more than once from similar attacks. Temp. 98·6°F. Height, 68" Weight 131 lbs. Appearance very sallow + dark: well developed but with some disproportion: Marked pigmentation round eyes. Haemopoietic System. - R.B. Corps. 3,000,000 p. m.m.³ Hb. 48%. A few poikilocytes present. Alimentary System - Tongue foul + buccal mucous membrane pale. Teeth bad. Has a feeling of fulness with occasional pain after food. Bowels very constipated. Circulatory System. - Right border of heart just beyond right edge of sternum. Soft systolic murmur over apex + in tricuspid area.

Case XIV (contd)

Venous hum over both clavicles.
Respiratory System: Breathing 18 per min.
Dyspnoea on exertion.
Integumentary System:- Skin pale + dark.
Adipose covering well preserved. Pigment
marked round eyes, in axillae, + round mam-
millae. No striae abdominales.
Urinary System:- Nil
Reproductive System:- Amenorrhoea present
Mammae &c well developed. No leucorrhoea
Nervous System:- Headache often present.
Somewhat depressed in spirits.

Treatment

Ferrum Redact. gr 3 t. i. d along with
gr 30 Pulv. Glyc. Co. For constipation 3ss
each of Pil. Hydrarg + Pil Colocynth +
Hyoscyami - every 3 or 4 days. At end
of a fortnight Hb = 56% + R.B. Corpuscles
3,080,000. Skin clearer + patient felt so
well that after 3 weeks further treatment
she returned to her situation - the amenor-
rhoea still persisting.

Case XV

Catherine Reid. aet. 17. Tobacco-Factory Girl 19, Factory St. Inverness. Complained of breathlessness, weariness, & menorrhagia present 6 months. Patient was always well up to the occurrence of menstruation 6 months ago – very profusely. Has been irregular & profuse since. Patient accustomed to poor food, surroundings are insanitary & unsatisfactory. Is 4th of a family of 7 – no other member nor mother having suffered similarly

Height 65", weight 110 lbs. General appearance fair, pale, & well made Temp. 98·6°F

Haemopoietic System. – R.B.C. 2,980,000 p mm³
Hb. 58% Poikilocytes sparingly present.

Alimentary System. – Some symptoms of gastric Catarrh. Bowels constipated

Circulatory System. – No evidence of dilated heart No murmurs over praecordia. Venous hum heard on both sides of neck.

Respiratory System. – Breathing 18 per minute. Dyspnoea on exertion.

Integumentary System. Skin pale & coarse. Fat well distributed. No oedema.

Case XV (contd)

Urinary System :- Nil

Reproductive System :- Catamenia irregular and profuse. Breasts &c well developed.

Nervous System :- Headache & "nervousness" often present.

Treatment

Milk diet gradually added to. Ergot & Iron internally - the former 20 m Liq Erg. Ext. to be taken for a week before the next period is expected, & longer if required. Iron given in form of Pil. Bland gr 4: 2 t. d. s

After a month of treatment - the catamenia having been almost normal in amount - Hb = 60% & R.B. Corpuscles 3,010,000. Patient went back to work at end of 2nd month Hb = 65% & R.B.C. 3,180,000. Still under observation (April 1897.)

Case XVI

Catherine Ramsay, aet 20. 24 Telford St. Inverness. Complained of amenorrhoea lassitude, pain in stomach - present 8 months. Has never been very strong, and since her 16th year when the menses appeared, if anything, has been less so than before. No inclination to take food, which causes pain. General surroundings favourable. Has 4 brothers & sisters, in whom has been no similar disease nor in mother. Is a dark ill-proportioned but big-boned girl, of sallow muddy complexion. Height 65" weight, 110 lbs. Temp 100°7.

Haemopoietic System. - Hb 50% Red Blood Corps. 3,152,000. Some poikilocytes present.

Alimentary System. Buccal mucous membrane pale: Digs, taking food causes pain & has done so for 18 months: Pain sometimes so severe as to require relief by morphine. Has occasional attacks of vomiting & when she was ill first put up some dark coloured material at least twice

Circulatory System. - Rt. border of heart a little to right of sternum. No murmurs

Case XVI (contd)

Venous hum over both clavicles.

Respiratory System.- Breathing 17 per min. Dyspnoea on exertion.

Integumentary System.- Skin pale: fat present in good amount.

Urinary System.- Urine not examined

Reproductive System.- Catamenia suppressed. Slight leucorrhoea: Breasts &c not well developed.

Nervous System.- Headache often present.

Treatment

Pil. Bland (2) in capsules 2 t. i. d. Milk diet. I am informed that patient is now (April 1897) much improved i. at the end of 3 months treatment. I did not have an opportunity of examining her myself as she is another practitioner's patient.

Case XVII

Christina Maclean, aet 21, 10 View Place Inverness, complained of breathlessness pain in stomach + vomiting – present 5 months. Came to live in the town 3 years ago, & since then has not felt so strong as before. Menstruation has always been regular since her 16th year, when it began. Habits as to taking of food not so regular as when she lived in the country. Surroundings healthy. Pale & fair in appearance. Height 68", Weight 120 lbs. Temp. 100°F / in family none of whom suffered similarly.

Haemopoietic System. – Hb 60% Red Corps. 3,320,000 p. mm³. No poikilocytes observed.

Alimentary System. Tongue flabby & furred: appetite not good & owing to pain being caused she has taken no solid food for a month. Never vomited any dark material – present & vomit being slimy & of yellowish colour with a bitter acid taste. Constipation marked.

Circulatory System. – No evidence of dilated heart: no murmurs nor venous hum

Case XVII (contd)

Respiratory System. - Breathing 17 per min. Dyspnoea on exertion.

Integumentary System. - Skin pale: fatty deposit fair: No oedema.

Urinary System. - Nil.

Reproductive System. - Menstruation regular: Breasts & well developed.

Nervous System. - Nil.

Treatment

Bismuth, Soda & Hydrocyanic acid Dil. given to relieve gastric symptoms & in a week Ferri & Ammon. Citras in 5 gr doses. Patient slowly improved, in 3 weeks feeling much better & looking better. Had no opportunity of further testing the blood, owing to patient's objection.

Note

Note

The foregoing cases occurred during the years 1893, 1894, 1895, 1896 — the first 7 patients being observed in Hospital — The Northern Infirmary, Inverness — & the remaining 11 at their own homes. In the course of my ordinary practice, I have met with others — 6 in 1894, 7 in 1895 and 6 in 1896 — of which notes could not be, for various reasons, particularly taken. The cases occurred with almost equal frequency in summer & winter. The ratio of cases of Chlorosis occurring in a general practice like mine to the total number of cases attended is a little over 1 %.

Table

	1893	1894	1895	1896
Cases Noted	7	2	3	5
Cases not Noted	—	6	7	6
Total	7	8	10	11
Percentage of all cases seen	·937	1·27	1·3	1·1

Appendix No II

Analysis of Preceding Cases

I General Analysis

No. of Case	Age	No. of Attack	Hereditary Tendency	Occupation	Surroundings	Appearance	Development	H.S.	A.S.	C.S	R S	I S	U. S	R. S	N S.
I	24	2nd	X	Dom. St.	Good	Dark	Good	·X·	X	X	X	X	0	·X·	0
II	18	1st	0	Weaver	Fair	Dark	Good	·X·	X	0	X	X	0	X	0
III	16	1st	0	Weaver	Indifferent	Dark	Good	·X·	X	X	X	X	0	X	0
IV	18	1st	0	Weaver	Fair	Dark	Not Good	X	X	X	X	X	0	X	0
V	19	1st	0	Dom. St.	Good	Dark	Good	·X·	·X·	0	X	X	0	X	0
VI	19	1st	0	Weaver	Indifferent	Dark	Fair	·X·	X	X	X	X	0	·X·	0
VII	18	1st	X	Dom. St.	Good	Dark	Fair	·X·	X	X	X	X	0	0	0
VIII	16	1st	X	Dom. St.	Bad	Dark	Bad	·X·	X	X	X	·X·	0	X	·X·
IX	18	1st	X	Dom. St.	Good	Fair	Good	·X·	X	0	X	X	0	·X·	0
X	22	1st	0	Domestic	Good	Dark	Good	·X·	X	X	X	X	0	·X·	·X·
XI	16	1st	0	Weaver	Bad	Fair	Good	·X·	·X·	X	X	X	0	X	·X·
XII	17	1st	X	Dom. St.	Bad	Fair	Bad	·X·	·X·	X	X	X	0	·X·	0
XIII	16	1st	0	—	Good	Fair	Fair	·X·	X	X	X	X	0	0	0
XIV	25	2nd	X	Dom. St.	Good	Dark	Good	·X·	X	X	X	X	0	·X·	X
XV	17	1st	0	Factory Girl	Bad	Fair	Fair	·X·	X	X	X	X	0	·X·	X
XVI	20	1st	0	—	Good	Dark	Poor	·X·	X	X	X	X	—	·X·	X
XVII	21	1st	0	—	Good	Fair	Good	·X·	·X·	X	X	X	0	0	0

Note

Dom. St. = Domestic Servant. H.S., A.S., &c = Haemopoietic Symptoms &c. X means "Symptoms present", ·X· "Symptoms marked" and 0, "Symptoms absent".

II Particular Analysis

I.

No. of Case	Age	Occupation	Residence	Complaint	Duration of Illness	Habits as to food &c.
I	24	Laundry-Maid	Inverness	D. L. A.	5/12 yr.	Irregular
II	18	Weaver	Inverness	D. Pft. A.	6/12	Irregular
III	16	Weaver	Inverness	D. Pft. A.	6/12	Irregular
IV	18	Weaver	Inverness	D. A.	2	Irregular
V	19	Nurse-Maid	Inverness	D. A. P.	7/12	Irregular
VI	19	Weaver	Inverness	D. A. P.	1 7/12	Irregular
VII	18	Domestic Servant	Inverness	D. P. L.	6/12	Irregular
VIII	16	Domestic Servant	Inverness	D. P. A. L.	6/12	Irregular
IX	18	Nurse-Maid	Inverness	D. A.	9/12	Irregular
X	22	Domestic	Dingwall	D. A. {vision diminished}	1 6/12	Irregular
XI	16	Weaver	Inverness	D. A. P.	1	Irregular
XII	17	Domestic Servt.	Inverness	P. L. A.	1 6/12	Irregular
XIII	16	—	Inverness (County)	P. M. Ö.	9/12	Irregular
XIV	25	Nursery Maid	Inverness	A. D. Ö	3/12	Irregular
XV	17	Factory Girl	Inverness	D. L. M.	6/12	Irregular
XVI	20	—	Inverness	A. L. P.	8/12	Irregular
XVII	21	—	Inverness	D. Pft. P.	5/12	Irregular

Note

D = Dyspnoea. L = Lassitude. Pft. = Palpitation of Heart
A = Amenorrhoea. M = Menorrhagia. P. = Pain and
Ö = Oedema of feet.

II Particular Analysis (cont'd)

2

No. of Case	Surroundings	No. in Family	Hereditary Tendency	Height inches	Weight lbs.	Development	Complexion
I	Good	10	X	66½	130	Good	Dark
II	Fair	8	0	65	112	Good	Dark
III	Indifferent	?	0	66	115	Good	Dark
IV	Fair	9	0	63	112	Not good	Dark & Muddy
V	Good	6	0	61	96	Good	Dark
VI	Indifferent	3	0	63½	114	Fair	Dark & Muddy
VII	Good	7	X	62	94	Fair	Dark
VIII	Bad	7	0	63½	97	Bad	Dark & pigmentation
IX	Good	3	X	65½	120	Good	Fair
X	Good	5	0	67	130	Good	Dark
XI	Good	10	0	66	112	Good	Fair
XII	Bad	8	X	65½	107	Bad	Fair
XIII	Good	7	0	63	84	Fair	Fair
XIV	Good	5	X	68	179	Good	Dark & pigmentation
XV	Bad	7	0	65	110	Fair	Fair
XVI	Good	5	0	67	125	Poor	Dark
XVII	Good	6	0	68	120	Good	Fair

Note

0 = absence of : X = presence of.

II Particular Analysis (contd)

3.

No. of Case	Alimentary System					Haemopoietic System					Circulatory System			
	Appetite	Constip.	Haematemesis	Pain	Fulness	Hb. before treated	Hb. after treat.	R.B.C. before tt. (Hundreds of Thousands)	RBC after tt. H. 97%	Poikilocytes	Palpitation	Dilatation	Murmur	Venous Hum
I	Fair	0	0	0	X	33%	65%	28·856	31·5	X	X	X	X	X
II	Poor	0	0	0	X	38"	65"	40·	40·002	X	0	X	0	X
III	Poor	0	0	0	X	55"	68"	35·	37·79	X	0	X	X	X
IV	Poor	X	0	0	X	50"	65"	36·	40·	0	0	0	0	X
V	Fair	·X·	0	X	X	40"	60"	30·05	40·	0	0	0	0	X
VI	Poor	X	0	X	X	40"	60"	22·148	35·	X	0	0	0	X
VII	Fair	0	0	X	X	33·5"	60"	35·6	42·	0	0	X	X	X
VIII	Poor	X	0	0	X	60"	65"	35	35·6	X	X	0	0	X
IX	Fair	X	0	0	X	58"	62"	31·08	32	0	0	0	0	X
X	Fair	X	0	X	X	60"	—	35·	—	0	0	0	0	X
XI	Poor	X	0	X	X	48"	—	32·9	—	0	X	0	0	X
XII	Poor	X	0	X	X	54"	60"	31·1	32·	0	X	X	X	X
XIII	Poor	X	0	0	X	58"	66"	30	31·	0	X	0	X	X
XIV	Poor	·X·	0	X	X	48"	56"	30	30·8	X	X	X	X	X
XV	Poor	X	0	X	X	58"	65"	29·8	31·8	X	0	0	0	X
XVI	Bad	X	X	X	X	50"	—	31·52	—	X	0	X	0	X
XVII	Poor	X	0	X	X	60"	—	33·2	—	0	X	0	0	0

Note

X = present : 0 = absent ·X· = present markedly.

II Particular Analysis (contd)

4.

No. of Case	Respiratory		Integumentary			Urinary		Reproductive System		
	Respirations per min.	Dyspnoea	Pallor	Oedema	Fat	Colour	Reactions (path.)	Breasts &c	Leucorrhoea	Catamenia
I	20	X	X	?	·X·	Pale	Negative	Very G. D.	X	0
II	19	X	X	?	X	Pale	Negative	G. D.	X	0
III	17	X	X	?	X	Pale	Negative	G. D	0	0
IV	18	X	X	X	X	Pale	Negative	B. D	X	0
V	19	X	X	X	X	Pale	Negative	G. D	0	0
VI	18	X	X	X	X	Pale	Negative	B. D	X	0
VII	17	X	X	X	X	Pale	Negative	G. D	0	X
VIII	20	X	X	X	X	Pale	Negative	P. D	0	0
IX	17	X	X	X	X	Pale	Negative	G. D	0	0
X	17	X	X	0	X	Pale	Negative	G. D	X	0
XI	18	X	X	0	X	Pale	Negative	G. D	X	0
XII	19	X	X	0	Poor amount	Pale	Negative	P. D	0	0
XIII	18	X	X	X	Fair	Pale	Negative	F. D	0	X
XIV	18	X	X	X	X	Pale	Negative	G. D	0	0
XV	18	X	X	0	X	Pale	Negative	G. D	0	profuse X
XVI	17	X	X	0	X	—	—	P. D	X	0
XVII	17	X	X	0	X	Pale	Negative	G. D	0	X

Note

X = present : ·X· = present markedly : 0 = absent. D = Development : G = good, B = Bad, P = poor, F = fair.

II Particular Analysis (contd.)

5.

No. of Case	Nervous System					Treatment				
	optic neuritis	other fundal change	Head-ache	reasonolor changes	Mental changes	Three Sulphates	Bland	Ferrum Redact.	Sr. + Am Citras	Duration Days
I	0	0	0	0	0	X	—	—	—	29
II	0	0	0	0	0	X	—	—	—	33
III	0	0	X	0	0	X	—	—	—	35
IV	0	0	X	0	X	X	—	—	—	20
V	0	0	X	0	0	—	X	—	—	22
VI	0	0	X	0	X	—	later X	—	Hypodermically X	36
VII	0	0	0	0	X	First $MgSO_4$ later X	—	—	—	—
VIII	0	0	X	X	X	—	—	X	—	—
IX	0	0	0	0	0	—	c Arsenic X	—	—	84
X	0	X	X	0	0	—	c Arsenic X	—	—	42
XI	0	0	X	0	0	—	—	—	X	30
XII	0	0	0	0	0	—	—	X	—	23
XIII	0	0	X	0	0	—	X	—	—	15
XIV	0	0	X	0	X	—	—	X	—	22
XV	0	0	X	0	X	—	c Ergot X	—	—	56
XVI	0	0	X	0	0	—	X	—	—	—
XVII	0	0	0	0	0	—	—	—	X	—

Note.

X = present (Under last Heading "Treatment," X = treatment adopted)

0 = absent. "Three Sulphates" = Mixture containing Iron, Magnesium Sulphate + Quinine Sulphate. "Bland" = Pil. Ferri (B.P.)

Appendix No. III

Tabular Statements of Cases of Chlorosis treated in the Northern Infirmary, Inverness, during ten years, — from 1887 to 1896,

and

at the Forbes Dispensary, Inverness, during five years — from 1891 to 1896.

I. Northern Infirmary

1887

No. of Case	Patient	Age	Address	Surroundings	Duration of Treatment Days
1	B. McL.	20	Ross-shire	Good	23
2	M. D.	16	Muirtown St.	Indifferent	27
3	A. C.	20	Inverness-shire	Good	8
4	M.A.R.	20	Do	Good	26
5	M. R.	22	Watts' Hotel	Good	16
6	M.L.	19	16 Petty St.	Indifferent	19
7	M. McL	23	Inverness-shire	Good	34
8	J. B.	20	Midmills Rd.	Good	22

Percentage of cases admitted 1.78

1888

1	M. McL	23	Inverness-shire	Good	40 ẋ
2	J.B.	20	Midmills Rd	Good	25 ẋ
3	J. N.	19	Ross-shire	Good	47
4	J. K.	18	Ness Bank	Good	28
5	A. McD	24	Ross-shire	Good	39
6	A. C.	19	Castle St.	Indifferent	24
7	J. F.	18	Inverness-shire	Good	26

Percentage of cases admitted 2.08

1889

1	J. D	24	Castle St.	Indifferent	28
2	M. M.	24	Inverness-shire	Good	55
3	J. McD.	22	21 Crown St.	Good	86 +
4	J. McK	16	Inverness-shire	Good	20

ẋ relapse + complicated with hysteria

1889 – continued.

No. of Case	Patient	Age	Address	Surroundings	Duration of Treatment Days
5	M.A.R.	14	18 Friars Street	Indifferent	22
6	M.M.	26	Ross-shire	Good	32
7	C.R.	19	King Street	Indifferent	60
8	M.McD.	18	Hill Street.	Good	23
9	B.P.	18	26 Upper Kessock St.	Indifferent	8
	Percentage of cases admitted=1.99				

1890

1	A.C.	17	Ross-shire	Good	31
2	G.McL.	19	Hilton	Good	15
3	E.McL	19	Greig Street	Good	27
4	M.McL.	15	Shore St.	Fair	23
5	J.S.	23	King St.	Fair	19
	Percentage – of cases admitted-1.09				

1891

1	J.McD	20	Tomnahurich St.	Indifferent	12
2	A.McK	18	Church St.	Good	46
3	C.McL.	24	Huntly St.	Good	22
4	A.C.	17	Ross-shire	Good	40 ⁂
5	F.C.	25	Upper Kessock St.	Indifferent	5
6	E.McL	22	Glen Albyn Hotel	Good	11
7	J.F	22	Ross-shire	Good	29
8	M.C.	21	8 McLean's Close	Bad	20
9	A.McM.	18	Greig St.	Good	47

⁂ relapse

1891. – Continued.

No. of Case	Patient	Age	Address	Surroundings	Duration of Treatment Days
10	M.F.	23	Castle St.	Fair	41
	Percentage of cases admitted – 1·82				
	1892				
1	B.McL	26	Inverness. shire	Good	14
2	A.D.	16	Petty Street	Fair	17
3	J.F.	18	Westbourne	Good	37
	Percentage – of cases admitted – 0.69				
	1893				
1	J.S.	19	22 Upper Kessock St.	Indifferent	56
2	J.H.	18	10 Huntly St.	Fair	84
3	C.F.	18	59 Huntly St.	Fair	33
4	J.McL	16	6 Nelson St.	Indifferent	35
5	E.D.	18	22 Muirtown St.	Fair	20
6	A.B.C.	19	Strome Lodge	Good	22
7	E.D.	19	1 Cameron's Close Muirtown St	Indifferent	36
8	C.McG.	18	8 Albert Place	Good	–
9	M.R.	24	Inverness Dist. Asylum	Good	29
	Percentage – of cases admitted – 1·67				
	1894				
1	C.M.	18	Millburn	Good	27
2	D.J.	19	Station Hotel	Good	43
3	E.McG.	19	Caledonian Hotel	Good	35
4	M.F.	26	11 Castle St.	Indifferent	46

1894 — Continued

No of Case	Patient	Age	Address	Surroundings	Duration of Treatment Days
5	M. J.	20	Church St.	Good	48
6	I. J.	20	Station Hotel	Good	27
	Percentage — of cases admitted — 1·04				
	1895				
1	M. McD	19	23 Laurel Terrace	Good	18
2	C. F.	17	Southside Road	Good	16
3	M.A.R	19	Ness House	Good	23
4	I. McL	19	Station Hotel	Good	16
5	C. McK	16	8 Shoe Lane	Bad	23
6	J. G.	26	Inverness-shire	Good	28
7	M. McD	22	Do	Good	20
8	H. McK	17	Kingsmills Rd	Good	25
9	C. McM.	25	Eden Court	Good	28
	Percentage — of Cases admitted — 1·56				
	1896				
1	A. McK	22	18 Lr Kessock St	Bad	17
2	A. M.	19	2 Innes St.	Good	15
3	R. McD	19	Inverness-shire	Good	11
4	C. F.	21	64 Castle St.	Indifferent	56 +
5	M. M	23	Station Hotel	Good	18
	Percentage — of Cases admitted 0·83				

N.B. All the foregoing cases were indoor

+ complicated with thrombosis of leg

Summary

Year	No. of Cases	Percentage
1887	8	1·78
1888	7	2·08
1889	9	1·99
1890	5	1·09
1891	10	1·82
1892	3	0·69
1893	9	1·67
1894	6	1·04
1895	9	1·56
1896	5	0·83

II Forbes Dispensary

	1891-92	1892-93	1893-94	1894-95	1895-96
No. of Cases	57	55	52	24	31
Per-Centage	1·49	1·53	1·6	1·32	1·39

N.B. These cases were all out-door.

Certificate of Authorship

I certify that the foregoing Thesis entitled "Chlorosis — The Anaemia "of Adolescence : its Symptoms, Causa- ": tion, Nature and Treatment," has been wholly composed by me, and that the appended Records and Analyses of Clinical Cases have been compiled by me from original notes, and the Statements from the Official Registers of the Institutions mentioned.

H. E. Fraser