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ANÆMIA:

ITS TREATMENT BY A NEW PREPARATION OF IRON.*

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When one considers the frequency of pathological conditions of the blood, no apology is necessary for presenting a paper upon this subject. These conditions are found in all grades and classes of people; the pampered daughter of the millionaire is no more exempt than the shop-girl; our foreign-born suffer equally as the native population.

In the discussion of this question, I prefer to follow the classification of Oppenheimer and Gräber:

1. Simple Anæmia Where both the corpuscles and hæmoglobin are diminished.

2. Chlorosis: Where the corpuscles are normal and hæmoglobin diminished (females).

3. Primary Chlorosis or Pernicious Anæmia: Where the corpuscles are diminished and the hæmoglobin relatively increased. Perhaps this might be better stated by saying that the percentage of decrease of corpuscles is greater than that of hæmoglobin, which latter may fall to 20 per cent

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The symptomatic varieties of Anæmia may be due to many causes:

1. Hæmorrhage.
2. Pathological discharges—*e. g.*, prolonged lactation, sexual excesses, profuse menstruation, suppuration, albuminuria, diabetes, watery diarrhœa.
3. Malignant growths.
4. Toxic and infective processes, such as the fatal cases of pernicious anæmia, reported by Koran, from carbonic-dioxide poisoning; from tea, coffee, tobacco, alcohol, syphilis, tuberculosis, or myxœdema. Here should also be considered those cases of auto-infection designated fæcal anæmia by Sir Andrew Clark.
5. Animal parasites.
6. Obstacles to taking food which are mechanical in their nature.
7. Dyspepsia.
8. Venous stasis in cardiac and pulmonary disease.
9. Impaired sanguinification in diseases of cytogenic organs, malaria, leukæmia, or Hodgkin's disease.
10. Fever.

Etiology: Predisposing causes:

1. Sex. female.
2. Age: infancy and youth, old age.
3. Constitution: so-called irritable weakness.

Exciting causes:

1. Deficient supply of food.
2. Want of light and air.
3. Excess or defect of bodily exercise.
4. Unusual states of temperature; hot or cold temperatures.
5. Increased expenditure of unoxidized material, physiological discharges; menstruation or lactation.
6. Psychical influences: depressing emotions.

The symptomatology of anæmia may be divided into the General: dropsy, loss of body weight, fever.

Alimentary: retching, vomiting, atonic dyspepsia, constipation, sometimes diarrhœa.

Circulatory: palpitation, faintness, præcordial distress, hiccough.

Respiratory: dyspnœa, slight cough without expectoration.

Integumentary: pallor, hyperidrosis.

Genito-urinary: polyuria, variable menstruation, sexual torpidity

Nervous. irritable weakness, morbid hyperæsthesia; headaches, tinnitus, neuralgia, convulsions, delirium. In regard to œdema, however, Benczúr and Csatasy found that in the anæmia of Bright's disease the amount of hæmoglobin was not consonant with that of œdema.

The physical signs of anæmia are practically two, so far as the circulatory apparatus is concerned. 1. The *bruit de diable* of Bouillaud or the *Nonnengeräusch* of Skoda is due to slackness of the venous wall and a comparative emptiness of the vessels. This murmur is intensified with deep inspiration, arrested by forced expiration or coughing; it is better heard and is more musical when the patient is standing or sitting than when recumbent. The vibratory sensation. the *frémissement cataire* of Lænnec is due to vibrations of the walls of the veins which are imparted to them by the vibrations of the blood. The muscular contraction produced by turning the head on its axis, strengthens the bruit; so does also light pressure of the stethoscope. The jugular veins can always be compressed by the belly of the omo-hyoid muscle, so that the presence of the murmur must be determined by an avoidance of these conditions. I prefer to accept Hamernyk's theory, that these murmurs are produced by the whirling movement of the blood in the jugular bulb at the lower end of the internal jugular veins, and that these veins have a different sized lumen along their course, and at the termination of the sinus venosus, which explains these eddies.

2. The cardiac anæmic murmurs are due to functional disorder of papillary muscles, and are ventriculo-systolic. Balfour believes that these murmurs in the pulmonary area are really due to mitral regurgitation, which in turn is due to defective nutrition of cardiac muscle and dilatation of ventricular cavity, so that we may say that in the lighter grades of anæmia the murmur in the neck is heard, as it becomes greater that in the second left intercostal space appears. When this

condition becomes extreme, then we obtain intra-ventricular murmurs, and these are heard at the apex. It is interesting to note that in the following recorded cases, as the percentage of hæmoglobin increased, the murmur at the apex was the first to disappear, with further improvement, that in the second left intercostal space followed, and when the percentage approached the normal, the *bruit de diable*, last of all, vanished.

The composition of the blood has recently received considerable attention. Gorup-Besanez states that the blood of man contains one part of iron to two hundred and thirty parts of red blood corpuscles, quoting the analysis of C. Schmidt. Schmaltz, in his investigations concerning the specific gravity of human blood, found that it varied from 1,059 in the male to 1,056 in the female, the annual variation being only three one-hundreths. Ingestion of 1000 cubic centimeters of physiological solution of salt had a very short and feeble influence. The specific gravity may fall to 1,030 in anæmia and cancerous cachexia; it varies according to the hæmoglobin it contains In serious disease of stomach, the mass of the blood itself is diminished on account of inanition. In phthisis and cardiac disease, its density is increased because of the slowing of the peripheral circulation. Jones finds a resemblance between his specific gravity curves and those of Leichtenstern for hæmoglobin, and explains that the variations of these substances are closely related to those of specific gravity. Hence the determination of the hæmoglobin by means of the color is accurate, because it is dependent upon the specific gravity and number of corpuscles.

Meyer and Pernou found that the iron in the liver cells of a fœtus was ten times greater than in a grown animal, showing that it might be stored there to provide for future growth. Jacobi injected iron in the blood vessels of dogs and rabbits and found that ten per cent. of it was excreted by bowels, liver and kidneys. Of that deposited, fifty per cent. was found in the liver, the rest in spleen, the kidneys, the walls of the intestine and other organs. It was all removed from the blood, however, in two or three hours after administration. The fact that the excess of iron is stored in the liver may be looked upon as a physiological, not a pathological process.

In estimating the value of a remedy for the increase of the iron in the hæmoglobin, it is necessary that we should not trust entirely to the physical examination of the heart and the blood vessels, the color of the mucous membrane and of the skin, but also should have an exact method of measuring the hæmoglobin in the blood. Daland has shown conclusively, what I have for some time more than suspected, that the methods of counting blood-corpuscles, namely, Gower's or the use of the Thoma-Zeiss hæmacytometer, give such variable results from the same specimen of blood, not only when examined by different observers, but as well when several portions are examined by the same observer, that the results are by no means satisfactory. Besides it is extremely trying work for the eyes, and I have for some time abandoned making estimations of the number of blood corpuscles. In the hæmoglobinometer made by Reichert, of Vienna, which I show, we have not only simplicity of operation, but, I believe, accuracy in ascertaining the amount of hæmoglobin contained in the given specimen of blood.

The technique of this instrument is simple; however, to insure accuracy of results, certain precautions must be taken. In the examination of the blood in the cases that I am narrating to-night, the time from 11 A. M. to 1 P. M. was selected. My light was a gas jet, four-foot burner, five feet distant. I made use of the same capillary tube for all examinations. The fingers from which the blood is taken, should be cleansed with ether and thoroughly dried. The cut was made with a sharp-pointed tenotomy knife. The blood should flow freely, and the work should be done quickly, so that clots do not form. The finger must not be squeezed. The capillary tube must be filled at one attempt. Use water for dilution at the temperature of the body, and clean the tube at time of using. Discharge the blood and water into the cell slowly, so as to avoid bubbles and marked meniscus at the edge, filling, however, both divisions of the cell to the same level. The water should be discharged with steady current, so as to thoroughly diffuse the blood into the menstruum. Turn the color-wedge from light to dark and note the reading, then turn from dark to light and make a second reading, which should correspond

with the first. Do not refer to a past record before an examination. Above all things, the examination should be made quickly and neatly. In this method of recording our results we are unbiased by any statement of the patient, and are also independent of any deception in the estimation of the color of the mucous membranes, which readily simulates that of health in those cases, by no means infrequent, where a febrile reaction accompanies anæmia.

In successfully treating anæmia it is necessary to fulfill the *indicatio causalis*, thus presupposing a consideration of the subjects mentioned above. The *indicatio morbi* brings up the consideration of food, which should be nourishing and easily digested, mostly nitrogenous; exercise in the open air, the amount to be regulated; the breaking off of bad habits; and the treatment by remedies.

In recent times it has been observed that the hæmoglobin of the blood has increased after moderate bleeding. Dogiel, on the strength of experiments upon dogs, confirms the deductions of Scholz that moderate bleeding, with say ten or fifteen leeches, does not alter arterial the blood tension, but if it is repeated every three or four weeks the patient gains in weight and the number of blood corpuscles increases. Vogt and Schtchberbakoff also found the hæmoglobin to be increased under similar circumstances. Schubert treated a number of cases of chlorosis by blood-letting and hot baths. The venesection was at the rate of seven to fifteen grains to the pound of body weight for each bleeding. The patient was kept in bed from twenty-four to forty-eight hours after the operation, and this treatment was repeated once or twice each year. The treatment with laxatives has at times been followed by so much success that Hamilton has said that if he were compelled to treat anæmia by either laxatives or chalybeates he would use the former. In Sir Andrew Clark's theory that anæmia arises in a large number of cases from auto-infection—in other words, that a large number of anæmias are of fæcal origin—there is certainly some proportion of truth; however, the most rigid and extraordinary antisepsis, which nowadays can be readily obtained by naphthaline, salicylate of bismuth, or beta-naphthol, does not seem to meet with the success that we should

expect, although quite recently Pick has professed to have obtained good results in chlorosis from this method. My own personal experience is, that it will succeed in only in a limited number of cases, so at the present time we can say that neither in blood-letting nor in laxatives, nor yet in securing intestinal antisepsis, can we hope to obtain so brilliant results as in the administration of iron.

In giving iron we have, up to this time, been hindered by certain apparently insurmountable difficulties. The organic salts of iron have had but a limited use, owing to their comparative inefficiency. The inorganic salts of iron have hitherto presented many disadvantages. Blaud's pills, so much lauded and popularized by Niemeyer, certainly fail in a considerable number of cases. Notwithstanding the large amount of iron which one can administer in them, in many instances improvement does not follow their prolonged and uninterrupted administration. I am inclined to think that the potash is partly responsible for this, since it is, as we know, one of the agents that promote waste. The tincture of the chloride of iron has easily held the first place in popularity and efficiency. Combined with phosphoric acid, when well borne by the stomach, its therapeusis is unassailable. The formula of Flint has been for many years one of my favorites. The coated tongue, the feeble digestion, and constipation are supposed to contraindicate the use of iron. I would rather say that these conditions call for a previous purgation and correction of the digestion, preliminary to a course of ferruginous treatment. On the other hand, I am quite as strongly opposed to the administration of a laxative at the same time with iron, such as is frequently found in its association with aloes, because the metal, being slowly absorbed, requires a slow passage along the intestine. I believe that there is no doubt that large doses of iron are less constipating than small ones, but I do not believe that the final result—namely, the absorption—is so satisfactory. Iron is absorbed more rapidly in catarrhal conditions of the alimentary tract, and in those cases tends to accumulate in the liver. Castellino has found, in his experiments, that hæmoglobin is absorbed rapidly, is always well borne, increases the number of red cells and the specific gravity of the

blood, and improves the general condition. If the hæmoglobin, however, is stopped before the normal condition is reached, its effect is only fugitive. In secondary anæmia it fails completely, in that its effects are only transitory. It is more rapid in its action than any other iron preparation. Obviously the use of this preparation will be extremely limited. The iron found in wines is too small to be considered, yet I am in the habit of prescribing wines, and especially Schreiber's dietetic Tokay, for my patients.

Since, then, we are of the opinion that iron is our sheet-anchor in the treatment of anæmia, and since all preparations hitherto used have been either inefficient or have presented certain disadvantages, we come now to a consideration of a preparation which, I think there is no reasonable doubt, will revolutionize the treatment of anæmia, in that the objections to the strong preparations have been done away with. Dr. George W. Weld, of New York, realizing the great injury done to the teeth by the tincture of the chloride of iron, set about obtaining a preparation which, while retaining all the therapeutic effects, should present none of the disadvantages. After years of experimentation, this preparation has been put on the market by Parke, Davis & Co. under the name of Weld's syrup of chloride of iron. It was found with the officinal tincture that the acid would attack the enamel of the teeth, and, curiously enough, in Smith's experiments, when two drachms of the tincture were added to an ounce of water, the destructive energy upon the calcium salts of the teeth was increased, and it was found that, of iron preparations the chloride was the most harmful, the syrup next, and the wine the least of all. Other preparations of iron, which are bland, are by no means so valuable as the tincture of the chloride of iron. I have tested, clinically, all the albumenates and peptonates of iron, and all are objectionable because, on the one hand, they are inefficient, frequently requiring administration for many months, and, in the second place, give rise to extremely bad-smelling flatus. If you add water to a simple solution of iron chloride, which is devoid of other acid, you get the basic salts of iron in free hydrochloric acid. Weld has shown that these basic salts of iron are not soluble in strong acids, so that they protect the teeth in the same

way that alcohol and syrup do; when, however, water is added, these salts are dissolved and the acid then attacks the enamel. Thus it is seen that it is the free hydrochloric acid that is so destructive to the teeth. In Weld's iron this excess of acid, which is unnecessary for perfect solution of the iron salt, is removed, and in no way does this impair the therapeutic value of the preparation, because the hydrochloric acid is again added to it from the gastric fluids. It is easily assimilated, better tolerated than the old tincture of the chloride, because it does not produce nausea; gives rise to no disagreeable eructations; and contains no alcohol save that which is found in the tincture, of which one-half an ounce contains only twenty drops. The constipation, which is noticeable with all iron preparations, is easily corrected by equal parts of fluid extract of cascara sagrada and glycerin the proper dose to be determined by experiment.

Each fluidounce of Weld's syrup of the chloride of iron contains forty drops, equaling twenty-four minims, of the tincture of the chloride of iron of the United States Pharmacopœia. It is not pretended that Weld's syrup will not stain the teeth; soft-boiled eggs, salads, etc., will of themselves stain the teeth; but it can be asserted that Weld's syrup will not injure the enamel of the teeth. On using a tooth-brush the surface is always found intact, even after month-long immersion in this preparation. Weld's syrup of the chloride of iron is simply the tincture of the chloride of iron, United States Pharmacopœia, with the excess of acid neutralized and a certain amount of syrup of gaultheria added to improve the taste. The following cases will illustrate its usefulness:

Case I.—*January* 15, 1892.—H. B. C., United States, aged 24, single, no occupation. Glycosuric fourteen months ago. Under Martineau's treatment sugar disappeared from the urine in three months, and has not returned. Has suffered from polyuria; the daily amount of urine sixty to ninety-five ounces. Complains of dull headache in the afternoon; suffers backache when walking, nausea and occasional vomiting, trembling; and pains in limbs. Slight cough without expectoration, dizziness, and fainting spells. Dyspnœa which is marked on ascending stairs. Her diet has not been restricted.

Physical Examination.—Pallor; lips bloodless, not œde-

matous. Pulse 92, small and weak. Anæmic murmur in right side of neck, also in second left intercostal space. Apex beat weak, otherwise normal. Liver easily felt at edge of ribs. No enlargement of spleen. Urine, ninety-four ounces; free from albumin, sugar, and casts. Specific gravity, 1.018; acid. Reichert's hæmoglobinometer, seventy-eight per cent. Ordered Weld's iron, two drachms three times daily.

February 13th: Reichert's hæmoglobinometer, eighty-five per cent.; quantity of urine, fifty ounces, normal. Anæmic murmur has disappeared from left intercostal space. Improvement marked as regards symptoms and faintness. Pulse good, 82, and of fair volume. Ordered Weld's iron, three drachms three times daily.

March 14th: Reichert's hæmoglobinometer, ninety-one per cent.; much improvement in headache and backache. No nausea nor vomiting; cough, however, still continues. Less dyspnœa; pulse 72, of good force; murmurs have both disappeared; urine sixty-two ounces. Ordered two drachms Weld's iron three times daily.

April 11th: Symptoms are entirely relieved. Urine fifty-five ounces, specific gravity 1.017, no sugar, albumin, bile or casts. Liver normal in size. Reichert's hæmoglobinometer ninety-eight per cent. Discharged, cured.

Case II.—*January* 19, 1892.—L. D., aged seventeen, single. Sick one year. Complains of headache, which is frontal, constant, sharp, but not enough to keep awake at night, sometimes worse in middle of day. Pulse weak. She is languid, disinclined to exertion, sometimes dizzy, but never faints. No cough; formerly palpitation, marked shortness of breath, hands and feet cold. No appetite, no distress after eating. Bowels regular every day. Catamenia anticipate two or three days. Flows four days, not profuse, of good color. No urinary or bowel symptoms.

Physical Examination.—Pulse 72, weak, small, and of low tension. Tongue pale and flabby; teeth indent the edges. *Bruit de diable* in right side of neck. Ventriculo-systolic murmur in second left intercostal space. Apex beat weak, diffused, shortened, somewhat irregular in force and rhythm on exercise. Reichert's hæmoglobinometer sixty-six per cent. Ordered Weld's iron, two drachms three times daily.

February 4th: Headache yesterday; is now fourteen days over period. Pulse seventy-two, better. Still has anæmic murmurs. Reichert's hæmoglobinometer seventy-six per cent. Ordered Weld's iron, two drachms three times daily.

February 23d: Has not felt quite so well during last week owing to loss of sleep caused by death of father. Pulse now weaker in force, rhythm is good. Sounds at apex weaker also. Anæmic murmur not so loud as before; heard in neck and at second left intercostal space. Period last week as usual. Reichert's hæmoglobinometer eighty-four per cent. Ordered Weld's iron, two drachms three times daily.

28th: Has felt very much better since last report. Anæmic murmurs cannot now be heard. Reichert's hæmoglobinometer ninety-three per cent. Ordered Weld's iron, three drachms three times daily.

March 15th: Richert's hæmoglobinometer ninety-seven per cent.

April 3d: Pulse 68, good; lips of excellent color. Richert's hæmoglobinometer one hundred and two per cent. Discharged, entirely well.

Case III.—*January* 23, 1892.—M. McC., United States, aged seventeen, single. Sick three weeks. Vomiting constantly, whether stomach is full or empty. Vomits a whitish matter, never bloody. Pain in head, in both temples; not always present, but worse on vomiting. Dizziness on going up stairs, also dyspnœa. Short dry cough, which is slight; palpitation of heart on walking; appetite fair. Bowels very constipated, no urinary symptoms. Menstruation very irregular, last three months ago, and continued two days, without pain; discharge pale and scanty. Sleeps well and is drowsy in day time. Has pains about heart.

Physical Examination.—Tongue clean, pale, and flabby, Conjunctivæ pearly. Lips pale, no swelling of feet. Pulse 90, feeble, compressible; slight anæmic murmur in right side of neck, also in second left intercostal space. Apex beat weak, with but little impulse. Reichert's hæmoglobinometer sixty-three per cent. Ordered Weld's iron, half an ounce three times daily.

February 7th: Has felt better, headaches and dizziness

better, shortess of breath less marked. Anæmic murmur in second intercostal space has disappeared. Reichert's hæmoglobinomneter seventy-four per cent. Ordered Weld's iron, three drachms three times daily.

24th: Has not taken medicine for two days. Nausea has returned; heart sounds, however, are better. Reichert's hæmoglobinometer eighty-eight per cent. Ordered Weld's iron, two drachms three times daily.

March 3d: No nausea, no vomiting; dizziness absent; very little shortness of breath. Pulse 72; of good volume and regular; no anæmic murmurs. Reichert's hæmoglobinometer ninety-one per cent. Ordered Weld's iron, one drachm three times daily.

29th: Reichert's hæmoglobinometer ninety-eight per cent. Discharged upon patient's statement that she feels perfectly well.

Case IV.—January 24th, 1892, C. B., United States, aged eighteen, single; sick one year. Menstruation at thirteen, always irregular, recurring three to eight weeks, lasting five or six days, profuse. For last six months has had her periods every fourteen days lasting eight to ten days profuse, but little leucorrhœa. Headaches at times, constant, worse in morning. Dizziness, palpitation of heart, fainting on one occasion, fainting feelings frequently, shortness of breath on ascending stairs, pain in stomach almost all the time, poor appetite of late. Pain under the right shoulder. As a rule food does not distress her. Bowels move regularly every day. Before each menstruation there is an attack of diarrhœa. Loss of flesh and strength.

Physical Examination.—Pulse 88, broad, weak, irregular in force and rhythm. Conjunctivæ jaundiced, pupils fully dilated. Lips pale, tongue clean and pointed. An anæmic murmur in neck, but none in the second left intercostal space. At the apex there is a shortened first sound varying in intensity and irregular in rhythm. Reichert's hæmoglobinometer fifty-six per cent. Ordered Weld's iron, three drachms, three times daily.

February 14th: After an interval of sixteen days, she flowed six days, first three days are as usual, the last three

there was an improvement. Pain during first day in stomach, some headache but less than formerly. Less pain in stomach, no diarrhœa. Reichert's hæmoglobinometer seventy-one per cent. Ordered Weld's iron, two drachms three times daily.

21st: Headache, dizziness, fainting feelings are all improved, appetite good. Reichert's hæmoglobinometer seventy-nine per cent. Ordered two drachms Weld's iron, three times daily.

March 12th: At her last period she flowed six days; her head aches very little, dizziness better, there is no palpitation, nor fainting; no shortness of breath, and very little pain in stomach, food does not distress; pulse 72, heart beats stronger than at last report. The murmur in neck is less loud. Reichert's hæmoglobinometer eighty-seven per cent. Ordered Weld's iron, two drachms, three times daily.

22d: No murmur now heard, and she has greatly improved in appearance and feelings.

April 4th: No headaches; and she has slight dizziness, and is restless at night. Pulse 68, good. Reichert's hæmoglobinometer one hundred and three per cent. Discharged well.

Case V.—*January* 26th, 1892, E. H., Ireland, aged nineteen, single Sick five weeks. She was a tea fiend. Vomited after eating, but not at other times. Pain in stomach before vomiting. The matter vomited is food unchanged. Belches wind. Bowels irregular, constipated, move two or three times a week, pain before movement, head aches in left frontal region, dizziness, shortness of breath on walking, violent palpitation on ascending stairs. Menstruation absent for two months, usually irregular, five to seven weeks, flows three days, color good, no pain. Has been losing flesh of late, and her appetite poor.

Physical Examination.—Pulse 92, weak, compressible, small. Conjunctivæ pearly. Tongue pale, tremulous, flabby. Anæmic murmur in neck, also in second left intercostal space. Apex beat and sounds normal. Reichert's hæmoglobinometer forty-nine per cent. Ordered Weld's iron, three drachms three times daily.

February 24th: No vomiting nor stomach pain, headache absent, palpitation and dizziness improved. Anæmic mur-

mur in neck, also in second left intercostal space. Reichert's hæmoglobinometer sixty-five per cent. Ordered Weld's iron, two drachms three times daily.

March 10th: Has returned to tea drinking and has some vomiting, otherwise improved. Anæmic murmur in second left intercostal space is now absent. Reichert's hæmoglobinometer seventy-eight per cent. Ordered Weld's iron, two drachms, three times daily. Tea was forbidden..

15th: Considerable improvement; vomiting has completely disappeared; murmurs now heard only in neck. Reichert's hæmoglobinometer ninety-one per cent. Ordered Weld's iron, two drachms three times daily.

April 12th. This patient has not yet reported, but, judging from her improvement, she is now well.

Case VI.—*February* 4th, 1892, L. C., United States, aged eighteen, single. Sick two weeks. Two weeks ago she had a cold in chest, cough, expectoration which was whitish, hard to raise. Dizziness, shortness of breath. In menstruation, considerable pain but nothing else unusual. Headaches on top of head, sometimes fainting feelings. Obliged to sit down suddenly. Bowels very constipated. Poor appetite. Food distresses her; nausea.

Physical Examination.—Pulse 93, small, feeble, slightly irregular. Conjunctivæ pale, pearly. Mucous membrane anæmic. Tongue coated, tremulous and flabby; anæmic murmur in neck and second left intercostal space and roughened respiration. Reichert's hæmoglobinometer fifty-two per cent. Ordered Weld's iron, three drachms three times daily.

18th: Much improved, but still is weak; shortness of breath and headache still present, but not so marked. Cough and expectoration less; appetite much improved; bowels now regular; food does not distress her. Pulse 90, of fair volume, respiration normal; anæmic murmur in second left intercostal space less marked. Reichert's hæmoglobinometer seventy per cent. Ordered Weld's iron, three drachms, three times daily.

March 15th: Murmur heard only in neck, and that is not marked; slight cough, dyspnœa absent. Reichert's hæmoglobinometer eighty-two per cent. Ordered Weld's iron, two drachms, three times daily.

April 6th: Feels perfectly well. Reichert's hæmoglobinometer ninety-five per cent. Iron to be continued in same dosage for two weeks. Discharged from observation.

CASE VII.—*February* 12, 1892. S. M. F., United States, aged thirteen, single. Sick one year. Complains of headache, dizziness, languor for several months; fair appetite; sweets easily coat tongue; constipation, sometimes palpitation. Cold does not result in cough, but tonsils rapidly enlarge. Has not menstruated.

Physical Examination.—Pale, skin soft, easily grasped, blue veins showing on forehead. Conjunctivæ pearly; lips pale; mucous membrane the same. Anæmic murmur in neck, also in second left intercostal space. No pulmonary signs; abdomen full. Scapulæ prominent. Expansion one-half inch in chest, showing thirty-six inches on expiration; muscles soft. Pulse 78, weak. Reichert's hæmoglobinometer eighty-three per cent. Ordered full diet, pulmonary gymnastics, and Weld's iron, one drachm, three times daily.

March 7th: Great improvement in appearance as regards muscles, but still anæmic murmurs are present. Abdomen less protuberant; scapulæ less prominent. Reichert's hæmolobinometer eighty-seven per cent. Ordered Weld's iron, two drachms, three times daily.

21st: Chest expansion two inches, in expiration its measurement is twenty-nine inches. No murmurs. Cheeks and lips of good color, pulse 72, good. Reichert's hæmoglobinometer ninety-two per cent. Ordered Weld's iron, two drachms, two times daily.

April 10th: Chest expansion, two inches, in expiration its measurement is twenty-nine and one-half inches. Feels very well. Reichert's hæmoglobinometer ninety nine per cent. The iron discontinued.

CASE VIII.—*February* 8, 1892: M. S., France, aged thirty-two, widow. Sick one month. Always healthy; for last month headache in temples, constant; sleep interrupted by it. Vomiting of food and mucus for two days; some pain in stomach; poor appetite; bowels regular every day. Of late some dry cough; palpitation on exertion, never dyspnœa. Loss of flesh; no swelling of feet; sometimes fainting feelings.

Physical Examination.—Tongue pale and flabby; mucous membranes pale; anæmic murmur in neck, also in second left intercostal space; apex sounds weak, pulse 90 and weak. Menstruation regular, but scanty and pale. Reichert's hæmoglobinometer sixty-six per cent. Ordered Weld's iron, two drachms, three times daily.

22d: Less headache and vomiting; palpitation now seldom; no fainting, pulse 88, heart sounds better, though appetite still poor; no murmur in second left intercostal space. Reichert's hæmoglobinometer eighty-five per cent. Ordered Weld's iron, three drachms, three times daily.

March 16th: Appetite has much improved. Pulse 72, good. Reichert's hæmoglobinometer ninety-six per cent. Ordered Weld's iron, two drachms, three times daily for two weeks and then report if not perfectly well.

Case IX.—*February* 11, 1892: E. S., United States, aged nineteen, single; sick six months. Cough, not severe, does not keep her awake at night; no vomiting; expectoration whitish, scanty and easy to raise, generally only in morning; palpitation of heart; shortness of breath, however, is absent. She has lost flesh and more strength; headaches, which are constant. She never faints; has cold hands and feet, but no dizziness; appetite good, food does not cause distress; constipation; has no menstrual symptoms except scanty flow and cramps.

Physical Examination.—High-pitched inspiration and expiration at right and left apices; whispering bronchophony; crepitant râles down to upper border of third rib; rest of chest normal. First and second sounds of heart accentuated. Anæmic murmur in neck, slight; soft-blowing ventriculo-systolic murmur at apex. Pulse 72, weak but regular. Lips pale, œdematous; mucous membranes pale. Reichert's hæmoglobinometer, seventy-one per cent. Ordered Weld's iron, three drachms three times daily.

February 25th: Cough improved; expectoration yellowish. No palpitation or shortness of breath. Feet now cold, but not the hands. Has had no menstruation since *January* 15th. Pulse 66, of better volume; lips not so pale. Reichert's hæmoglobinometer, eighty-five per cent. Ordered Weld's iron, three drachms three times daily.

March 10th: Has but little cough and scanty expectoration. No coldness of feet. Has menstruated since last report, color improved, otherwise no change. No murmurs either in neck nor at apex. Reichert's hæmoglobinometer, ninety-four per cent. Ordered Weld's iron, three drachms three times daily.

23d: Feels first-rate; no headaches, no coldness of hands or feet. Pulse 68, good. Inspiration less high-pitched; no whisphering bronchophony; no râles. Pulmonic second sound slightly accentuated. Reichert's hæmoglobinometer, one hundred and two per cent. To stop iron; discharged well.

Case X.—Feb. 11th, 1892: M. O'B., United States, aged seventeen, single. Sick five weeks. Suffered from chorea three years ago, with repetitions each spring. Constant headaches at vertex which keep her awake at night. Shortness of breath on exertion; palpitation, which is fluttering, on ascending stairs; also pain about waist; frequently fainting, dizziness, sometimes ringing in ears; appetite poor; food distresses after eating; nausea, but no vomiting; bowels regular; cold hands and feet. No disturbance in menstruation, except cramps. The feet swell; also face.

Physical Examination.—Lips pale, œdematous. Pulse 96, weak and irregular. Anæmic murmur in neck, also ventriculo-systolic murmur at second left intercostal space and at apex. Reichert's hæmoglobinometer, fifty-one per cent. Ordered Weld's iron, three drachms three times daily.

February 25th: Slight chorea in left side of face and left arm. Headache better; do not keep her awake nights, as present. No pain nor palpitation of heart; dizziness on two occasions; feet still cold; has not been unwell for five weeks; feet do not swell, neither does face. Pulse 84, more regular. Murmurs still present. Reichert's hæmoglobinometer, seventy-two per cent. Ordered Weld's iron, two drachms three times daily.

March 17th: Menstruation since last report; but not unusual. Shortness of breath improved. No palpitation¶ Appetite good; no distress after eating. Pulse 72, still weak. Murmur at apex very faint. Chorea diminished. Reichert's hæmoglobinometer, eighty per cent. Ordered Weld's iron, two drachms three times daily.

30th: Chorea less marked. Murmurs only in neck. Pulse 68, better force. Reichert's hæmoglobinometer, ninety-one per cent. To continue with Weld's iron for one month.

Case XI.—*February* 14th, 1892: A. C., United States, aged twenty-one, single; sick four years. Tubercular family history. For last two years has been subject to colds. Cough usually not marked, save in the morning; no expectoration; appetite poor; never distressed after eating. She sometimes complains of dizziness and faintness; sometimes dyspnœa and palpitation, especially on exertion. Four years ago she had infiltration of right apex, which was presumably tubercular.

Physical Examination.—Slight dullness over right apex; increased transmission of voice sounds, especially the whispered voice; markedly high-pitched and prolonged inspiration; no râles. Pulse 92, weak. Pupils dilated, conjunctivæ pearly. Anæmic bruit in neck on right side; no heart murmurs. Reichert's hæmoglobinometer, fifty-three per cent. Ordered Weld's iron, three drachms three times daily.

March 7th: No cough; appetite good; no dizziness, no faintness, no shortness of breath and very little palpitation, save on ascending stairs; no headaches. Her food does not distress her after eating; bowels regular every day. Reichert's hæmoglobinometer, seventy-one per cent. Ordered Weld's iron, two drachms three times daily.

20th: Appetite excellent; feels generally better. Pulse 68, good. Lips, good color; no anæmic bruit in neck, and all pulmonary signs have improved markedly. Reichert's hæmoglobinometer, eighty-eight per cent. Ordered Weld's iron, two drachms three times daily.

April 10th: Has markedly improved. Pulse 66, good force and volume. Reichert's hæmoglobinometer, ninety-nine per cent. Ordered to omit all medication.

Case XII.—*February* 16th, 1892. K. M., United States, aged nineteen, single. Sick three months. Always well until this. Complains of shortness of breath on exertion, palpitation of heart; throbbing in epigastric region, and sometimes coldness of hands and feet; headaches on top of head, constant, but worse on being tired; dizziness, sometimes weak

and fainting spells. She has no cough nor expectoration, no swelling of feet; is regular in menstruation, pain before flow for three days, flow becoming more scanty and pale; appetite good, bowels constipated, no distress after eating.

Physical Examination.—Pulse 103; weak. Skin and conjunctivæ pale. Tongue clean, tremulous, and flabby. Loud anæmic murmur in right side of neck. Rough blowing murmur in second left intercostal space. First sounds of heart weak; tenderness of liver, but no enlargement; spleen normal; no pulmonary signs. Reichert's hæmoglobinometer forty-six per cent. Ordered Weld's iron, three drachms, three times daily.

March 15th No shortness of breath, palpitation improved, feet still cold; has had one attack of headache which lasted three days; no fainting. Last menstruation was, as usual, of scanty flow with pain. Appetite has markedly improved; anæmic murmur in neck and second intercostal space still present, although not so loud. Reichert's hæmoglobinometer sixty-two per cent. Ordered Weld's iron, three drachms, three times daily.

March 15th: Shortness of breath the same; headaches improved, also palpitation. Pulse 71, good. Reichert's hæmoglobinometer seventy-four per cent. Ordered Weld's iron, one-half ounce, three times daily.

April 2d: Has no symptoms excepting occasional headaches. Pulse 68, good. No murmurs. Reichert's hæmoglobinometer ninety-eight per cent. Patient discharged well.

In making an analysis of these cases, we may say that the cause of the anæmia in Case I was a state of malnutrition following diabetes and arising in the liver. Cases II, VI, and XII evidently became anæmic through overwork, loss of fresh air and sunlight. Case IV is accounted for by the menorrhagia from which she suffered and which was cured during the last week of observation by curetting of the uterus under ether; her improvement, however, dated from the commencement of the treatment by iron. Dyspepsia evidently was the cause of the anæmia in Case III, which could well be named as one of Sir Andrew Clark's fæcal anæmias. I believe that the cure was obtained quite as readily with the administration of iron

as it would have been with beta-naphthol, and I speak after considerable experimentation with intestinal antiseptics. Case X developed her usual spring chorea while under treatment, yet the attack was mild and improved rapidly. Case V was a tea fiend, and a great portion of the result could be justly assigned to the breaking off of the habit. Cases VI, IX, and XI were of the tubercular diathesis, and Case VII should be added here, as the condition was one of hypotrophy such as has recently been described by Solis-Cohen. Iron, when change of life, scene, and habit can be obtained, is certainly a most valuable prophylactic. In all these cases outdoor exercise was insisted upon, for iron to be of the most value must be sunned; regular hours for sleep and meals, and a nitrogenous diet prescribed, and the bowels regulated by cascara sagrada and glycerin.

CONCLUSIONS.

1. In anæmia, iron is by far the best remedy.
2. Of all preparations, the tincture of the chloride is the most valuable.
3. This preparation is objectionable in that it excites nausea, disgust and vomiting, stains and destroys the teeth.
4. These disadvantages are obviated in Weld's Syrup of the Chloride of Iron.
5. In removing these disadvantages, its therapeutic efficacy is not in any way impaired.

690 MADISON AVE., *April 12th*, 1892.

DISCUSSION.

Dr. George W. Weld said that the preparation was practically non-alcoholic; the only alcohol in the syrup, so-called, was the alcohol contained in ordinary tincture of chloride of iron, each half-ounce containing twenty drops. Regarding the name of syrup of chloride of iron, when one came to taste it, one would discover that it was not a syrup in the sense of the other syrups, which, as everybody knew, were apt to derange the stomach. In regard to its acidity, it is acid in reaction, and necessarily so to hold the basic salt of the iron in solution, for the moment any solution of iron was brought to

a neutral point there would be precipitation of the basic salt, which in this case would be the hydrated oxide. The syrup was not acid enough to destroy the enamel of the teeth or to cause nausea or vomiting. Strictly speaking, there were five ingredients in the preparation—iron, saccharine matter, alcohol, oil of gaultheria, and an alkali used to neutralize the free drochloric acid. The oil of gaultheria and the hydrochloric acid were present in a very small percentage. Practically, then, there were only three ingredients—the alcohol, the iron, and the syrup. Some six or eight years before, in experimenting with tincture of chloride of iron, the speaker had placed a tooth in the tincture, and, on taking it out, after three hours, been very much surprised that the enamel was not destroyed in the slightest degree, because he had heard a great deal about the injurious effects of this particular preparation. He had thought it very strange, and had concluded there must be some mistake, but, in order to make sure, he had left it in for twenty-four hours, and on taking it out had again found that the enamel was not at all injured. Then his attention was called to an old experiment—that of putting zinc into strong sulphuric acid, when the zinc was not harmed in the least, but the moment water was added there was an immediate and powerful effect of the sulphuric acid. He then added some water to the tincture of chloride of iron and put the tooth into it. The enamel was entirely destroyed. [The speaker showed a number of teeth that had been immersed in solutions of tincture of chloride of iron of various strengths, which strikingly illustrated the destructive action upon the enamel.]

Dr. A. H. Elliot said that his interest in this subject was purely from a chemical standpoint. Some six or seven years before, Dr. Weld had gotten him interested in his endeavors to counteract the injurious action of tincture of chloride of iron upon the teeth, and, in order to get a thoroughly good idea of what he was working upon, he han made an examination of a lot of enamel of teeth, in order to see the kind of material that was being acted upon by tincture of chloride of iron. Then his attention was called to the fact that acids generally acted very rapidly upon this enamel; in fact, as near as he could remember, one of the first experiments of the kind had been

with a five-per-cent. solution of acetic acid—pretty good vinegar. In that case the teeth were attacked to such an extent that about five or six per cent. of the enamel was dissolved by this simple acid. Other acids would destroy the enamel as well, the effect varying with the strength, provided, of course, there was no grease or alkali on the teeth to protect them. Then Dr. Weld had called the speaker's attention to the fact that he had concluded that he could add Vichy water to the tincture of chloride of iron, and thus counteract the acidity. Although this had rather amused him as a chemist, nevertheless he had done it, and had found out afterward by making experiments that he could neutralize the free hydrochloric acid in the tincture of chloride of iron by adding bicarbonate of sodium, which Dr. Weld was practically doing by the addition of Vichy water. By adding too much bicarbonate of sodium the point of neutrality would be passed, and the solution would then, or course, become distinctly alkaline. This naturally would not do, as precipitates would be thrown down, and the preparation be made entirely useless. It became necessary, therefore, to add the bicarbonate of sodium very carefully so that only the free hydrochloric acid would be neutralized, but the solution will be acid in reaction, in order to hold the salt of iron in suspension. The difficulty that Dr. Weld had met with in using Vichy water, or, rather, the difficulties, as there were two, had been, first, that he did not know the strength of the tincture of chloride of iron, for, although the druggists said it was made according to the United States Pharmacopœia, we all knew that there were variations in the amount of the free acid. In the second place, he did not know the strength of the Vichy water, so he could never tell just how much Vichy water to add to the tincture of chloride of iron, unless he had the Vichy water analyzed every time. So that this method of counteracting the corrosive action of the tincture of chloride of iron was not always successful, although it could be used in a number of cases, and he did use it in that way. The speaker had then thought that, if one could use the bichloride of sodium carefully and find out how much to add to a stipulated amount of tincture of the chloride of iron, the free hydrochloric acid could be neutralized, and yet the

preparation still retain its acidity. This saturation point had been found and syrup of gaultheria added. The speaker still had a preparation of tincture of chloride of iron that had been treated by this method several months before, and there was not the slightest evidence of precipitation of any of the ingredients of the solution, whereas preparations of tincture of chloride of iron treated with Vichy water would precipitate if kept for any length of time.

He had obtained from various places in the city a number of samples of tincture of chloride of iron from pharmacists who were reliable. The actual amount of the solid chloride of iron averaged from 8.6 to 14.7 per cent.; so one could imagine what the preparations were. According to the United States Pharmacopœia, tincture of chloride of iron should contain about thirteen per cent. of the dry chloride. The acid over and above that necessary for the solution of the iron in it —for it must be remembered that metallic iron required a certain amount of hydrochloric acid to clear it—averaged from nothing in one to a sample which contained ten per cent. more than was necessary. A sample of syrup of chloride of iron obtained in the open market had been handed to him, and he had found no free acid in it, but more bicarbonate of sodium than appeared to be necessary. This had caused a curious chemical phenomenon to take place in the syrup—namely, the hydrochloric acid had acted on a portion, with the result that sodium chloride had been formed. But this had resulted in this one preparation of the syrup, something that had been entirely unlooked for, but that added to the efficacy of the syrup, for in this preparation there were the bicarbonate of the sesquioxide of iron and the protochloride of iron—a very curious and happy outcome, from a chemical standpoint.

Dr. J. C. Smith had used Reichert's hæmoglobinometer for several months at the same time with Gowers's, and was positive that the first-named instrument is not only more accurate in results, but also far easier of manipulation.

Dr. A. S. Dana spoke of a patient who, on March 2d, had been suddenly attacked with a severe chill, followed by very acute pleuritic pain in the left side. At the end of two weeks a purulent collection broke into the bronchial tubes, and large

quantities of pus were evacuated. The patient was very much emaciated, and his anæmic condition became extreme, with severe cough, profuse night-sweats, and a very irritable stomach. He was immediately put on the use of tablespoonful doses of syrup of chloride of iron every four hours, and the dose was increased to three tablespoonfuls, with gratifying results. The cough was relieved to a great extent, the anæmic condition was rapidly improving, the stomach took kindly to the iron, and the patient was on the road to rapid recovery. He had been taking during the preceeding two weeks an amount averaging seven ounces and a half of the syrup every twenty-four hours, without any stomach irritation. The speaker mentioned also the case of a child, three months old, that had pronounced diarrhœa, milk passing through with the stools in an apparently undigested condition. The abdomen was much distended, and there were nausea and vomiting. After using the usual remedies with no apparent effect, the speaker had resorted to Weld's syrup of chloride of iron giving teaspoonful doses every two hours. The improvement was marked, almost from the beginning, the nausea and vomiting were checked, the tympanites subsided, and the complexion of the child entirely changed for the better. In a number of other cases he had had unusual success with the syrup.

Dr. C. E. Quimby called attention to a preparation of ozone, and said he believed it was now possible to make a permanent solution of ozone in a neutral menstruum.