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IN view of the great and constantly-increasing pressure on our space, we would urgently request correspondents and authors of communications to assist us in endeavouring to place their views before our readers by condensing their communications to the utmost extent.

THE TREATMENT OF CHLOROSIS BY IRON AND SOME OTHER DRUGS.

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It is generally agreed that chlorosis may be cured by the administration of iron preparations by the mouth, but opinions differ widely and fundamentally as to the way in which the cure is brought about. So long ago as 1824 Wöhler advanced the opinion that iron is not absorbed from the alimentary canal, because he failed to detect it in the urine after giving it *per os*, while Kletzensky (1854) experimenting on himself, and finding in his feces as much iron as he had previously swallowed, came to the same conclusion. These views have received support from a considerable number of cotemporary and later observers. On the other hand, Becquerel, Herberger, Nasse, Quevenne, and many others have believed it to be absorbed, but no rigorous proof of its absorption has ever been given. It is unnecessary to discuss the older literature, as the whole question has been reworked in recent years with improved methods and much greater accuracy. At the present time there are three chief theories as to the *modus operandi* of iron.

I. THE ABSORPTION THEORY.

Iron being an essential constituent of the red blood corpuscles, it has been very generally assumed that it must be absorbed, since it cures certain conditions in which the iron of the blood is deficient. To support this view there is now a considerable amount of experimental evidence, but after examining it in great detail I have come to the conclusion that most of it must be rejected. Recent researches have shown that the sources of fallacy are exceptionally numerous, that they have only lately been fully realised, and that therefore most of the earlier experiments and results are quite inconclusive. The following, however, appear to be more to the point. Coppola¹ fed cocks on a diet containing no iron, having selected these animals because they have large blood corpuscles in which changes can be readily observed. The hæmoglobin fell rapidly, but the red corpuscles were not diminished in number, although, just as in chlorosis, there were many irregularly-shaped, small, and pale ones among them. In one experiment the hæmoglobin fell in seven days from 42° to 33°, and then 25 milligrammes lactate of iron was added to the diet daily; after five days the hæmoglobin had risen again to 65°. He concludes that inorganic iron must be absorbed and go to form hæmoglobin.

Cervello² gave a dog 0.015 g. ferric chloride, and in two hours and a-half recovered only 0.006 g. ferrous chloride from the gastro-intestinal canal, but this experiment has never been confirmed. Further, Kunkel³ fed two dogs on a similar diet, but to one gave iron in addition. After some time he killed them, and on determining the amount of iron in the various organs he found that the liver and other organs of the dog which had taken iron along with its food contained considerably more than those of the other dog. Experiments on mice gave similar results. He himself, however, points out that this experiment is not conclusive, as the iron administered might only improve digestion and allow the iron of the food, which is in organic combination, to be more freely absorbed. The same objection applies to the results of Lewald's⁴ and Bistrow's⁵ experiments. They gave

¹ *Lo Sperimentale*, 65, 227, 1890. Sul valore fisiologico e terapeutico del ferro inorganico.

² *Archiv. gen. per le Scienze med.*, iv, 1880.

³ *Pflüger's Archiv*, 50, 1, 1891, Zur Frage der Eisenresorption.

⁴ *Hilfsmittel Schrift*, Breslau, 1857.

⁵ *Virchow's Archiv*, 45, 98, 1839, Der Uebergang des Eisens in die Milch bei Thieren und dessen quantitative Bestimmung.

inorganic iron in large doses—for example, 1 to 3 g. lactate daily—to a goat, and found that the amount of iron in its milk was greatly increased.

These results taken together might seem conclusive, were it not that strong evidence has also been brought on the other side of the question.

II.—THE STIMULATION THEORY.

The second theory rests on the supposition that iron preparations given by the mouth are not absorbed. It is argued that the iron of the food, which equals about 6 to 9 centigrammes daily in an ordinary diet, is more than sufficient to make up any deficiency of iron in the blood, and that unused iron is always being excreted from the bowel even in chlorosis. The intestinal mucous membrane, however, is supposed to be so bloodless that it cannot properly perform its absorptive functions hence the iron of the food is not taken advantage of. But when inorganic iron is given it stimulates and tones up the gastro-intestinal mucous membrane, so that digestion and absorption of food take place satisfactorily, and in a short time the iron in the dietary makes good the deficiency in the blood.

This view of the matter has been supported by many authorities such as Buchheim, Kletzensky,⁶ Schmiedeberg,⁷ Kobert,⁸ and Dujardin-Beaumez.⁹ The last named, after advancing arguments against the probability of the absorption of iron, and stating that in chlorosis it acts simply by stimulating appetite and digestion, says that in the treatment of anæmic conditions he places it in the second rank behind arsenic, quinine, diet, and hygienic measures. Kletzensky goes so far as to say "from all the hundredweights of iron given to anæmics and chlorotics during centuries, not a single blood corpuscle has been formed."

The experimental evidence which has been advanced in support of the non-absorption view is as follows. Hamburger,¹⁰ after keeping a dog on fixed diet, found that the addition of ferrous sulphate to its food did not increase the excretion of iron in the urine—a result which has been amply confirmed. Damaskin¹¹ found that in normal human urine only about 1 milligramme of iron is excreted in twenty-four hours. Kumberg¹² confirms this, and finds that iron preparations given by the mouth cause in man no increase whatever of the urinary iron, these results having been thoroughly established also by the researches of Gottlieb¹³, Müller¹⁴, Jacobi¹⁵, and Socin¹⁶. If iron circulated in the blood it would be excreted in the urine; hence they conclude it does not circulate, and therefore cannot be absorbed into the blood. Nor is iron excreted in the bile. This much vexed question is now settled by the very exact researches of Gottlieb¹⁷ and of Anselm¹⁸, who found that a dog on mixed diet excreted in its bile only 0.38 milligramme Fe in twelve hours, and that iron given by the mouth or subcutaneously did not augment the amount. This further strengthens the probability of non-absorption.

The significance of these facts, however, is lessened by the discovery of Mayer¹⁹, which has been fully confirmed by Bidder and Schmidt²⁰, Jacobi, Gottlieb²¹, Stender²², and

⁶ *Ztschr. der Gesellsch. der Ärzte zu Wien*, 1854, ii, 281, Ein kritischer Beitrag zur Chemie des Eisens.

⁷ *Arzneimittellehre*.

⁸ *St. Petersburg med. Wochenschr.*, 1891, 73, Ueber den jetzigen Stand der Eisenfrage.

⁹ *Bull. gén. de Thérap.*, 90, 396, 1876, Réflexions critiques sur l'Emploi du Fer dans le Traitement de la Chlorose.

¹⁰ *Ztschr. f. phys. Chemie*, ii, 191, 1878.

¹¹ *Arbeiten des Pharmak. Instituts zu Dorpat*, vii, 1871, Zur Bestimmung des Eisengehalts des normalen und patholog. Menschenharnes.

¹² *Ibid.*; Ueber die Aufnahme und Ausscheidung des Eisens aus dem Organismus.

¹³ *Archiv f. expt. Path.*, xxvi, 139, 1889, Beiträge zur Kenntniss der Eisenausscheidung durch den Harn.

¹⁴ *Inaug. Diss.*, Erlangen, 1882.

¹⁵ *Archiv f. expt. Path.*, xxviii, 256, 1891; Ueber das Schicksal der in das Blut gelangte Eisensalze. *And Inaug. Diss.*, Strassburg, 1887; Ueber Eisenausscheidung aus dem Thierkörper nach subcutaner und intravenöser Injection.

¹⁶ *Ztschr. f. phys. Chemie*, xv, 93, 1891; In welcher Form wird das Eisen resorbiert?

¹⁷ *Ztschr. f. phys. Chemie*, xv, 371, 1891.

¹⁸ *Arbeiten des Pharmak. Instituts Dorpat*, viii, 1892; Ueber die Eisenausscheidung durch die Galle bei normalen Verhältnissen.

¹⁹ *De ratione qua ferrum mutetur in corpore*, *Inaug. Diss.*, Dorpat, 1850.

²⁰ *Die Verdauungsgäfte und der Stoffwechsel*, Leipzig, 1852.

²¹ *Ztschr. f. phys. Chemie*, xv, 371, 1891; Ueber die Ausscheidungsverhältnisse des Eisens.

²² *Arbeiten des Pharmak. Instituts Dorpat*, vii, 1891; Mikroskop. Untersuchungen über eingespritztes Eisen, etc.

Schmul²³, namely, that iron given by a vein or subcutaneously is excreted from the blood chiefly through the wall of the gastro-intestinal canal. Supposing iron to be absorbed from the alimentary canal, it may be excreted into it also, and may on that account, although absorbed into the blood, be absent from the bile and urine. In determining this the physiological presence of iron puts an apparently insuperable barrier in the way; but to elude the difficulty Kobert²⁴ and Cahn²⁵ have experimented with manganese, which is an element foreign to the body, and easily detected. They have proved that it is not absorbed, and from analogy conclude that iron also is not.

Further arguments against the absorption theory are that iron circulating in the blood acts as a very active poison²⁶; also that large quantities are necessary to cure anæmia, many times more than the total amount of iron present in the blood; and, finally, that many cases recover without iron being given except in the food.

III.—BUNGE'S THEORY.

The publication of Bunge's very striking researches²⁷ as to the value of inorganic iron has unsettled the whole question, and has been the cause of most of the recent work on the subject. Bunge holds that the ordinary preparations of iron, including the so-called albuminates and peptonates, cannot be absorbed from the alimentary canal. He points out that ordinarily the iron of the red corpuscles is formed from the organically combined iron in our food, which is something like hæmoglobin in constitution, and which can be readily absorbed and readily converted into hæmoglobin. From milk and yolk of egg he isolated such an organic iron combination. But he admits that inorganic iron preparations are capable of curing chlorosis, and explains this as follows. In chlorosis digestion is disturbed with formation of sulphuretted hydrogen and alkaline sulphides in the bowel. These combine with and separate out the organic iron of the food, and sulphide of iron is formed, an inorganic compound which, according to Bunge, cannot be absorbed; hence the blood loses its necessary supply of iron, and chlorosis results. When inorganic iron is given, however, it combines with and neutralises the sulphuretted hydrogen, and thus protects the organic iron of the food, which, therefore, becomes absorbed, and goes to form hæmoglobin. In support of this view he adduces the received opinion that large doses of iron are necessary for the cure of chlorosis, and this, he says, is because large amounts are necessary to neutralise all the sulphuretted hydrogen in the bowel. Further, he states, on Zander's authority, that hydrochloric acid cures anæmia more satisfactorily than iron does, because it is antiseptic, and prevents formation of sulphuretted hydrogen in the bowel. Bunge has thus amplified a theory put forward long previously by Hannon and by Kletzinsky.

Socin,²⁸ under Bunge's direction, has continued the investigation. He fed some mice on an iron-free diet, and others on the same diet, to which was added either hæmoglobin, or hæmatogen (organic iron compound from yolk of egg), or ferric chloride. The mice all died about the same time. His opinion is that the question is insoluble in this way; and, further, that by a simple comparison of the amount of iron ingested by the mouth, and then excreted by the bowel and other organs, the question of the absorption of inorganic iron cannot be settled.

It seems to me, also, that the question cannot be solved by these methods; the presence of iron in our food, in the tissues and secretions of the body, its constant ingestion and excretion, and the small quantities with which one has to deal, apparently place a complete barrier in the way of rigidly proving by chemical methods that it is or is not absorbed. It is certain that iron in organic combination can be absorbed and used to make hæmoglobin, for the child forms red blood corpuscles from milk alone, and the chick from yolk alone, in both of which foods Bunge has

shown that iron exists only in organic combination. Moreover, in healthy persons the wear and tear of the physiological iron is made up for from the food. It appeared to me that the matter would be most easily settled by making observations on anæmic patients, the observations being so contrived as to test the truth of the different theories.

1. If it be found that inorganic iron preparations given hypodermically will cure chlorosis, there can in such cases be no question of the iron exerting its effect by stimulation of the alimentary canal, or by combining with sulphuretted hydrogen in the intestines. It must be absorbed and utilised to make hæmoglobin.

2. If sulphide of iron cure chlorosis when given by the mouth, this alone would serve to disprove Bunge's theory. As previously stated, Bunge holds that the only use of inorganic iron is to neutralise sulphuretted hydrogen in the alimentary canal; but if iron sulphide be the form in which iron is given, the iron cannot take up any more sulphur, and is therefore useless as an absorbent of sulphuretted hydrogen. Ferrous sulphide is also non-astringent, and locally cannot stimulate the mucous membrane. If it cure anæmia it must apparently do so by being absorbed.

3. If bismuth, manganese, and other drugs—which are just as capable as iron is of absorbing sulphuretted hydrogen or of acting as intestinal stimulants—should prove inert in chlorosis, it forms an additional reason for regarding the absorption of iron as indirectly proved.

In this paper I wish to confine myself to questions bearing on the absorption or non-absorption of inorganic iron preparations, without entering into any question as to the etiology of chlorosis and anæmia. I have for this purpose only used my observations on typical uncomplicated cases of chlorosis. They were all treated in hospital, and if they suffered from dyspepsia or constipation, were carefully dieted and purged. Otherwise they had no medicines except those stated in the reports of the cases. The hæmoglobin and corpuscles were estimated by means of Gowers's hæmoglobinometer and hæmacytometer.

I. IRON SUBCUTANEOUSLY.

CASE I.—Millworker, aged 18, ill for about three years, during which time she had taken iron frequently with some temporary benefit, but had always had a relapse in a very short time.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Mar. 28.....	—	3,620,000	44
" 29.....	Citrate of iron and sodium in water 6 m subcutane- ously = $\frac{1}{2}$ gr. Fe		
" 30.....	12 m daily = $\frac{1}{2}$ gr. Fe	4,700,000	46
" 31.....		5,820,000	52
Ap. 7.....		5,500,000	56
" 10.....		5,600,000	66
" 14.....		5,700,000	70
" 17.....		5,650,000	72

She had in all 12 grains Fe subcutaneously, and improved in every respect just as if she had been taking iron by the mouth.

CASE II.—Millworker, aged 15, ill about a year. Is a very pronounced case of chlorosis.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Ap. 23.....	—	3,350,000	28
" 24.....	Peptonate of iron given sub- cutaneously, 10 m daily = $\frac{1}{2}$ gr. Fe		
" 27.....		2,980,000	30
May 1.....		3,600,000	34
" 4.....	Citrate of iron substituted, 10 m daily = $\frac{1}{2}$ gr. Fe	3,820,000	38
" 9.....		4,020,000	42
" 14.....		4,640,000	50
" 19.....		4,490,000	60

The last subcutaneous injection was given on May 17th. She got in all 6 grains Fe in twenty-four days, and improved very rapidly. She was put on iron by the mouth to complete the cure.

CASE III.—Nursemaid, aged 16, ill for two months. This is her first illness of the kind.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Jan. 30.....	—	4,170,000	38
" 31.....	Citrate of iron and sodium subcutaneously = $\frac{1}{2}$ or $\frac{1}{4}$ gr. Fe. daily	3,640,000	40
Feb. 3.....		4,170,000	48
" 7.....		4,240,000	50
" 11.....		4,650,000	66
" 21.....		4,600,000	68

This patient had altogether 9.5 grains Fe subcutaneously, and improved rapidly as soon as the iron was begun.

CASE IV.—Girl, aged 23, ill for four years. Suffers severely from dyspepsia and constipation.

²³ *Inaug. Diss.*, Dorpat, 1891; Ueber das Schicksal des Eisens im thierischen Organismus.

²⁴ *Archiv f. expt. Path.*, xvi, 361, 1882; Zur Pharmakologie des Mangans und des Eisens.

²⁵ *Archiv f. expt. Path.*, xviii, 127, 1884; Resorptions- und Ausscheidungsverhältnisse des Mangans im Organismus.

²⁶ Meyer and Williams, *Archiv f. expt. Path.*, xlii, 70, 1881, Ueber acute Eisenwirkung.

²⁷ *Lehrbuch der physiol. und pathol. Chemie*, 1887.

²⁸ *Loc. cit.*

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Apr. 17.....	Citrate of iron and sodium subcutaneously 12 m daily = $\frac{1}{2}$ gr. Fe	4,000,000	48
" 21.....		4,200,000	50
" 27.....	= $\frac{1}{2}$ gr. Fe	4,440,000	58
May 1.....		4,900,000	60
" 15.....		4,900,000	70
" 19.....		5,220,000	72
		4,900,000	74

She had 11 grains Fe subcutaneously.

In all four cases the improvement was without doubt due to the iron. The total amount of Fe administered in each case was comparatively small, and even all this is not utilised, as I invariably found iron in the urine. In no case did I observe any ill effects, except in iv, where the $\frac{1}{2}$ gr. Fe caused nausea and colic, which disappeared on reducing the dose.

On looking up the literature of the subject, I found that there was abundant evidence that iron given hypodermically will cure chlorosis and anæmia; but it does not seem ever to have occurred to anyone previously that this is a strong argument in favour of the absorption of iron. Rosenthal,²⁹ Lutton,³⁰ Neuss,³¹ Glaevecke,³² Da Costa,³³ Chiara,³⁴ Mori,³⁵ Alvazzi,³⁶ Foà,³⁷ Gauthier,³⁸ Ciamparelli,³⁹ Vachetta,⁴⁰ Nasse,⁴¹ Huguenin,⁴² Goudran,⁴³ and some others have all reported cases of anæmia and chlorosis which were successfully treated with hypodermic injections of various preparations of iron. Further, Vachetta has cured cases by injecting albuminate of iron into the peritoneal cavity, while Chalhoub⁴⁴ has given it with success *per rectum*.

The evidence, therefore, is overwhelming that iron will cure some forms of anæmia without ever having had the opportunity of stimulating the alimentary canal or of neutralising any possible sulphuretted hydrogen in the bowel. Iron given subcutaneously is now known to be stored up in the liver chiefly, from which it is slowly excreted into the blood—probably in some organic combination—and no doubt thus subserves the gradual necessities of the organism. It ultimately gets excreted into the bowel, but so gradually and in such small amount that it can have no influence on it or its contents.

Whether the hypodermic injection of iron preparations is a good and rapid method of curing chlorosis is another matter. Many of the above-mentioned authors report very favourably of its value in cases where iron could not be retained by the stomach, or seriously disturbed digestion. I must confess I have never met with a case of chlorosis where iron judiciously administered disagreed at all seriously with the patient's digestion. Quincke⁴⁵ and Hirschfeld⁴⁶ both object strongly to the pain caused by hypodermic injection; but if the solution be thoroughly neutral and the injection be made into the thick tissues of the back it is not painful. None of my patients ever objected to it, and I never saw any worse effects than slight local hardness. The dose, however, which one can safely give is small, and recovery is probably more rapid on larger doses given by the mouth. One cannot give above $\frac{1}{2}$ grain Fe, and even this is too much for some patients. There is also some risk of it irritating the kidneys (Glaevecke, Kobert), although I never saw the slightest trace of this. No preparation thoroughly satisfactory for hypodermic use has yet been proposed, and thus its exact value is somewhat difficult to gauge.

II. SULPHIDE OF IRON.

To certain cases of chlorosis pure sulphide of iron was given under the same conditions as before—namely, that the

bowels were regulated by purgatives, but no other medicines given except those stated in the reports.

CASE V.—Housemaid, aged 22, ill for some months. Had a similar illness two years ago, which was cured by Blaud's pills. Appetite is poor, and there is severe constipation.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Jan. 22.....	Ferrous sulphide 4 grs. thrice daily	3,540,000	50
" 28.....		3,420,000	50
" 30.....		4,020,000	58
Feb. 6.....		3,840,000	64
" 11.....		4,420,000	72

She now felt quite well, and left hospital.

CASE VI.—Housemaid, aged 24, ill for a few months, but has had frequent illnesses of same kind since she was 16 years old. She has no dyspeptic symptoms, and only very trifling constipation.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Feb. 6.....	Ferrous sulphide 2 grs. thrice daily	2,110,000	32
" 11.....		2,200,000	38
" 19.....		3,140,000	44

The increase in these cases and in another was perfectly marked, but there is a fallacy in giving ferrous sulphide in this way, expecting it to reach the bowel unchanged. The hydrochloric acid of the stomach will convert it, in part at least, into ferrous chloride, which passes into the bowel in a form ready to combine with sulphuretted hydrogen. To obviate this objection, the ferrous sulphide was enclosed in keratin capsules. Such capsules (if properly made) are not affected by the gastric juice, but, as soon as they reach the alkaline juices of the duodenum, they dissolve and liberate their contents. Inorganic iron in the form of ferrous sulphide was thus introduced into the bowel, and it is thus incapable of absorbing more sulphuretted hydrogen, or of acting as a stimulant to the mucous membrane.

CASE VII.—Girl, aged 19, ill for four months, slight dyspepsia, no constipation.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Sep. 23.....	Ferrous sulphide, $\frac{1}{2}$ grs. thrice daily in keratin capsules	4,520,000	48
" 28.....		4,320,000	48
Oct. 5.....		4,280,000	60
" 20.....		4,800,000	82
" 26.....		5,340,000	84

CASE VIII.—Housemaid, aged 20, ill nearly a year; has been taking Blaud's pills without benefit; suffers from dyspepsia and constipation.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Oct. 7.....	Ferrous sulphide, $\frac{1}{2}$ grs. thrice daily in keratin capsules	3,550,000	38
" 17.....		4,200,000	70
" 26.....		4,600,000	72

Both of these cases, therefore, recovered rapidly. It appears to me that this result alone is sufficient to disprove Bunge's theory that inorganic iron is useful simply by absorbing sulphuretted hydrogen in the bowel. But further I have treated cases with small doses of reduced iron ($\frac{1}{2}$ to $\frac{1}{4}$ gr. thrice daily), and they have recovered rapidly and satisfactorily. It can scarcely be supposed that such small amounts of iron would combine with sufficient sulphuretted hydrogen to make much difference in the quantity of that gas present in the intestines.

III.—BISMUTH AND OTHER DRUGS.

I treated several cases of chlorosis with bismuth oxide, subnitrate, and salicylate, but have only kept an accurate record of one. In no case was there any improvement effected in the blood condition until iron was substituted, when recovery took place rapidly. Bismuth is quite as capable as iron of absorbing H_2S in the bowel if that were all that is necessary for cure.

CASE IX.—Tablemaid, aged 19, ill five months; suffers from pain after eating and constipation.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Jan. 3.....		4,000,000	55
" 4.....	Bismuth oxide gr. 30 four times daily	3,996,000	55
" 7.....		4,080,000	56
" 8.....	Bismuth oxide gr. 30 six times daily	—	—
" 13.....		4,008,000	54
" 14.....	Ferrum redactum gr. 5 thrice daily	—	—
" 17.....		4,768,000	61
" 22.....		5,088,000	67
" 30.....		5,016,000	78

Bismuth relieved gastric dyspepsia, but did no good otherwise.

²⁹ *Wien. med. Presse*, 1872, 1873, 1884.

³⁰ *Études de Thérapeutique*, Paris, 1882.

³¹ *Ztschr. f. klin. Med.*, lii, 1881.

³² *Archiv f. expt. Path.*, xvii, 466, 1883.

³³ *New York Med. Record*, 1878.

³⁴ *Annali di Ostetrica, etc.*, vii, 1, 1885.

³⁵ *ibid.*, 546.

³⁶ *BRITISH MEDICAL JOURNAL SUPPLEMENT*, 1891.

³⁷ *Lo Sperimentale*, 48, 561, 1881.

³⁸ *Medicina Contemporanea*, 1884.

³⁹ *Annali Chir. di Osp. Incur.*, Naples, 1880.

⁴⁰ *Annali Universali di Med.*, 267, 1, 1884.

⁴¹ *Allgemeine Ztschr. f. Psychiatrie*, 41, 526, 1885.

⁴² *Correspondenzbl. f. Schweizer Aerzte*, 1876.

⁴³ *Du Fer Dialysé*, Montpellier, 1883.

⁴⁴ *Étude d'un Nouveau Sel de Fer*, Thèse de Paris, 1883.

⁴⁵ *Deutsches Archiv f. klin. Med.*, xx, 1, 1877. Weitere Beobachtungen über perniciose Anæmie.

⁴⁶ *Bull. gén. de Thérap.*, 1886, 19 and 79. Contribution à l'Étude des Ferrugineux en Injections hypodermiques.

The other cases got very varying doses, but all with the same unsatisfactory results. This is a further argument against Bunge's theory, because large doses of bismuth must absorb more sulphuretted hydrogen than the usual doses of iron, and thus, if Bunge be correct, should quickly cure chlorosis.

ARSENIC IN CHLOROSIS.

It is a very common practice to give small doses of arsenic in combination with iron in chlorosis, and there is a general belief that it hastens the cure. It is also very generally thought that arsenic increases the number of red blood corpuscles, without exercising so marked an effect on the amount of hæmoglobin. The published proofs supporting these opinions are not very strong evidence.

Arsenic appears to have been first recommended by Isnard⁴⁷ in chlorosis, but Dr. Wilks states⁴⁸ that he began to use it about 1855 "with much benefit, but it was not until about ten years afterwards that I had some striking examples of its good effects." A careful perusal of Dr. Wilks's paper brings the conviction that the benefit was obtained in cases of pernicious anæmia, Addison's disease, and general wasting, rather than in chlorosis.

Renzi⁴⁹ recommends it strongly, but his cases of severe anæmia seem also to have been pernicious. Dujardin-Beaumez⁵⁰ places arsenic before iron in utility; he holds that it stimulates the alimentary tract and acts as a food by diminishing tissue waste (*aliment d'épargne*), but Schücking⁵¹ is of opinion that for this very reason it should be withheld, as it lessens oxidation in the body.

Fenoglio⁵² used Fowler's solution in girls of 10 to 14 years of age. In some the hæmoglobin remained unaltered, in some there was an increase, in others a decrease. He is of opinion that arsenic is of value in anæmia, but his results as stated are very inconclusive, and the girls from their age (they were inmates of an institution) were probably not the subjects of typical chlorosis. Dr. Hunt⁵³ gave Fowler's solution also in a number of cases, and "though it occasionally effected a considerable rise in the number of corpuscles, this rise was very unsteady, and liable to great fluctuations and relapses." Dr. Willcocks⁵⁴ also failed to get any improvement from its use in two cases of chlorosis, as in both the corpuscles and hæmoglobin diminished considerably, but improved as soon as iron was substituted. Dr. Andrew Smart⁵⁵ failed to get any marked improvement under arsenic, and Hayem⁵⁶ also finds it of no value, while Delpeuch⁵⁷ and Cutler and Bradford⁵⁸ state that it diminishes the number of corpuscles in healthy adults. The latter found that in one case the number of red corpuscles, which had previously fallen 1,000,000 cubic mm. below the normal, rose again in three weeks after discontinuing the arsenic.

Certainly the balance of evidence is not in favour of arsenic as a hæmatinic in chlorosis or in health. My own cases bear out this view. They were all treated in hospital, and were cases of typical chlorosis without any unusual complication.

CASE X.—Nursemaid, aged 17, ill for three months; appetite good; no dyspepsia and no constipation.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Nov. 18.....	Liq. arsenicalis, 5 m thrice daily after food ...	2,180,000	25
Dec. 1.....		2,430,000	26
" 7.....		2,190,000	25
" 12.....		2,160,000	26
" 13.....	Ferrum redactum, 3 gr. thrice daily ...	.....	.....
" 17.....		3,020,000	32
" 21.....		3,480,000	46
" 24.....		4,120,000	52
Jan. 4.....		5,040,000	60
" 7.....		4,980,000	66
" 22.....		4,520,000	78

⁴⁷ *De l'Arsenic*, etc., Paris, 1865.

⁴⁸ *Lancet*, i, 653, 1885, On the Therapeutic Value of Arsenic in Anæmia and Atrophic Conditions.

⁴⁹ *Cbl. f. klin. Med.*, 1889.

⁵⁰ *Loc. cit.*

⁵¹ *Das Wesen der Bleichsucht*, 1888.

⁵² *Medicinische Jahrbücher*, 1882, 635, Ueber die Wirkung einiger Arzneien auf den Hämoglobingehalt des Blutes.

⁵³ *Lancet*, ii, 89, 1880, Observations on Blood in Anæmia.

⁵⁴ *Practitioner*, xxxi, 7, 1883, On Some Points in the Pathology of Anæmia and on the Action of Iron and Arsenic.

⁵⁵ *Lancet*, i, 1893.

⁵⁶ *Du Sang*, Paris, 1889.

⁵⁷ *Thèse de Paris*, 1880.

⁵⁸ *Am. J. of Med. Sci.*, 75-76, 1878, Action of Iron, Cod-liver-Oil, and Arsenic on the Globular Richness of the Blood.

The blood in this case contained a very large number of undersized corpuscles, while many were pear-shaped, cucumber-shaped, and otherwise badly formed. The arsenic agreed perfectly, but during its administration no change for the better took place either in the blood or general condition. Both began to improve almost at once when iron was substituted.

CASE XI.—Tablemaid, aged 20, ill for nine months, during which time she has been taking iron almost constantly, but has only improved slightly and temporarily.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Oct. 21.....	Liq. arsenicalis 5 m thrice daily ...	4,480,000	44
" 26.....	.....	.....4,220,000	42
" 30.....	.....	.....3,940,000	44
Nov. 4.....	.....	.....4,200,000	42
" 9.....	Ferrum redactum, 2 gr. thrice daily.	.....	.....
" 16.....	.....	.....4,250,000	50
" 21.....	.....	.....4,650,000	55

She left hospital, but continued to take iron. Here also no improvement in the blood or otherwise was observable while she was taking the arsenic, but it became at once marked on iron being given instead.

CASE XII.—A domestic servant, aged 20, ill for several months. Has the usual symptoms of chlorosis, with a good deal of gastric dyspepsia, but no constipation. Has been treated with Bland's pills without benefit.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
Oct. 6.....	.....	.....4,340,000	48
" 8.....	Liq. arsenicalis 5 m thrice daily after food ...	4,400,000	48
" 13.....	.....	.....4,500,000	46
" 16.....	.....	.....4,580,000	46
" 21.....	.....	.....4,500,000	46
" 27.....	Ferrum redactum, 2 gr. thrice daily ...	4,240,000	42
" 30.....	.....	.....4,720,000	50
Nov. 4.....	.....	.....5,220,000	56
" 9.....	.....	.....4,900,000	66

She continued to improve on iron. The small and misshapen red corpuscles, which were very numerous on admission, began to diminish in number only after beginning the iron.

CASE XIII.—Housemaid, aged 16, ill for seven months, during which time she has taken three gross of Bland's pills, but without much improvement. A year ago she had a similar illness, which was cured by Bland's pills.

Date.	Medicines.	Red Corpuscles.	Hæmoglobin. Per Cent.
June 13.....	Liq. arsenicalis 2m thrice daily ...	2,740,000	32
" 19.....	Liq. arsenicalis 4m thrice daily ...	3,540,000	34
" 23.....	.....	.....3,350,000	33
" 29.....	Liq. arsenici hydrochlor. 8m thrice daily ...	3,120,000	33
July 3.....	.....	.....2,900,000	34
" 4.....	Fer. Malesci 20 drops daily ...	3,100,000	34
" 8.....	.....	.....3,580,000	40
" 15.....	.....	.....4,360,000	43
" 20.....	Fer. Malesci 30 drops thrice daily ...	4,100,000	50
" 27.....	.....	.....4,200,000	53
" 30.....	.....	.....	.....

She went to the country, still taking iron, under which she completely recovered, but had a relapse about six months afterwards.

CASE XIV.—Dressmaker, aged 21, ill for four months. In this case the arsenic had not a fair chance, as the patient suffered greatly from gastric dyspepsia and slight feverish attacks. In consequence it was not given quite regularly. On admission, May 19th, she had 4,980,000 red corpuscles and 66% hæmoglobin; on June 19th she had 4,740,000 corpuscles and 66% hæmoglobin. During this time she was taking liq. arsenicalis in 2 to 5 m. doses, generally thrice daily, and the corpuscles and hæmoglobin oscillated somewhat, but this I attribute rather to her dyspepsia, headaches, and feverish attacks than to the arsenic. As soon as she was put on saccharated carbonate of iron, 10 grains twice daily, the blood condition improved steadily and uninterruptedly.

Five cases is not a large number, but the results are supported by those of other observers as previously mentioned; and besides the uselessness of arsenic was so obvious in the appearance of the patients that it seemed quite unnecessary to increase the number. The immediate improvement when iron was substituted for the arsenic was most striking. My cases show no reason to suppose that either the red corpuscles or the hæmoglobin are increased by the administration of arsenic in chlorosis. They were all under the most favourable conditions for recovery, their diet and bowels were carefully attended to, and they had complete rest in bed or very gentle exercise in the hospital garden, but not one of them showed any material improvement. In four cases the hæmoglobin was not affected up or down beyond 1 or 2 per cent., which is within the limits of error of observation, and even, if correct, is an unimportant variation; in

Case xii it fell 6 per cent., there being no apparent reason for this as the arsenic agreed well. Nor were the corpuscles affected, except in Case xiii, where a rise apparently took place at first, but was followed by a fall. Whether this was a real change or simply due to the admitted inaccuracy of the method of counting corpuscles, I am unable to say. In no case did arsenic improve the irregularities in size and contour of the red blood corpuscles. My own opinion is that it exerts no direct influence on the blood in chlorosis.

Whether it has an indirect value in chlorosis when given in combination with iron is very difficult to say. I have several times attempted to compare the relative rapidity with which cases treated with iron alone and iron *plus* arsenic recover, but it is impossible to do so satisfactorily, for the simple reason that apparently similar cases vary much in the time taken for recovery under the same treatment. In so far as it acts as a gastro-intestinal tonic, arsenic may improve appetite and digestion, and thus indirectly assist in the cure; but if it irritates and lessens appetite it will exert a contrary effect. In fact, certain writers state expressly that they never give it along with iron in chlorosis, because it is apt to disturb digestion. I myself have seen this in several cases, which did much better when arsenic was omitted from the prescription. However, it usually agrees well enough when given in small doses.

The only other point which occurs to me in this connection is one largely, if not purely, theoretical. Arsenic is credited with lessening tissue metabolism, and thus diminishing the amount of oxygen required in the body. In chlorosis the breathlessness is due partly to the lessened oxygen-carrying capacity of the red corpuscles. Arsenic, by diminishing the demand of the tissues for oxygen, may decrease the breathlessness of the patient and thus add to her comfort. The view, however, which I wish to emphasise here is that arsenic, if it act beneficially at all in chlorosis, does not do so by any direct effect in increasing the number of the red blood corpuscles or the quantity of hæmoglobin contained in them.

[To be continued.]

A CASE OF SYMPHYSIOTOMY.

By W. J. SMYLY, M.D.,
Master of the Rotunda Hospital, Dublin.

As the case which I now report is the first in which delivery by division of the symphysis pubis has been successfully carried out in the United Kingdom, I think that it should be recorded. The only occasion upon which it was previously had recourse to was in 1782, when Mr. Welchman, of Knighton in Warwickshire, delivered a woman of a putrid fœtus in this way. Why he should have selected this method in preference to craniotomy is difficult to understand. The woman's death was not due to the operation, yet the result has certainly deterred others from having recourse to it.

In France, where the operation originated in 1768, one successful case was greeted with enthusiasm, and was characterised as the result of inspiration. The Faculté de Médecine voted medals to MM. Sigault and Le Roi, and procured a pension for the former and his patient.

Sigault performed five operations with the loss of one mother and some of the children, by no means a bad record considering the general results of obstetric operations in maternity hospitals at that time. Its employment by others in unsuitable cases, however, soon brought the proceeding into disrepute, and it sank almost into oblivion. Its modern revival is due to Professor Morisani, of Naples, but its adoption by Professor Auvard, by Leopold and by Harris, of Philadelphia, have rendered it popular in France, Germany, and the United States of America, and their writings contain all that is at present known of this subject; I need not, therefore, repeat what they have written, but shall simply give an account of my own case.

The patient, Mrs. M., aged 43, was somewhat below the middle height, but without obvious deformity or sign of rickets. She had suffered for the past eight years from chronic articular rheumatism, which had latterly almost completely confined her to bed. Her first eight pregnancies had

terminated naturally, but the ninth labour was difficult and very protracted. Her usual medical attendant—a practitioner of considerable skill and experience—having failed to deliver her with forceps, sent her into the Rotunda Hospital, where a dead child was extracted.

Upwards of three years after she again became pregnant, and was admitted into the Rotunda on November 19th, 1892, labour having already commenced. On examination the abdomen was found to be pendulous, and the recti muscles widely separated. The uterus hung over to the left side, and the child presented obliquely in the second position, with its head in the right iliac fossa; the os uteri was about the size of a shilling, and the membranes were intact. The sacral promontory could be easily reached by the finger, and the true conjugate of the brim, measured with Skutsch's pelvimeter was $7\frac{1}{2}$ centimetres, or about 3 inches. The presentation having been corrected, and a binder applied, the patient was directed to lie as much as possible on her right side. The labour pains were short and inefficient, and continued so throughout, in spite of hot douches. On November 21st the membranes ruptured, but little progress was made; at night morphine was administered hypodermically, and she had some sleep. During the two following days the os continued slowly to dilate, but the head did not enter the brim of the pelvis. On the evening of November 23rd, the fifth day of labour, the funis prolapsed, and meconium began to come away. The contraction ring could be easily felt a hand's breadth above the pubes, so that version was impracticable. The head was freely movable above the brim, with the sagittal suture in the transverse diameter. Forceps were applied, but grasped the head so unfavourably that I abandoned the attempt to deliver by their means, and determined to resort to symphysiotomy.

The patient was placed in the lithotomy position with the buttocks over the end of the couch and two assistants held her legs on either side. The mons veneris was shaved and, as well as the vulva and vagina, carefully aseptically. The soft parts were divided with a scalpel in the usual manner, and the first finger of the left hand passed down behind the symphysis, along which a probe-pointed bistoury was guided. The edge of the knife had scarcely touched the cartilage when the bones sprang apart, tearing the soft parts beneath, including the urethra. The child was immediately and without any difficulty expressed by my assistant, and, though deeply asphyxiated, was resuscitated, and is now alive and well. It weighed $7\frac{1}{2}$ lbs. and measured 20 inches in length. A tolerably brisk hæmorrhage followed the rupture of the soft parts, but was easily controlled by securing a few vessels. The urethra was restored by a catgut suture; the ends of the bones approximated; a few silk sutures closed the wound, which was dressed in the usual manner. A firm bandage was applied around the hips, and the patient put to bed.

Convalescence was delayed by the formation of a bed sore, but she ultimately made a good recovery. The urethra did not completely heal, and there was incontinence of urine, but I was fortunate in being able to cure this by a subsequent operation. Excepting the rheumatic affection already alluded to, she went home in perfect health.

From the results of this operation in the 54 cases recorded in Dr. Harris's interesting pamphlet, it appears certain that it will take a permanent position amongst our methods of treating labour complicated by pelvic deformity. It has the double advantage of being easy of performance and successful in its results. If my case be added to those tabulated by Dr. Harris, there were, up to the end of last year, 55 cases with only 1 maternal and 5 foetal deaths.

THE new Biological Station on the Island of Heligoland is now in working order under the direction of Professor Heincke.

PRESENTATION.—Dr. Partridge, of Stroud, has been presented with a silver table gong, sugar basin, and sifter by the members of his ambulance class as a recognition of his services as lecturer.

MEDICAL MAGISTRATE.—On the recommendation of the Duke of Westminster, the Lord Lieutenant of the County, the Lord Chancellor has appointed Dr. Ralph Gooding, F.L.S., of Blackheath, a Justice of the Peace for the County of London.