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C. F. Boehringer & Soehne,

7 Cedar Street, New York.

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FERRATIN:

Its Dietetic and Therapeutic Uses

BY

Prof. O. SCHMIEDEBERG, of Strassburg, 1/E.



The iron required in the formation of blood is, under ordinary conditions, supplied to the organism with the food, in which it exists in the form of a peculiar compound, differing from the ordinary iron albuminates, and in which the iron is united with an albuminous substance in a manner similar to organic compounds. Bunge first prepared a compound of this character, containing 0.29 per cent. of iron, from the yolk of hen eggs. This compound he named haematogen. The latter, however, is only a modification, poor in iron, of the actual compound, rich in iron, which exists in the animal body.

After Dr. Marfori, under my direction, had first isolated the latter, more or less mixed with albuminous substances containing no iron, from various organs, I finally succeeded by an exceedingly simple method in preparing the same, free from foreign substances, from the liver of hogs. This compound contains 7 per cent. of iron on an average, and may be briefly termed "**Ferratin.**" Other iron compounds of this kind are not contained in the normal organs of the body, so that **Ferratin** is the only iron compound which we take up with the articles of food and which is found secreted in the tissues to serve as a reserve for the formation of blood. For example, if blood be drawn from a dog at considerable intervals of time, the **Ferratin** disappears almost entirely from its liver, if meanwhile the animal experimented on be fed on food very poor in iron. The reserve or stored supply of the iron compound is in this case used in

the formation of blood. In addition to this, **Ferratin** seems also to have direct bearing upon the nutrition of the tissues.

From these facts it is self-evident that **Ferratin** may be utilized for the purpose of supplying the organism in a methodical way with the same iron compound which, under ordinary circumstances, is offered only incidentally and, probably in many cases, in insufficient quantity with the articles of food, for the purpose of promoting nutrition and growth, and removing or eliminating morbid conditions.

The extraction of this natural **Ferratin** is carried out only with difficulty in practice, however. At all events it is very expensive. For this reason it became desirable to prepare **Ferratin** artificially. This object was attained only after experiments covering a period of several years.

Marfori has already reported on a compound containing 0.7 per cent. of iron.* Subsequently he obtained compounds with from 5 to 8 per cent., and more, of iron, but they were not fully identical with the natural **Ferratin**, as was found after the latter had been prepared, inasmuch as they contained varying quantities of other iron compounds of this kind not occurring in the organism. Only after many vain experiments have I succeeded in artificially producing **Ferratin** of constantly uniform composition, and the same as that obtained from the liver.

The technical difficulties which at the start confronted the production of **Ferratin** on a more extensive scale have been overcome by the firm of C. F. BOEHRINGER & SOEHNE, of Mannheim, Germany, not without considerable labor and exertions, however. These difficulties consisted particularly in keeping the preparation free from other iron compounds.

Ferratin, with respect to its physiological properties, cannot be replaced by other iron compounds, inasmuch as these are either useless as reserve nutritive substances, as in the case of ferro and ferricyanides and the related hæmoglobin and its derivatives, or act injuriously by their corrosive action on the stomach and intestinal tube in almost every instance, and are, therefore, incompatible, as in the case of the ordinary salts of iron, even when taken and assimilated in very small quantities.

Ferratin, however, is the assimilable iron compound in contradistinction to the said cyanides and hæmoglobin. Exhaustive experiments with animals and experiences of considerable extent with human subjects have shown that the same produces no disturbances in the

* *Archiv für experim. Pathologie u. Pharmakologie*, 1891, Vol. XXIX, p. 212.

functions of the stomach or intestines ; indeed, it seems to exercise a beneficial influence upon these in many cases, by virtue of its slight astringent properties, without, however, causing any injurious corrosive action. Moreover, it binds the sulphuretted hydrogen generated by processes of decay in the intestines, being slowly decomposed by the latter in the presence of alkalies. A consequence of this local action may be an improvement of the appetite and regularity in the stool.

The absorption of the **Ferratin** takes place in more copious or more limited quantities according to conditions not yet accurately determined. On the whole, however, this absorption proceeds with comparative slowness, at least for dogs having a sound intestinal canal. But even in those cases where this absorption appeared to be slight, animals weighing from 5 to 7 kg. would have had to consume from 5 to 20 liters of milk in order to assimilate the same amount of iron as contained in doses of from 0.1 to 0.2 g. of **Ferratin**. It is to be observed in this connection that large doses are more favorable to absorption only in so much as that there is a greater certainty that a part of the same will escape decomposition by the acid gastric fluid and sulphuretted hydrogen than would be the case with small doses. For this reason the dose must be so regulated so that a surplus of **Ferratin** is constantly present in the intestinal canal, in order that the organism may be enabled to absorb the necessary quantity of the same. There is no danger of overcharging the organs with iron under this method, inasmuch as absorption and secretion seem to be regulated automatically. The latter, the secretion of iron, is never carried out by the kidneys, and the same, therefore, are not injuriously affected under any circumstances.

Ferratin, therefore, is pre-eminently an article of nourishment, and may be employed in this capacity, especially in those cases where an apparently healthy subject shows indications of an insufficient alimentation and blood-formation, be they ever so slight. This is particularly the case with children, and applies also to those cases where a suspicion of approaching chlorosis exists. In its application for medicinal purposes, the usual symptoms requiring the use of iron must for the present govern. When more ample experiences will have been gathered with **Ferratin** these indications will become plainer than heretofore, because the therapeutic effect due to the administration of the proper dose will not be disturbed or obscured by any injurious effects, as is so often the case with iron preparations.

Ferratin is introduced for use as a fine powder, having a reddish-brown color resembling oxide of iron, and in two forms, viz., in the free state insoluble in water, and as a sodium compound, which,

after being allowed to stand for some time, and then stirred, is readily dissolved in water. The water for this purpose must be as free as possible from lime, as otherwise the insoluble calcium-**Ferratin** is liable to be formed.

These aqueous solutions of sodium-**Ferratin** may be used with advantage as additions to milk or other liquid foods, particularly for the nourishment of small children.

Soluble as well as insoluble **Ferratin** may also be used directly as food without any further additions. For children, daily doses of from 0.1 gm. to 0.5 gm. will be sufficient; while for adults the same may be made from 1 gm. to 1.5 gm. daily, to be taken at once, or divided into 2 or 3 portions. No particular diet need be observed, but very sour articles of food should be avoided, as they might decompose the **Ferratin**. Other particulars can be learned only from practical experience.

A detailed communication on **Ferratin** will shortly appear in Vol. XXXIII of the *Archiv für experimentelle Pathologie und Pharmakologie*.

[Reprint from *Correspondenzblatt für Schweizer Aerzte*, No. 11, June 1, 1894.]

Ferratin in the Treatment of Anæmia*

BY

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Schmiedeberg has succeeded in isolating from pig's liver a peculiar organic iron compound, looked upon by him as the natural form in which iron is taken in the food. This compound, which is deposited in the liver, he considers to be a first step towards sanguification, and therefore a spare material for the organism.†

Schmiedeberg's preparation contains about 7 per cent. of iron, and has been called Ferratin. Possessing, as it does, all the properties of the absorbable iron albuminate of food, it may even be called a

* Read before the Medicinische Gesellschaft of Basel, Switzerland.

† *Archiv für exper. Pathol. u. Pharm.*, XXXIII, p. 101.

food in the proper sense of the word, as only by means of this remedy is it possible to supply the organism methodically with the amount of natural iron which it requires in order to maintain all functions in the case of derangements of nutrition or of growth.

It is obvious, however, that economic difficulties would have stood in the way of employment of Ferratin obtained from animal organs. But Schmiedeberg, by experiments extending over several years, succeeded in producing the same substance artificially, and the agent is thus made available. The synthetic compound is produced of constant uniform quality, and has been proved in its behavior to re-agents to be identical with the natural product.

The absorbability of Ferratin from the intestine was demonstrated by experiments on animals, when it was shown that the preparation is tolerated even for a longer time by the mucous membrane, and does not act irritatively, as do other iron compounds when given in larger doses.

The firm of C. F. BOEHRINGER & SOEHNE, at Mannheim, Germany, have undertaken the task of producing Ferratin on a large scale, and have put on the market a preparation chemically identical with Schmiedeberg's original preparation.

Last year one of us had occasion to send you a communication regarding "the most recent investigations in the domain of iron pharmacology," when he also dwelled upon a preparation produced by Marfori, very similar to Ferratin. We need not, therefore, repeat preliminaries; we will rather give the results of the experiments which were foreshadowed at that time.

The large quantity of Ferratin required for our extensive experiments was most readily placed at our disposal by the firm of C. F. BOEHRINGER & SOEHNE.

The remedy is supplied in two forms:

1. As free Ferratin, insoluble in water.
2. As a soda compound, readily soluble in water, and therefore suitable for administration with liquid food, as milk.

Although the absorbability of the original preparation had been ascertained, still it was necessary to test in this respect the Ferratin produced on a large scale.

To this end we first made an experiment on a dog.

A little dog, weighing 6,850 grm., was given from the 24th to 30th of June daily 1 liter (about 1 quart) of milk; during this period the bowels were twice evacuated by administration of Karlsbad salt.

Quantity of urine from 30/VI, 6 P. M., to 1/VII, 6 P. M., 420 ccm. = 0.0012 grm. Fe.

Quantity of urine from 1/VII, 6 P. M., to 2/VII, 6 P. M., 740 ccm.
= 0.001 grm. Fe.

On the 3d and 4th of July the animal was given altogether 3 grammes Ferratin in 3 doses, with 270 ccm. milk. A small portion was vomited, the vomit carefully collected, washed and analyzed.

On the 5th of July the animal was bled to death, washed through the jugular vein with a solution of kitchen salt, stomach and intestine were carefully prepared, contents washed and separated, and with the liver and the fæces evacuated during the period from the 3d to 5th of July, all separately analyzed.

Amount of iron of the absorbed Ferratin	= 5.93%	= 0.166 Fe.
Deduct therefrom amount of iron in the vomit		= 0.012 Fe.

Therefore there was absorbed 0.154 Fe.

Amount of iron in the fæces evacuated from 3d to 5th of July	= 0.092 Fe.
Amount of iron in the contents of the intestine,	= 0.002 Fe.
Amount of iron in the liver,	= 0.049 Fe.
Amount of iron in the stomach and intestine,	= 0.009 Fe.

Deducting from the quantity of the iron given the quantity of iron contained in the fæces, as well as in the contents of the stomach and of the intestine, one finds that 38.7% of the total quantity have disappeared, consequently have been absorbed, and are found again to a large extent in the liver.

A further proof of the absorption of iron is furnished by the quantity of iron in the urine during the period from the 3d to the 5th of July: 140 ccm. with 0.004 Fe.

On the strength of this experiment we felt justified in making observations also on patients of the medical clinic at Basel.

For estimating objectively the effect of a preparation, one has hitherto always had in view the condition of the blood. It is, indeed, much more suitable for objectively estimating an effect, which, moreover, may be dependent on numerous other factors than the subjective sensations of the patient, such as improvement of general state of health, increase of appetite and disappearance of the usual symptoms of anæmia.

The examinations of the blood of patients and convalescents were made, whenever possible, every eight days, so that in this manner we had the effect of Ferratin clearly before us in a series of results upon the same person.

The method of examination was briefly as follows :

For counting the blood corpuscles we used Zeiss-Thoma's counting chamber, the blood, in a dilution of 1 : 200, being taken by the

mélangeur improved by Miescher,* mixed for five minutes, and after filling the chamber, the preparation was first examined with a weak magnifier in regard to uniform distribution of the individual cells. Counting was not commenced until a preparation with thoroughly uniform distribution of corpuscles had been obtained.

The result was frequently checked by filling the chamber a second time.

As appears from Miescher's book, the probable error of 1.66% is reduced to 0.69% by the improvement of the apparatus.

The estimation of the amount of hæmoglobin was made with Fleischl's† apparatus, which has likewise been much improved by Miescher. The exactness of the results obtained thereby is greater than with Gower's method. Above all, Fleischl's hæmoglobinimeter renders possible for one mixture of blood an indefinite number of readings, irrespective of the possibility of making single estimations with greater accuracy.

Miescher's improvements are mainly based on the fact of getting a given concentration of the blood under consideration, and not a certain quantity as formerly.

Numerous errors are inherent in the method of measuring the blood by means of Fleischl's tubes. It is hardly possible to gauge such capillary tubes with absolute exactness, and the solution of the blood contained therein takes place with difficulty and frequently incompletely. For this reason Miescher has preferred to mix the blood in a "mixing pipette" especially constructed for this purpose, so that in each estimation a definite quantity of blood is diluted to a definite degree. For diluting and for the better dissolving of the corpuscles a $\frac{1}{10}$ normal soda solution is used.

This hæmoglobin solution of accurately known concentration is poured into a chamber similar to that of Fleischl.

This chamber differs from the original one in that the hemispheres are much narrower, and, therefore, a smaller quantity of fluid is required for filling. Moreover, the partition wall separating the two halves of the chamber overtops their level slightly, so that overflowing from one cell into the other is with certainty avoided.

A glass plate having a groove in its centre for receiving the partition wall is now placed over the chamber, so that a constant height of the fluid column is maintained, viz., of the hæmoglobin solution. A further advantage of this cover consists in the removal of the light-

* Corr.-Blatt für *Schweizer Aerzte*. 1893. S. 830.

† Corr.-Blatt für *Schweizer Aerzte*. 1893. S. 814.

disturbing reflections, which always occur even in the case of low meniscus lenses.

Finally, there is put over the cover a diaphragm, provided with a slit 3 mm. wide, so that the portion of the glass prism accessible to the eye presents as uniform a shade as possible.

The glass prism itself was gauged by means of solutions whose percentage of hæmoglobin was ascertained most accurately by Hüfner's spectro-photometer, so that we were enabled to reduce the values exactly to the absolute hæmoglobin figure. The construction and manipulation of Fleischl's apparatus will be more fully reported upon elsewhere.

A further advantage of our method of estimating hæmoglobin is based on the fact that, by means of two chambers of different heights, readings may be obtained at various parts of the glass prism, so that both estimations check one another.

The results obtained by this method are exact within 1.7% of Fleischl's scale for a single reading. But as we always took the mean of 10 readings for our estimation the probable variation must be still less. The method followed by us for hæmoglobin estimations not being in use as yet clinically, and as a simple return of the absolute hæmoglobin values might render a comparison with the results of other investigators more difficult, we have deemed it advisable to give likewise the direct readings on the apparatus.

The results of the examination of the blood during the treatment with Ferratin are arranged in the two tables.

The first table comprises the cases of in-patients, the second those of out-patients.

(Continued on next page.)

BANHOLZER, of Professor Eichenhorst's clinic, relates (*Centralbl. f. inn. Med.*) his clinical investigations with this preparation, introduced by Schmiedeberg (*Epitome*, December 2, 1893, par. 461). In the cases in question the amount of hæmoglobin, in most instances, and the number of red cells were estimated. In anemia following acute disease the hæmoglobin was quickly increased (over five per cent. in eight days), as also the number of red cells. In chlorosis the same results were visible even in a more marked degree. The general condition was improved, and the increase in weight in most cases considerable. The good effects on the appetite were obvious. When compared with Blaud's pills, which also give good results, Ferratin was found to lead to a greater increase in the hæmoglobin. The results of these investigations are set forth in tabular form. The author concludes that Ferratin is a prompt, useful and harmless remedy in chlorosis and anemia following past disease, and is well deserving of further trial.—*British Medical Journal*.

PATIENT. (DATE.)	Number of the red blood corpuscles.	HÆMOGLOBIN.		Prescription (Fer- ratin) per diem. Gramme.	REMARKS.
		According to Fleischl's scale.	In percentage of the blood in question.		
Dietsche, Caroline. Age, 19; factory girl Admitted, 1, IX, '93	4,262,000	47,5	8,38	3×1	Bronchitis chron. foetida. Tuberculosis? Anæmia: headache, lassitude; appetite and sleep bad; appearance pallid.
9, IX.	4,608,000	57,8	10,66	"	No headache; appetite good; patient doing light work in the room without fatigue; sleep better.
22, IX.	5,320,000	76,2	13,88	"	General health good. Increase in weight in 3 weeks=4.9 kg. (about 10½ lbs.)
Schulz, Johanna. Age, 23; barmaid.	4,876,000	63,6	11,66	2×1	Anæmia: lassitude, debility, appetite bad, pains in the feet and neck.
29, VIII, '93.	4,476,000	70,9	12,74	"	General health better, likewise appetite.
9, IX.	4,820,000	77,3	14,18	"	General condition and appetite good; no more lassitude.
21, IX.	4,820,000	77,3	14,18	"	Myomauteri, with abundant flooding. Condition very anæmic, cachectic; appe- tite nil; besides, no other trouble.
Eckert, Hermine. Age, 48; housewife.	3,128,000	20,2	4,52	3×1	Appetite better; patient gets up; appear- ance very pallid.
25, IX, '93	3,466,000	25,1	5,24	"	Examination in chloroform-narcosis; con- siderable loss of blood.
3, X.				"	Admission to the medical section.
5, X.				"	Flooding continues.
6, X.	2,964,000	20,9	4,62	"	Condition not essentially changed.
11, X.	3,580,000	24,7	5,16	"	2. XI. Supravaginal amputation of the uterus.
24, X.	3,248,000	28,16	5,66	"	No increase in weight. † Abundant hæmatemesis—22, IX, '93.
1, XI.	3,248,000	28,16	5,66	"	Black stools; great debility; very pallid appearance.
Wipfler, Franz. Age, 46; joiner.	3,172,000	48,7	8,70	3×1	General health better; no fatigue; appe- tite good.
30, X, '93.	4,276,000	55,3	10,20	"	Appearance still pallid; discharged. Increase in weight in 3 weeks=4.7 kg. (about 10½ lbs.).
7, XI.				"	Chlorosis: palpitation of the heart; great lassitude, giddiness, headache, oppres- sion; appetite moderate.
8, XI.				"	Great pallor; no venous murmur; state of the heart normal.
Buser, Emilie. Age, 18; domestic servant.	4,312,000	39,5	7,30	3×1	Slight headache; appetite good; appear- ance much better.
9, XI, '93.	5,040,000	52,53	9,68	"	Still slight headache; otherwise good health.
16, XI.	5,228,000	55,2	10,20	"	General health good; appetite large.
24, XI.	5,468,000	62,1	11,38	"	Appearance very good; florid complexion. Increase in weight in 3 weeks=3 kg. (about 6½ lbs.).
30, XI.	5,184,000	70,8	12,74	"	Ulcus ventriculi; hæmatemesis; anæmia. Appearance said to have always been pallid.
7, XII.	5,212,000	77,6	14,34	"	Repeatedly chlorosis: giddiness, palpita- tion of the heart.
14, XII.				"	Very pallid appearance; appetite good.
Leuenberger, Anna. Age, 42; domestic servant.	2,740,000	38,5	7,14	3×0,5	
23, XI, '93.	2,954,000	37,1	6,96	3×1	

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PATIENT. (DATE.)	Number of the red blood corpuscles.	HÆMOGLOBIN.		Prescription (Fer- ratin) per Gramme.	REMARKS.
		According to Fleischl's scale.	In percentage of the blood in question.		
9, XII, '93.	3,544,000	42.94	7.70	3×1	Still easily fatigued in walking. Lips somewhat reddened; little fatigue. Discharged. Patient does not work yet. Appearance good; strength allows of re- sumption of work. Icterus and gastric disorder: anæmia; frequently headache, dyspnoea, palpi- tation of the heart, lassitude.
16, XII.	3,876,000	42.3	7.50	"	
22, XII.	4,156,000	52.9	9.74	suspended.	
8, I, '94.	4,956,000	68.9	12.46	"	
Bay, Oscar. Age, 41; day laborer					
21, XI, '93.	4,192,000	62.1	11.04	3×1	Appearance very pallid and anæmic; emaciation.
29, XI.	4,708,000	70.4	12.68	"	Appetite good; appearance better.
8, XII.	5,232,000	77.2	14.12	"	Good health. Increase in weight in 2 weeks=1.6 kg. (about 3½ lbs.).
Burri, Anna. Age, 17; factory girl.					Pththis incipiens: anæmia; for the past 2 years frequent headache, giddiness, palpitation of the heart, lassitude, want of appetite; appearance pallid.
1, XII, '93.	2,916,000	33.8	6.50	3×1	Appetite considerably better, likewise general state of health.
9, XII.	3,558,000	43.3	7.54	"	
16, XII.	3,848,000	56.8	10.48	"	Mucous membranes and cheeks red- dened; ravenous appetite.
23, XII.	4,452,000	64.1	11.72	"	Improvement of general state of health every day.
30, XII.	?	81.5	15.30	discon- tinued	2, I, '94. Colic-like pains, diarrhoea. Ferratin discontinued.
6, I, '94.	4,988,000	80.0	14.88		6, I. Good appearance; good health. Increase in weight in 3 weeks=3.6 kg. (about 7¾ lbs.).
Schöttli, Marie. Age, 19; domestic servant.					Pericarditis and endocarditis rheumatica; anæmia, tonsillar abscess, lassitude, faintness, headache, palpitation of the heart, appetite moderate.
26, XII, '93.	3,462,000	33.2	6.38	3×1	Strength better, likewise appearance; appetite good.
5, I, '94.					
12, I.	3,972,000	41.5	7.56	"	General health good; appetite large; no lassitude.
19, I.	4,480,000	58.1	10.70	"	Owing to rheumatic pains and increase of temperature.
26, I.	5,220,000	66.0	12.04	Malakine Ferratin continued	
29, I.					
2, II.	5,332,000	70.3	12.68	"	From 3, II. Again free from fever, free from pains.
7, II.					Discharged, with good complexion, subj. good state of health. Increase in weight in 4 weeks=2.7 kg. (about 5½ lbs.).
Suter, Bertha. Age, 17; daughter.					Chlorosis. (Admitted as suffering from pernicious anæmia.) From 11th year constantly recurring chlorosis.
5, I, '94.	2,712,000	18.7	4.26	3×1	For the past 7 weeks again headache, dyspnoea, palpitation of the heart.
14, I.	3,382,000	22.74	4.90	"	Patient gets up; health fair; appetite good.
21, I.	3,804,000	35.33	6.72	"	Appearance still pallid; visible mucous membranes pallid.

PATIENT. (DATE.)	Number of the red blood corpuscles.	HÆMOGLOBIN.		Prescription (Fer- ratin) per diem. Gramme.	REMARKS.
		According to Fleischl's scale.	In percentage of the blood in question.		
27, I, '94.	4,058,000	43,22	7,74	3×1	Considerably better appearance; subjective state of health good; slight venous murmur; appetite large.
3, II.	4,528,000	44,8	7,78	"	Scanty menstruation without trouble.
10, II.	4,748,000	54,7	10,12	"	15, II. Discharged. Pallid appearance; good subj. state of health.
17, II.	5,160,000	58,25	10,74	"	Further treatment as an out-patient.
24, II.	5,316,000	66,4	12,10	"	20, II. Scanty menstruation; appearance much better; appetite good.
3, III.	5,016,000	66,9	12,16	"	Owing to departure treatment suspended. Increase in weight in 3 weeks=3.2 kg. (about 7 lbs.).
Jacot, Marie. Age, 21; domestic servant.					Pneumonia after influenza; for a long time past pallid appearance; easily fatigued; palpitation of the heart.
8, I, '94.	3,192,000	30,13	5,94	3×1	Appetite good; no headache; anæmia.
15, I.	4,296,000	40,45	7,42	"	16, I. Discharged in perfect good health. Ferratin continued.
23, I.	4,620,000	42,85	7,68	"	Patient does her work without trouble.
30, I.	4,682,000	46,00	8,00	"	Owing to departure observation interrupted.
Wiss, Louise. Age, 26; domestic servant.					Chlorosis, gastralgia; Much headache; palpitation of the heart; dyspnœa when going up stairs; pains in the stomach.
13, I, '94.	3,796,000	24,75	5,18	3×1	Great pallor of the mucous membranes.
22, I.	3,560,000	30,33	5,96	"	Appetite fair; patient gets up; still easily fatigued.
29, I.	3,744,000	36,63	6,88	"	Cheeks reddened; appetite large; general health good.
5, II.	4,532,000	46,55	8,16	"	Florid appearance; appetite large.
12, II.	4,860,000	54,95	10,18	"	Discharged. Further treatment as an out-patient. Patient takes a situation.
13, II.				"	
19, II.	4,864,000	54,8	10,16	"	
26, II.	4,528,000	53,4	9,86	"	Continued good appearance; appetite good; patient can do her work without trouble.
5, III.	4,614,000	54,5	10,06	"	
12, III.	4,624,000	54,7	10,10	"	No gastrodynia; good health. Increase in weight from 29, I. to 7, II.=1.5 kg. (about 3½ lbs.).
19, III.	4,542,000	54,7	10,10	suspended	
Ludwig, Babette. Age, 33; domestic servant.					Ulcus ventriculi; Anæmia; phthisis incipiens; pains in the gastric region; vomiting.
15, I, '94.	3,168,000	50,72	9,20	3×1	Much headache; lassitude; pallid appearance.
24, I.	3,560,000	57,0	10,50	"	Appetite good; appearance still pallid; no pain.
31, I.	4,044,000	60,2	11,06	"	Ravenous appetite; strength much greater.
7, II.	4,408,000	72,2	12,94	"	Appearance good; general health very good.
14, II.	4,608,000	76,47	13,94	"	
20, II.	5,268,000	87,62	16,80		Increase in weight in 4 weeks=7.4 kg. (about 16½ lbs.).

PATIENT. (DATE.)	Number of the red blood corpuscles.	HÆMOGLOBIN.		Prescription (Fer- ratin) r diem. Gramme.	REMARKS.
		According to Fleischl's scale.	In percentage of the blood in question.		
Pfenninger, Elise. Age, 25; domestic servant. 25, I, '94.	5,208,000	52.9	9.74	3×1	Anæmia, rheumatismus chronicus; head- ache; tinnitus aurium; lassitude; appe- tite small. Tendency to vomit; palpitation of the heart.
1, II.	5,956,000	58.43	10.76	"	From commencement of treatment appe- tite very large.
8, II.	6,448,000	62.1	11.38	"	Appearance florid; appetite very large.
15, II.	6,108,000	73.14	13.06	"	Perfect good health. Increase in weight in 2 weeks=5.0 kg. (about 11 lbs.).
Kreutner, Sophie. Age, 20; domestic servant. 31, I, '94.	2,852,000	37.1	6.94	3×1	Pronounced anæmia after morbis macu- losus Werlhofii. Free bleeding from the uterus, intestine and nose. Great lassitude and drowsiness; great pallor.
6, II.	3,480,000	50.0	9.00	"	Appetite good; appearance already con- siderably better.
13, II.	4,448,000	66.76	12.14	"	10, II. At the normal period very free menstruation until 12, II.
20, II.	4,528,000	71.4	12.82	"	Florid appearance; appetite large.
27, II.	5,140,000	81.3	15.24	"	Excellent general health. Increase in weight in 3 weeks=2.4 kg. (about 5½ lbs.).
Schwarz, Rosalie. Age, 12; school girl.					Rheumatismus artic. acutus; anæmia; giddiness; headache; sleeplessness; appetite good.
1, II, '94.	?	60.4	11.08	3×1	Pain in the joints of the extremities.
5, II.	3,660,000	68.62	12.42	"	Appearance very pallid.
13, II.	4,236,000	69.8	12.58	"	Sleep very good; appearance still pallid; appetite large.
23, II.	4,640,000	75.95	13.80	"	General health very good.
2, III.	4,858,000	78.42	14.48	"	Appetite excellent; strength good. Increase in 4 weeks=4.8 kg. (about 10½ lbs.).
Fischer, Franziska. Age, 30; domestic servant.					Gastralgia; Anæmia; shooting pains in the stomach after eating; vomiting; giddiness; headache; palpitation of the heart; easily fatigued; want of appe- tite.
6, II, '94.	3,408,000	53.2	9.78	3×1	Discharged. Resumes situation; appe- tite good.
10, II.				"	Owing to unsuitable food in the situation immediate falling back; vomiting; headache; appetite nil.
14, II.	4,084,000	59.0	10.86	"	16, II. Re-admitted. Immediate im- provement.
21, II.	3,916,000	55.1	10.18	"	General health much better; appetite good again.
1, III.	4,172,000	67.75	12.30	"	Subjective good state of health.
7, III.	4,456,000	69.75	12.58	"	Appetite large; good appearance.
14, III.	4,652,000	73.4	13.14	"	Very good appearance; no trouble of any kind.
21, III.	5,152,000	80.0	14.88	"	Increase in weight in 4 weeks=7.2 kg. (about 15½ lbs.).

PATIENT. (DATE.)	Number of the red blood corpuscles.	HÆMOGLOBIN.		Prescription (Fer- ratin) per diem. Gramme.	REMARKS.
		According to Fleischl's scale.	In percentage of the blood in question.		
Bannwarth, Agathe Age, 26; domestic servant. 12, II, '94.	4,072,000	34,3	6,56	3×1	Chlorosis: easily fatigued; headache; tin- nitus aurium; sleeplessness; appetite diminished.
20, II.	3,840,000	37,7	7,04	"	Pale mucous membranes; no venous murmur.
27, II.	4,356,000	50,45	9,12	"	Appearance better; subjective state of health not changed.
6, III.	4,688,000	58,35	10,74	"	Still headache and lassitude; appetite good.
13, III.	4,820,000	59,85	11,00	3×0,5	9, III. Discharged. Resumption of situa- tion.
20, III.	4,592,000	63,6	11,64	"	State of health good also when at work.
27, III.	3,532,000	50,25	9,08	"	Appearance good; subjective state of health likewise so.
Meyer, Hieronym. Age, 18; Carter's man. 2, II, '94.	3,500,000	55,0	10,18	3×1	Cause of decrease unknown.
14, II.	4,172,000	69,4	12,52	"	Increase in weight in 2 weeks=2.1 kg. (about 4½ lbs.).
1, III.	4,504,000	75,2	13,60	"	Large abscess under the left scapula; anæmia.
9, III.	5,032,000	90,84	17,50	"	{ Steady improvement; appetite very large.
Cartier, Rosa. Age, 38; domestic servant. 24, III, '94.	1,461,000	10,20	3,06	3×0,5 solub.	{ Strength good; no lassitude, in spite of walking for hours.
29, III.					Increase in weight in 4 weeks=6.9 kg. (about 15½ lbs.).
5, IV.	1,772,000	15,27	3,80	3×1 solub.	Ulcus ventriculi: pronounced anæmia; frequent vomiting of blood. 12, III.
16, IV.	2,354,000	31,70	6,16	"	Abundant hemorrhage (said to have been 2 litres—about 1½ quarts).
24, IV.	3,544,000	44,35	7,84	"	Admitted 13, III., with pallid, waxlike appearance.
2, V.	4,640,000	52,72	9,70	"	No more vomiting of blood; stools up to 24, III, black; strong feeling of faintness, with drowsiness; venous murmurs.
16, V.	4,680,000	71,26	12,80	"	General health fair; appetite improved; appearance as before.
					Subjective good state of health; visible mu- cous membranes somewhat reddened;
					appetite very good; patient gets up.
					Much better appearance; subjective good state of health.
					Appearance good; appetite large.
					Very good general health. Mucous membranes reddened.

PATIENT. (DATE.)	Number of the red blood corpuscles.	HÆMOGLOBIN.		Prescription (Fer- ratin) per diem. Gramme.	REMARKS.
		According to Fleischl's scale.	In percentage of the blood in question.		
Hepp, Frieda. Age, 15½; factory girl. 26, I, '94.	3,868,000	40,8	7,50	3×1	Since end of 1893 chlorosis, lassitude; headache; palpitation of the heart; op- pression when going up stairs. Want of appetite; monthly period regular; pallid appearance.
3, II.	4,068,000	43,45	7,74	"	Owing to scanty menstruation Ferratin suspended for 2 days.
10, II.	4,104,000	45,38	7,94	"	Appearance and general health somewhat better.
17, II.	4,872,000	55,5	10,18	"	Appetite somewhat better; strength fair.
24, II.	4,548,000	53,35	9,84	"	Diet at home: little meat but much milk.
3, III.	4,624,000	55,9	10,34	"	On 26, II., with fair state of health, scanty menstruation.
10, III.	4,864,000	58,15	10,70		Appearance pretty good; visible mucous membranes reddened; appetite some- what better; work resumed.
Sauer, Elise. Age, 16½; tailoress					Anæmia; chlorotic since the school pe- riod; latterly gastrodynia, palpitation of the heart, headache.
27, I, '94.	3,380,000	42,93	7,70	3×1	Easily fatigued; appetite small; appear- ance very pallid.
3, II.	3,648,000	47,69	8,42	"	Patient does not work now; takes fre- quent walks.
10, II.	3,940,000	47,66	8,40	"	No essential improvement yet.
17, II.	4,000,000	49,20	8,80	"	Appetite somewhat better; otherwise status idem.
24, II.	3,708,000	45,55	7,94	"	No essential improvement of the general health.
3, III.	4,168,000	50,25	9,06	"	Appearance still pallid; waxlike.
10, III.	4,116,000	47,4	8,30		Appetite said to be better; patient re- sumes work.
					N. B.—Previous to treatment with Fer- ratin patient had been treated with every kind of Iron preparation without success.
Brügger, Elise. Age, 27; nurse.					Anæmia after severe menstrual flooding; frequently chlorosis; monthly period frequently irregular. In January, 1894, for 14 days copious flooding; great las- situde; sleep and appetite slight; head- ache; giddiness; visible mucous mem- branes pallid.
17, II, '94.	4,056,000 ?	66,5	12,10	3×1	Appetite small.
1, III.	3,924,000	67,48	12,24	"	Very many small blood cells; sleep better; appetite small.
9, III.	4,124,000	65,05	11,92	"	Strength better; appetite as before; re- peated vomiting.
16, III.	4,546,000	66,2	12,06	3×0,5	Appearance better; no vomiting; less easily fatigued.
24, III.	4,384,000	64,7	11,84	"	From 2, IV., 3×1 gr. F. solub.; appetite somewhat better.
31, III.	4,312,000	64,43	11,78	"	Patient leaves on 16, IV., for 14 days' holiday; ordered to continue with F. solub. 3×1 gr.
11, IV.	4,652,000	66,40	12,08	3×1 solubil.	

PATIENT. (DATE.)	Number of the red blood corpuscles.	HAEMOGLOBIN.		Prescription (Fer- ratin) per diem. Gramme.	REMARKS.
		According to Fleischl's scale.	In percentage of the blood in question.		
Ruh, Eugenia. Age 22; tailoress.				F. solub.	Chlorosis: Father suffers from phthisis. Frequently chlorosis; menstruation ir- regular, scanty; headache; giddiness; nausea.
20, III, '94.	?	42,9	7,70	2×1	Great lassitude; sleep and appetite bad; constipation.
27, III.	4,130,000	44,8	7,88	"	General health somewhat better; appetite still small.
2, IV.				suspended	Owing to vomiting, gastrodynia; general indisposition.
16, IV.				2×1	By doctor in the town: dieted; arg. nitric; thereupon improvement.
26, IV.	4,520,000	51,90	9,50	3×1	Appearance as at the commencement of the treatment.
Stegmüller, Auguste Age, 16; daughter.					Chlorosis of 2 years' standing, which defied every treatment with iron; lassit- tude; palpitation of the heart when going up stairs; appetite moderate; predilection for sour food; has not menstruated yet.
7, IV, '94.	3,182,000	24,3	5,12	3×1	Mucous membranes very pallid; waxlike appearance; venous murmur.
16, IV.	4,112,000	31,45	6,14	"	General health better; appetite good; sleep likewise.
23, IV.	4,152,000	37,37	7,00	"	Visible mucous membranes slightly red- dened; no lassitue. Owing to departure observation inter- rupted.

To the foregoing observations we have to add the following remarks:

Ferratin agreed well with all the patients without exception, and but three times did we observe vomiting during the treatment, and these were in cases of persons who had frequently vomited previously. Even where the treatment continued for several weeks, there occurred no symptoms of digestive trouble that necessitated the suspension of the remedy. In particular no derangement of the stools was observable.

The change in the condition of the blood produced objectively in all cases an improvement of the general state of health with a decrease of anæmic symptoms. This improvement of the general condition is no doubt partly attributable to the favorable hospital

surroundings ; however, the success of the treatment is so constant and so great in a proportionately short time, that we cannot resist the impression that the improvement set in more quickly after the exhibition of Ferratin than with any other treatment.

The result in the case of out-patients showed this improvement in a much lesser degree ; but in each case there was a distinct improvement of the general health. Especially if one considers that all these cases had been unsuccessfully treated previously with every kind of iron-preparation, we surely must recognize the favorable influence of Ferratin.

We were not much surprised at the reduced degree of improvement in out-patients, because of the unfavorable circumstances under which these patients are obliged to live ; on the one side imperfect nutrition, unsuitable mode of living, on the other side hard and continuous work. Very striking, in our observations, was the increase of appetite as a consequence of the treatment. We even had opportunities to follow up cases in which there existed complete Anorexia, and where by Ferratin the appetite was recovered.

In the case of two patients suffering from latent phthisis pulmonum, with whom the most varied appetite-promoting remedies had been used unsuccessfully one after the other, and who consequently upon refusing to take food had rapidly become emaciated, an increase of appetite and thus an essential improvement of the general health was produced by continued Ferratin-treatment. While one of the patients, previous to taking Ferratin, had considerably decreased in weight, her weight during the treatment increased in three weeks by 1 kg. (about 2½ lbs.)

On the ground of these observations one is, surely, justified in attributing to Ferratin a decided importance as a dietetic and therapeutic remedy. It would be going too far to follow a subjective impression and to assert that Ferratin acts better than this or that iron-compound. To substantiate such an assertion we ought to have at our disposal for comparison hundreds of observations made under similar conditions.

But taking into consideration that Ferratin is a remedy of which we know with certainty that it is absorbed by the organism, whereas with the other iron-preparations absorption is hardly perceptible ; if, furthermore, we take into account that this compound is to be considered as being of equal value with that contained in the food ; and finally, if we add the fact, that even when large doses of the preparation are continuously administered for weeks we have never observed the slightest derangement of digestion, and that the remedy even agrees very well with little children, we must admit and state that it is a valuable preparation, which in all likelihood will have a great future in the treatment of anæmic conditions.

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