

**The three kinds of cod liver oil : comparatively considered with reference to their chemical and therapeutic properties / by L.J. de Jongh ; translated from the German, with an appendix and cases, by Edward Carey.**

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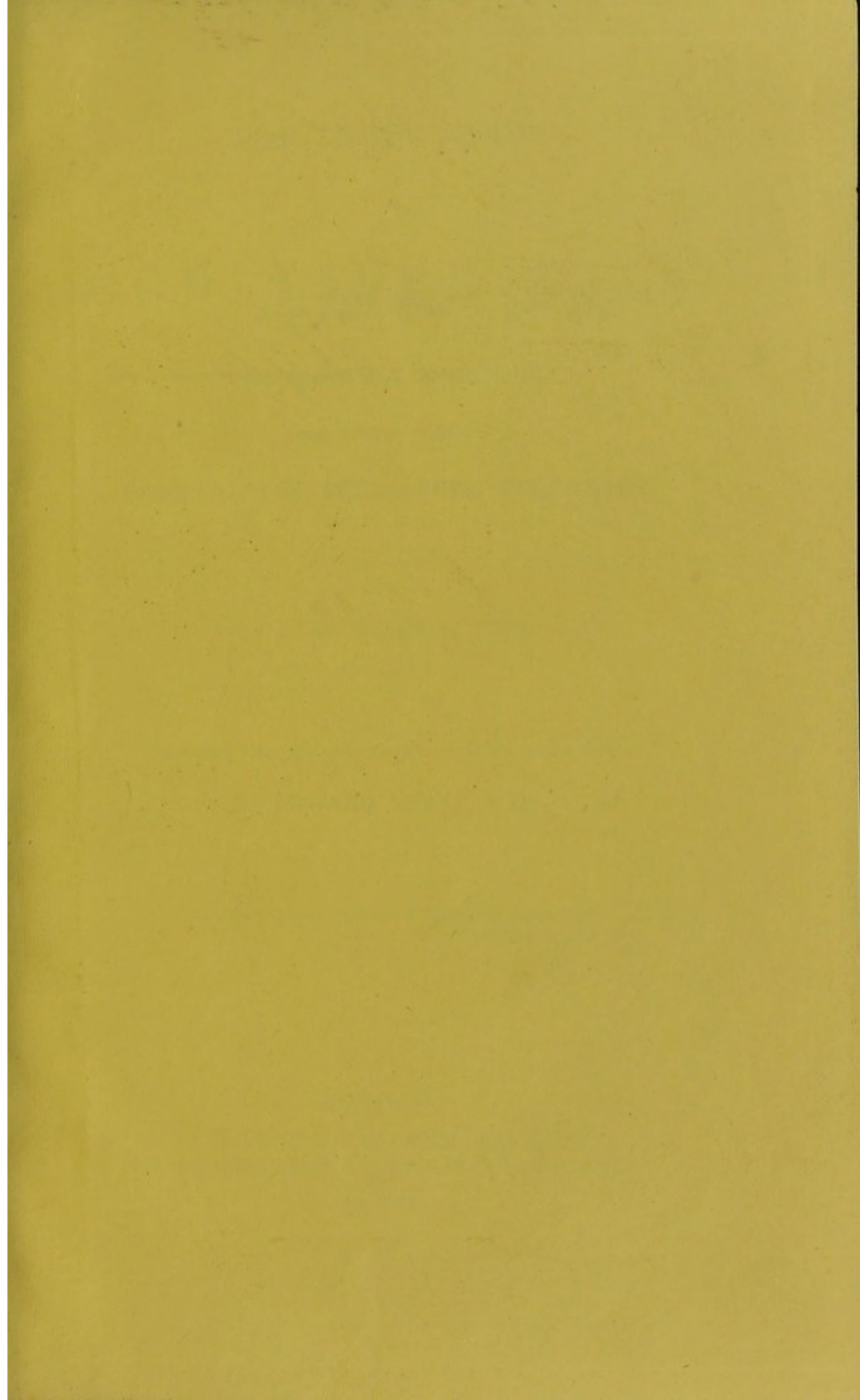




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Compliments



THE THREE KINDS  
OF  
COD LIVER OIL;

COMPARATIVELY CONSIDERED

WITH REFERENCE TO THEIR

CHEMICAL AND THERAPEUTIC PROPERTIES.

BY

L. J. DE JONGH, M.D.,

OF THE HAGUE.

TRANSLATED FROM THE GERMAN, WITH AN APPENDIX AND CASES,

By EDWARD CAREY, M.D.

Opinionum commenta delet dies, Naturæ judicia confirmat.

CICERO *de Natura Deorum*.

LONDON:

TAYLOR, WALTON, AND MABERLY,

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PHYSIOLOGY  
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THE THREE KINDS

GOD ALIVE AND OLD

CONSTITUTION

OF THE

CHURCH AND SOCIETY

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TO

W. F. CHAMBERS, M.D., K.C.H.,

PHYSICIAN TO THE QUEEN, ETC. ETC.

MY DEAR SIR,

Your having kindly consented to allow your name to be associated with this volume, gives me the opportunity of acknowledging the many personal favours and great assistance which I have, on various occasions, received at your hands.

In dedicating these pages to you, I am anxious to record the high esteem in which your professional opinion has ever been held, as well as the urbanity and courtesy invariably shown to those by whom it has been sought. Your name will live in the grateful recollection of thousands.

That your wonted health may be speedily restored, and your invaluable services preserved to your Sovereign, the profession, and public, is the sincere desire of

Your obliged and faithful Servant,

EDWARD CAREY.

SAUMAREZ STREET, GUERNSEY,  
*March 18th, 1849.*



W. N. CHAMBERLAIN, M.D.

NEW YORK

Your letter of the 10th inst. is received and the  
enclosed will give you some idea of the  
nature of the work which is being done  
at the present time.

In following these papers to the  
extent of the first volume, which contains  
the first part of the work, and  
there is also a list of the names of  
the persons who have contributed to the  
work.

Your kind regards are  
and your valuable services are  
most highly appreciated.

Very obliged and faithful servant,

W. N. CHAMBERLAIN

100 West 42nd Street  
New York

## PREFACE.

---

THIS work, originally composed in Latin from the Author's inaugural treatise, entitled, "Disquisitio Comparativa Chemico-Medica de tribus Olei Jecoris Aselli speciebus," xvi. u. 363, 8vo, was published at Leyden by Luchtman in the year 1844, and has since been translated into German, with many additions and copious notes.

Berzelius, in the "Rapport Annuel sur les Progres de la Chimie" for 1844, reviewed it most favourably; and after entering into a critical examination of its merits, says, "Quant aux autres details, très interessants de ce beau travail analytique je dois renvoyer au memoire original;" and again, speaking of the Gaduine, "Il est fort à desirer pour la science, que ce chimiste de merite entreprenne de ce nouveau point de vue une recherche exacte sur cette matiere."

With this, no mean authority, before me, and knowing it to contain much novel and important information respecting



a remedy which is daily becoming more known and appreciated, not only by the profession, but by the public generally, I am led to hope that it may prove acceptable to the English reader.\*

As the German Translator observes in his Preface, it was not the intention of the author to form a monograph of the History of the Cod Liver Oil, to laud it as a therapeutic agent, or to give it new medicinal properties when prescribed in particular cases, but to furnish information on some points respecting the operation of this remedy not previously explained, and to examine the three kinds of oil which are in common use, as well in reference to their origin as their chemical composition, and their comparative therapeutic properties. This has been so accurately done, that at all events the solution of the questions—What is the origin and method of preparation of the different kinds of Bergen Oil? What are the external signs by which they may be recognised? What its chemical composition—and in what respects they differ in this relation? has been quite determined; while a nearer approach has been made towards investigating which of the three kinds possess the greatest efficacy.

It cannot be supposed that researches of this nature can

\* This analysis is also referred to by Dr. J. Pereira, in an article on Cod Liver Oil in the "Pharmaceutical Journal and Transactions" for February, 1849.

be instituted without affording many fresh discoveries on the origin—important notices with regard to new facts, explanations on the chemical composition, as also much that is interesting respecting the medicinal virtues of the Cod Liver Oil, the perusal of which must necessarily afford considerable benefit.

As a very proper conclusion to the whole, the Author has provided his treatise with an Historical retrospect, to which considerable additions have been made by the German Translator; who, by collecting the different opinions of every writer on the subject, has produced the most perfect history of the Cod Liver Oil, and of the literature relating to it up to that time.

A mass of information, alike useful to the pharmacist and physician, has thus been embodied, which does infinite credit to the Author, whose enthusiastic zeal in the prosecution of his subject deserves the highest praise. Should I have been successful in faithfully imparting his views, and communicating any matter which may lead in future to the more extended knowledge of its chemical and therapeutic properties, or to the elucidation of the *vexata questio*, What is the active principle of the Cod Liver Oil and its *modus operandi*? I shall feel that my labours, however unimportant, have not been totally unproductive in their results.



I have endeavoured, as nearly as possible, to adhere to strict accuracy throughout the translation, at the risk, perhaps, of being considered too literal. The importance of adhering to the true sense, and a fear that too much regard to style might interfere with the correctness of our Author's meaning, particularly in the chemical experiments, must plead my excuse to the more exact and literary reader.

EDWARD CAREY.

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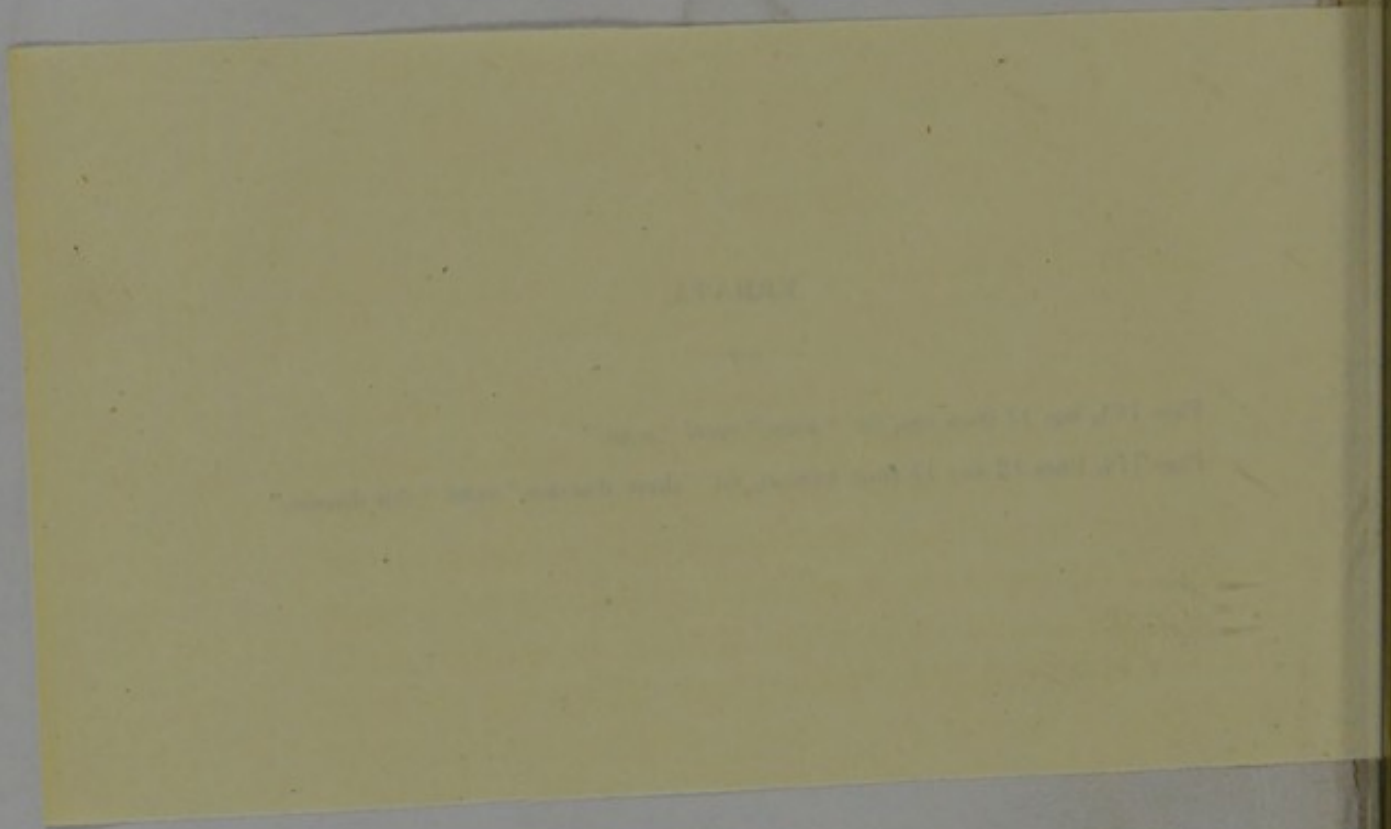


ERRATA.



Page 165, line 17 from top, *for* "more," *read* "none."

Page 174, lines 12 and 13 from bottom, *for* "these diseases," *read* "this disease."



THE  
THREE KINDS OF COD LIVER OIL.

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SECTION I.

THE SOURCE, METHOD OF OBTAINING, AND PHYSICAL  
PROPERTIES OF COD LIVER OIL.

OLEUM JECORIS ASELLI—sive Jecinoris Aselli, Oleum Morrhuae, Levertraan, Huile de Morue, Cod Oil, Olio de Becalhao, Olio di Baccala, are the synonymous appellations of an oil which is liquid at an ordinary temperature, and is obtained particularly from the livers of several species of *Gadus*, a genus of fish of the order Thoracici, family Malacopterygii, found in the Northern Atlantic, Levant, and Mediterranean Seas. According to Agassiz, the *Gadus* belongs to the Cyclades islands. The genus is characterised by an oblong roundish body; ventral fins pointed, the back and anal fins soft, and the head anteriorly shortened and smooth.

The species which here immediately come under our notice, with the exception of the Burbot, which is only found in fresh water, (*Gadus lota*, sive *mustela fluvialis*), and the small species, *Gadus virens*, *Gadus minutus*, (*Asellus mollis minor*) and *Gadus aeglefinus*, (*Asellus mollis major*) are the following:—

1. *GADUS MORRHUA SIVE ASELLUS MAJOR* (Codfish, in



different states of preparation for commerce, called stockfish, Aberdeen fish, dried codfish, Torsk, or Thorsk) is caught in such immense numbers on the Irish, Scotch, and Norwegian coasts, that the English alone employ 20,000 sailors yearly in the fishery. The proper codfish are from three to three feet and a half long, with one barbule on the chin, three back and two anal fins.

2. *GADUS MOLVA SIVE ASELLUS LONGA*, (*Lota molva*, German leng, Norwegian langa, English ling), is met with in great numbers, particularly on the English coast; three to four feet long, narrow, a barbule, two back-fins, one anal fin.

3. *GADUS CARBONARIUS SIVE ASELLUS NIGER*, (*Coal-fish*, Norwegian seij), three to three feet and a half long, three back fins, two anal fins, without barbule on the chin, dark brown, with a short upper jaw.

4. *GADUS CALLARIAS SIVE ASELLUS STRIATUS*, (*the Dorse*), one foot and a half to two feet long, sharper head and smaller tail, otherwise like the codfish.

5. *GADUS POLLACHIUS SIVE ASELLUS HAITINGO POLLACHIUS*, (*Norwegian Haakjering or Haaifisch*). The pollack, exactly like the coal-fish, but silvery underneath, and spotted on the sides.

[These three kinds in particular are found on the coast of Norway.]

6. *GADUS MERLANGUS SIVE ASELLUS ALBUS*, (*Merlangus vulgaris*—the Whiting), are found, more especially on the English and French coasts. The most of this species is as often eaten fresh as it is prepared like the codfish and brought into commerce.

Opinions are divided upon the subject as to which species the officinal Cod Liver Oil comes from. According to Elberling,<sup>1</sup> that which is consumed in Germany comes from the

<sup>1</sup> *Diss. de Oleo Jecoris Aselli. Berol. 1826.*



gadus morrhua, and molva, and in England, Percival<sup>1</sup> states that it is procured usually from the gadus merlangus, and also, Elberling says, from the gadus carbonarius. Reder<sup>2</sup> mentions that the gadus morrhua, molva, and carbonarius, are used in Norway for the preparation of the Cod Liver Oil. Dulk<sup>3</sup> derives the origin of the brown Cod Liver Oil alone from the gadus morrhua; according to others, the yellow as well as the brown oil is obtained from gadus callarias;<sup>4</sup> and according to Spaarman and Berzelius,<sup>5</sup> from gadus carbonarius. Marder<sup>6</sup> is of opinion that although the several species of gadus are equally useful in obtaining Cod Liver Oil, in which opinion Potempa<sup>7</sup> agrees, still, however, the gadus morrhua and molva are more especially so. Calama<sup>8</sup> thinks that the Cod Liver Oil is obtained especially from gadus morrhua, molva, callarias, and merlangus, and that gadus pollachius, lota, virens, minutus, and carbonarius, are also employed for that purpose.

[Many more opinions might be adduced to show the different views which have been entertained respecting the species gadus from which the Cod Liver Oil is obtained; it is even said that the fishermen themselves are not able exactly to discriminate between them; all, however, concur in allowing that the several species are used everywhere indiscriminately for the production of the Cod Liver Oil. It is certain that gadus æglefinus (haddock) and gadus minutus (the poor) never come into use. On the coast of Newfoundland

<sup>1</sup> Essays Med. Phil. and Experim. Vol. ii. Washington, 1790.

<sup>2</sup> Diss. de Oleo Jecoris Aselli. Rost. 1826.

<sup>3</sup> Handwörterbuch der Prakt. Arzneimittelehre. B<sup>d</sup>. 2. (In the 4th edition of his commentaries on the Bor. Pharmacopœia, Dulk has expressed the opinion that the G. molva has equally a share. Dulk's Pharm., Bor. xviii., p. 783.—*German Trans.*)

<sup>4</sup> Seiger's Magazin, 1826. August, s. 101.

<sup>5</sup> Ebend., 1828. Juni, s. 302; Berzel Lehrbuch, 10 B<sup>d</sup>. s. 626.

<sup>6</sup> Brande's Archiv. B<sup>d</sup>. 32, s. 90; Pharm. Centralbl. 1830, s. 17.

<sup>7</sup> Diss. de Oleo Jecoris Aselli. Lips. 1837, p. 8.

<sup>8</sup> Verhandeling over de Levertraan, 1832, p. 8.



the production of the Cod Liver Oil is naturally connected with the preparation of the stock-fish; the livers of the *gadus morrhua*, therefore, form the greater proportion. On the English coast *gadus merlangus*, and *molva*, are more especially used. On the coast of Norway, however, particularly at Loffoden, only the dorse, (*gadus callarias*), the coal-fish, or seij, (*gadus carbonarius*), and the *gadus pollachius*, are to be met with. As the Bergen Cod Liver Oil alone is officinal with us, the Pharmacopœias are incorrect in quoting it as being produced from *gadus morrhua*. The frequent notice which is taken of the livers of the haifisch, dog-fish, arises from its being confounded with the Norwegian name, haaifisch, genus *pollachius*. This opinion is confirmed in the following original Norwegian letters.<sup>1</sup> The author besides makes no mention of the once officinal (*Ol. mustelæ fluvialis*), the liver oil of the burbot, neither of the once celebrated liver oil of Rouen, procured from a species of the rayfish, (*raya bates* and *raya clavata*,—*huile de foi de raie*),<sup>2</sup> which up to this time has not entered into commerce, but is prepared by the boiling the fresh livers of the rayfish in water by the apothecaries at Rouen and other sea-ports on the coast of Normandy, and it is on that account alone that it is so clear and pure, because the fresh livers only are used for that purpose; neither is it to be confounded with the oil prepared in the same way as the rayfish oil, also coming from Norway, but of inferior quality, from the fact of the roes and the entrails of the *gadus* species being boiled together.<sup>3</sup> That coming from Senegal to France, (*tourlourou* oil), is known to be obtained by the roasting of the entrails of a species of crab (*cancer ruricola*); and is a

<sup>1</sup> Dr. Flügel, in his Programme, gives a very good account of every circumstance connected with the natural and commercial history of the genus *gadus*. Der Kabelzau; Leipsic, 1842-4.

<sup>2</sup> Bergl. Preisser; Pharmac. Centralbl. 1843, p. 75, and 191.

<sup>3</sup> Pharm. Centralbl. 1843, s. 158.



rancid brownish-yellow oil which the negroes use externally in rheumatism.]—*German Trans.*

Various are still the opinions on the method of obtaining the three kinds of medicinal oils, namely, the clear pale, gout oil, (*blanke levertraan*, *Ol. jecoris as. flavum*), the light brown, (*bruin-blanke l.*, *Ol. jecoris as. subfuscum*), and the brown (*bruine l.*, *Ol. jec. as. fuscum, sive nigrum*).<sup>1</sup>

Elberling, who was only acquainted with the brown sort, says:—"The livers taken out of the fish are thrown into a cask with double perforated bottoms, into which at first blood and serum flow. After some time the livers in these casks begin to putrefy; they then swell to more than one half their original size, and much oil runs out, which is daily drawn off." The produce, according to him, is a dark brown, sharp, and bitter tasted oil. By purifying, or by the addition of other kinds of oils, he thinks the light-coloured Cod Liver Oil is prepared.

Reder speaks of all three kinds; according to him the livers immediately on being taken from the fish are exposed to the sun in large tubs, from which a great quantity of clear oil soon flows out, which, before the livers putrefy, is taken away and sold. Whilst the putrescent fermentation of the livers takes place, the light-brown oil runs off, and then when no more can be obtained, the residue of the livers are roasted in iron vessels, from which the brown oil is collected. Reder, however, has himself received from Norway three kinds of oil, differing from those he here describes, namely, the light-brown, that which is boiled, not altogether transparent, of a disgusting empyreumatic smell, of an acrid taste, and of

<sup>1</sup> Some make a difference between the brown kind and that which is boiled, as being a particularly prepared kind; this, however, is incorrect; the Cod Liver Oil prepared by boiling is, according to circumstances, either brown or light brown, which depends on either the fresh or the putrescent livers being used.—*German Trans.*



thick consistency, and also the dark-brown, obtained from the roasting of the livers, which, in a reflected light, is of a bluish-green colour. Potempa is of the same opinion. Marder (l. c.) makes a difference between the clear pale oil, which flows from the livers during the first eight days' exposure to the sun, and the brown which is obtained afterwards during the putrescent state of the livers. Calama remarks:—"The method of preparing the Cod Liver Oil differs from all other sorts of oil in this, that in its preparation only the livers of those fish which have been named are chosen, and indeed not boiled but roasted. There are three kinds: a clear pale, procured by roasting with a slow fire; a light-brown, by roasting and slight pressing; and a brown to a dark-brown, turbid kind, which is procured by boiling the livers together with the intestines."

Balzer, a merchant of Cologne, says, in a letter published in Hufeland's Journal, that the pale as well as the brown oil is procured by boiling; the former by moderate heat, and after it is drawn off, the latter is prepared by a greater heat. Gobst<sup>1</sup> is of opinion that the pale oil is procured by boiling the livers alone, the brown by boiling the livers with the intestines.

In order to obtain certain information respecting the source and method of preparation of the real Bergen Oil, I availed myself of the opportunity afforded me by my father, a wholesale dealer in Bergen Oil, to forward a recommendation through two respectable merchants of Amsterdam to the Consul, Charles Konow, in Bergen, and to Messrs Mack, Brothers, in Tromsøe, requesting the information I desired should be sent direct to me by these two gentlemen. The correspondence on the subject is contained in the three following letters:—

"Being engaged in writing on the natural history and chemical examination of the Cod Liver Oil, it is indis-

<sup>1</sup> Hufel. Journ. 1830, s. 3, p. 87.



pensable to the perfection of my work that a few questions on the subject should be answered, as our knowledge of the subject on some points is extremely deficient, while on others it is open to much controversy.

“ 1. What fish are used in the preparation of the Cod Liver Oil?

“ 2. Whether the three kinds of Cod Liver Oil used in commerce, the pale, the light-brown, and brown, are prepared from fish livers alone?

“ 3. What is the method of preparation of these three kinds in particular?

“ May I depend on your returning a speedy and exact answer to these questions, by which you will confer a benefit on science, and at the same time do me a great service.

“ *Utrecht, June 10th, 1841.*”

“ de JONGH.”

The following was received from Mr. Charles Konow:—

“ In answer to yours I have to inform you that the principal fishery from which the Cod Liver Oil is obtained is the Dorse Fishery, which during the winter is carried on in the Loffoden Isles to the north of this coast.

“ As soon as the fish is brought to land the livers are cut out and thrown into vessels, where they ultimately remain. If this is done at irregular times, the pale oil is not so clear and pure as when the fishery is concluded at once. When the fishery is ended (and for which there is no fixed time) the clear oil which comes off in these vessels is skimmed, poured off, and put into barrels. This is the pale oil. The residuum is then boiled, and thence is produced the brown oil. The light-brown oil is the impaired pale oil; partly because the livers have lain too long, and partly because the pale oil is old, and has remained in warehouses where it has been exposed to damp. The clearness of the pale oil



depends particularly on the fatness of the liver and on the method of preparation. This is known to connoisseurs; for when the pale oil runs off liquid as fine oil, it will keep, which is not the case when it is thick. There is besides pretty much oil obtained from the livers of seij-fish, but by no means either so plentiful or so efficacious as that from the dorse. The pale seij oil is clearer than the Cod Liver Oil; the brown, darker than that from the dorse, and somewhat granular, whilst the real Cod Liver Oil should be quite clear and somewhat green. There is much seij oil and Cod Liver Oil mixed together, but not in the principal fisheries, where the dorse only are caught. They fish along the whole coast in every season of the year, and the livers of different kinds of fish, as well as the fat of porpoises and other marine animals, are used indiscriminately. The greater number of fish may be classed among the dorse and seij species; when the oil, however, comes into the market, it is often difficult to distinguish the mixed sort from the true Cod Liver Oil.

“There exists also in commerce a so-called peasant oil, brought by the peasants in the neighbourhood, and proves to be coarser than the current articles.

“*Bergen, July 10th, 1841.*”

“CHARLES KONOW.”

Messrs. Mack, Brothers, have also communicated to me the following:—

“1. In commerce there are three kinds of liver oil, namely, from the dorse, seij-fish, and the pollack. The liver oil from the dorse, which is the most noted, is obtained in the following manner:—The livers of 40 to 80 cwt. of stockfish are thrown into tubs, and are allowed to remain there until they become putrescent, when the oil runs off of itself; this when skimmed is the pale oil. What remains in the tubs is boiled in iron kettles (from



16 to 20 hours) until it becomes of a dark brown colour, and is quite clear; this is the brown oil, which is strained, and the residuum in the kettles is used for manure.

“2. Exactly the same method is adopted in making the liver oil from the seij-fish as with the livers of the dorse, and only differs in the quality; the dorse oil remains liquid and clear in a cold temperature, and is easier obtained than the seij-fish oil; while the latter, the pale as well as the brown, congeals at a reduced temperature.

“3. Liver oil from the pollack. The liver of this fish is the fattest, and gives the most oil; in the preparation the same method is adopted as with the dorse and the seij-fish, both the pale and the brown oil are obtained in the like manner; as, however, a pretty long time is required before the livers putrefy, they are in the habit of putting them, fresh as they are, in the iron kettles to dissolve by a moderate heat, and then pouring off the clear oil, which is the light-brown oil; what remains in the kettles is boiled and yields the brown oil.

“The so-named light-brown liver oil, is for the most part, procured by moderate heat from the livers of the pollack; in great measure, however, it is obtained from the dorse and the seij-fish liver, and indeed from these two last sorts, without the application of heat, so that in this case both are mixed together; the colour of the light-brown oil arises in part from its remaining too long on the livers before it is poured off, partly after the pale is poured off, from the residuum being left standing some time in order that still more may be procured; it thus acquires a darker colour, and is named the light-brown oil.

“The export of the dorse is the most considerable, then that of the seij, and least of all, the pollack; but for some years past, the fishermen (at least on this coast) pursue this fishery more than they did formerly.



“All these kinds of oil above mentioned, are prepared alone from fish livers.

“*Tromsøe, July 16th, 1841.*”

“MACK, BROTHERS.”

From these two answers, which agree in every essential point, it appears that the Norwegian Liver Oil is principally procured from the dorse, as also from the coal-fish; the clear pale, by the spontaneous flow from the putrescent livers, the brown, by the boiling or roasting of the livers, from which at an ordinary temperature nothing is obtained. The light-brown oil is a clear pale oil, which either has stood long on the livers, or has got old in the warehouse. No other entrails but the liver are used for the liver oil. The difference between both answers consists chiefly in this, that in Tromsøe the livers of the pollack or dorse are used together indiscriminately, while, as the oil is given off with great difficulty, a light-brown colour is produced by heating the fresh livers; in this way the method of obtaining, and the source of the medicinal liver oil, is sufficiently explained.<sup>1</sup>

[The English Cod Liver Oil, and that which is made by the French on the Coast of Newfoundland, are not known to us medicinally, but are used by the carriers; the French make a distinction between the huile de morue, as the pure liver oil which is used medicinally with them, from what is called the draches or the crude oil. All the French Cod

<sup>1</sup> The Cod Liver Oil first found its way into the Pharmacopœia in 1830; it was also received in the Ph. Hass. Elect. Bor. 4th edition, Slevico-Hols. 1831; Danica, 1840; Saxonica, 1837; and in the new French codex. The Pharmacopœias do not at all define the kind, the Saxon incorrectly gives it an astringent taste, the Boravian recommends the brown oil, and the Slesvico-Hols. and Danish the pale as well as the brown, giving the latter the additional appellation of “*Ol. Jecoris empyreumaticum.*” Not any of these Pharmacopœias recognise a light-brown oil. It will always be found to be the best plan to keep ready for use the clear brown Cod Liver Oil, which is the most expensive, as well as the most approved; although opinions are still divided as to the greater efficacy of the two different kinds.—*German Trans.*



Liver Oil is obtained alone from the spontaneous flow from the livers which are brought in barrels (*charniers foassiers*), or the so-called *cagots*, (cases covered with cloth) out of which all that is fluid runs off in a deep trough, in which the blood and water separate from the oil—the first being allowed to flow by an under, the latter by an upper tap. A ton of oil of two hundred and forty litres, requires according to circumstances, the livers of from 40 to 80 cwt. of stockfish weighed in a dry state. The oil which has already been used for the preparation of the chamois leather, comes again into commerce to be used for other leathers.

It is the same oil that the English obtain from Newfoundland. The Newfoundland oil from the French fishery, amounts yearly to about twenty thousand tons; the English, from five to six thousand.]—*German Trans.*

The three kinds of real Bergen oil used in the three following researches, showed these physical properties.

1. OLEUM JECORIS ASELLI FUSCUM—(sive crudum, sive empyreumaticum). Colour dark-brown; by a reflected light, green; in small portions transparent; a peculiar, disagreeable, and empyreumatic smell, bitter and empyreumatic taste, strongly irritating the fauces; slightly acid with litmus paper. Sp. gr.  $17\frac{1}{2}^{\circ}$  Cartier = 0.929. One hundred parts of alcohol of  $30^{\circ}$  Ph. Belg. dissolves—

	I.	II.	III.
At ordinary temperature,	5.885	5.965	6.472
At boiling temperature,	6.553	6.767	6.877

The solution in cold alcohol is effected by allowing the alcohol to stand three days with a surplus of oil, and then filtering. The solution in boiling alcohol by longer boiling is separated with the surplus of the oil and filtering while hot; the brown oil is entirely soluble in ether.

2. OLEUM JECORIS ASELLI SUBFUSCUM (alias fuscum). Colour, like Malaga sherry; smell, peculiar, not disagreeable,

stronger than the following sort ; taste, fishy, bitterish, acrid ; slightly acid with litmus paper. Sp. gr.  $17\frac{1}{2}^{\circ}$  Cartier = 0.924.

	i.	ii.	iii.
100 parts of cold alcohol of $30^{\circ}$ dissolved,	2.816	3.028	3.232.
100 parts of boiling alcohol of $30^{\circ}$ dissolved,	6.548	6.676	6.826.

In ether, soluble in unlimited proportions.

3. OLEUM JECORIS ASELLI FLAVUM SIVE ALBUM.—Colour, gold-yellow ; smell, peculiar, not disagreeable ; taste, fishy, not bitter, slightly acid. Sp. gr.  $17\frac{1}{2}^{\circ}$  Cartier = 0.923.

	i.	ii.	iii.
100 parts of cold alcohol of $30^{\circ}$ dissolved,	2.471	2.692	2.721.
100 parts of boiling alcohol of $30^{\circ}$ dissolved,	3.468	4.006	4.512.

In ether, in every proportion.

These statements agree in the essential parts with all other previous accounts by different authors on the subject.<sup>1</sup>

<sup>1</sup> The ray-oil, from the livers of the ray, as it is obtained by boiling the fresh livers in water, poured off when floating above, and thus rendered clear by decanting ; is bright yellow, smells of whale-oil, has an acid reaction ; sp. gr. = 0.928, and, on standing, deposits a white substance, after the separation of which it becomes clearer and of a less strong smell. The substance deposited is probably the same as that thrown down from the fish-oil. One hundred parts cold alcohol of 89 p. c. dissolves 1.5, at a boiling heat, 14.5, parts. One hundred parts boiling ether, 88 parts, which, however, on cooling, is in a great measure again separated. In water the ray-oil leaves nothing dissolved.—*German Trans.*



## SECTION II.

### THE CHEMICAL COMPOSITION OF COD LIVER OIL.

WURTZER,<sup>1</sup> in 1822, effected the first chemical research into the composition of the Cod Liver Oil. He procured, by shaking it with water, a golden-yellow solution, and by evaporation a thick yellowish acid fluid extract, soluble in water, smelling of fish, and of a nauseous bitterish taste. Common fish oil gave the same results. The kind under examination was, from the description, light-brown oil. Spaarmann<sup>2</sup> has lately examined a red-brown oil congealing in the cold of sp. gr. 0·923. Wasser drew off 4·5 per cent. of a fish-smelling acid extract, yielding a precipitate with acetate of lead and infusion of galls. The remaining oil by solution in boiling alcohol, and being allowed to cool, is separated into 19 parts stearic (margaric) acid, 76·5 olein. The oil is saponified with potash ley. The soap is decomposed by acetic acid, which separates the fatty acids, is dissolved in boiling alcohol, the margaric acid (Spaarmann says the stearic acid) is allowed to crystallise, and the mother-liquor distilled. The acid-distilled product is saturated by baryta-water, boiled and decomposed by phosphoric acid, by which the delphinic or oleic acid is separated, uniting again with the colouring-matter, and a peculiar fishy-smelling brownish-yellow oil, of sp. gr. 0·941. One hundred parts give in this

<sup>1</sup> Hufel. Journ. 1822. Dec., s. 31.

<sup>2</sup> Seig. Magaz. 1828. Juni, s. 302.



way 17 margaric acid, 74.5 oleic acid, 5.5 stearic acid, and 3 colouring and odorous matter. In this first and, until now, only essay on the comparative analysis of the brown and pale Cod Liver Oil, Marder obtained the following result.<sup>1</sup> He found in 100 parts—

	Pale.	Brown.
Green soft resin . . . . .	0.052 . . . . .	0.065
Brown hard resin . . . . .	0.013 . . . . .	0.078
Gelatine . . . . .	0.156 . . . . .	0.468
Oleic acid . . . . .	55.917 . . . . .	47.500
Margaric acid . . . . .	10.312 . . . . .	4.000
Glycerine . . . . .	8.416 . . . . .	9.000
Colouring matter . . . . .	5.750 . . . . .	12.500
Muriate of lime . . . . .	0.052 . . . . .	0.105
Muriate of soda . . . . .	0.059 . . . . .	0.094
Sulphate of potash . . . . .	0.018 . . . . .	0.031

In reference to the physical properties, he mentions that the pale oil in a cold temperature deposits a somewhat consistent fat, consisting of oleic and margaric acids and glycerine, which the brown oil does not; the brown oil refracts the light stronger, and is more acid, than the pale; the latter appears in a transmitted light, yellow; in a reflected, green. Ether dissolves it entirely; 100 parts alcohol, 0.825, at 62° R., 9 parts of the pale, but 100 parts of the brown oil. Water shaken with both kinds becomes acid, and acquires the peculiar fish-oil odour. Both sorts are saponified with ammonia; with hydrate of baryta it makes a milky fluid, with tincture of galls, nitrates of potash, silver and mercury, muriate of tin, alkaline salts of the blood, they are not affected, but produce, with an excess of acetate of lead, a kind of linimentous fluid. Nitric acid causes no increase of temperature with either kinds, but changes the smell, and darkens the colour; sulphuric acid produces an increase of temperature, and the formation of sulphurous acid, a red, and

<sup>1</sup> Brandes' Archiv. 32, B<sup>d</sup>. s. 90, und Hufel. Journ. 1837, Mai, p. 115; Pharm. Centralbl. 1830, s. 17.



after some time black colour, and becomes thickened. Water impregnated with chlorine effects no particular change in either kind of oil.<sup>1</sup> The imperfection of the researches which have hitherto been made, considering the present state of organic chemistry, is evident, since the author, in the following excellent work, has discovered that margaric and oleic acids and glycerine exist in large proportions in Cod Liver Oil; he also examined more accurately the so-called resin and colouring matter, and recognised therein the biliary matter; he likewise examined the volatile acids, found therein no delphinic acid, but butyric acid; lastly, the organic constituents were first minutely examined by him. In these researches the presence of iodine has alone occupied attention. Kopp was the first who, in a therapeutic point of view, proffered the opinion, that Cod Liver Oil contained iodine. Soon after, Hopfer de l'Orme<sup>2</sup> proved experimentally the existence of iodine in Cod Liver Oil. Since this time, experiments of various kinds have been made for this object, almost always with the brown oil. That iodine exists in these kinds is confirmed by Hausmann,<sup>3</sup> Haarman,<sup>4</sup> Herberger,<sup>5</sup> Mertens and Springemühl,<sup>6</sup> Gmelin,<sup>7</sup> Bleyne and Brandes,<sup>8</sup>

<sup>1</sup> By others, the Cod Liver Oil is soon coloured darkly by chlorine gas. The ray-fish oil, according to Girardin von Preisser (A A O), is not coloured by chlorine, nor the smell destroyed. Sulphuric acid colours it red, then violet. Nitric acid does not change it. Potash saponifies it easily, and produces yellow, soft soap, which is easily dissolved in water. Margaric and oleic acids are separated by acetic acid, whilst phocenic acid and glycerine remain in the sediment.

<sup>2</sup> Hufel. Journ. 1836, April, s. 115.

<sup>3</sup> Ann. der Phar. 22,170; Centralbl. 1837, 492.

<sup>4</sup> Honst. en Letterbode, 1840, i. 23.

<sup>5</sup> Ann. der Pharm. 31,94; Jahrb. für Prakt. Pharm. 1839, 178, and Centralbl. 1839, s. 853.

<sup>6</sup> Summarium, vi. 94; Centralbl. 1837, 750.

<sup>7</sup> Gmelin first denied the existence of iodine, and put it on the soda containing iodine; Annal. de Pharm. 29, 218; Centralbl. 1839, 384. Later, however, he was convinced to the contrary, and found he had only experimented previously with the South-Sea oil. Ann. de Pharm. 31,94, and 321; Centralbl. 1840, 3.

<sup>8</sup> Brandes' Archiv. 24,156; Centralbl. 1838, 335.



De Brij,<sup>1</sup> and Wackenroder;<sup>2</sup> whilst Marder,<sup>3</sup> Hubschmann,<sup>4</sup> Potempa<sup>5</sup> and Sarphati,<sup>6</sup> deny its presence, because they have not been able to find it. Thereby it is evident that iodine exists in, and is given off from, Cod Liver Oil; and the opinion is pretty generally received, that iodine is found only in the brown kind, and that the pale contains no iodine. De Brij expresses this opinion, and gives this reason, that Sarphati has discovered no iodine in Cod Liver Oil. Wackenroder and Herberger also think that the pale Cod Liver Oil does not contain iodine, although the former relates that Haenert had once discovered much iodine in the pale Cod Liver Oil, and the latter has himself proved its existence in two cases. Hausmann and Herberger were agreed as to the existence of iodine in the light-brown oil, and indeed in a proportion quite in conformity with our author's analysis.

If the results of all these researches are taken together, it is evident that Cod Liver Oil may be found in which no iodine is contained, and which may occur, perhaps, from adulteration with ordinary oil, or by previous refining with sulphuric acid and bleaching for use in the arts. That, however, real and unrefined Bergen Cod Liver Oil contains iodine is certain, and the presence of iodine is a proof of its being a genuine oil, and as such approved of for its medicinal properties. The iodine cannot be detected by the mere solution in alcohol, ether, or water; nor even by the direct carbonisation of the oil, and treating the carbon by means of solution, but only by the saponification of the oil with potash or soda. The soap in most cases gives off the

<sup>1</sup> Chemisch. Pharm.; Archief door de Vrij-Eickma en van der Vliet, 1, Jaarg. s. 51.

<sup>2</sup> Archiv. der Pharm. 24,145; Centralbl. 11, 1841.

<sup>3</sup> Brandes' Archiv. 32,90; Hut. Journ. 1837, Mai, s. 115; Centralbl. 1837, 536.

<sup>4</sup> Centralbl. 1839, 493.

<sup>5</sup> Diss. de Oleo Jecoris Aselli, Lips. 1837.

<sup>6</sup> Konst. en Letterbode, 1837, i. 470; Centralbl. 1837, 747.



iodine, by direct solution in alcohol, and testing the solution with sulphuric acid and starch. Still it is better at all times, as Stein<sup>1</sup> has shown, to dissolve the soap in alcohol, after having carbonised it. The extract can then be essayed both for the qualitative and quantitative analysis of iodine. Stein found that by the saponification of the Cod Liver Oil no iodine remains in the mother-liquor, the separated soap is decomposed by acid, the iodine remaining in the oleic acid; the mother-liquor is consequently free from iodine. These results explain how the presence of iodine may escape the observation of many who do not employ the only certain method of discovering it; it also proves that iodine is by no means held free, or as hydriodate of soda in Cod Liver Oil, as may be supposed, but that it is in every case found in organic combination perhaps with a fatty substance.

These results have been perfectly established by our author in his researches. The best method of discovering the qualitative existence of the iodine is thus given:—The oil is saponified with pure potash, or soda in excess, by long boiling evaporated to dryness; the soap is carbonised in a platina crucible, and then saturated with carbonate of ammonia, and dissolved in water or alcohol. In the latter case, after the evaporation of the solution, there remains a pretty nearly pure hydriodate of potash or soda, which may serve for the quantitative analysis. In the qualitative analysis the iodine is best discovered by putting the evaporated watery or spirituous solution of the carbonised soap which contains the salt mass, in the bottom of a glass tube, with some concentrated sulphuric acid poured on it; then placing in the opening of the tube some starch paste, it should be gently warmed. The ascending vapour of iodine will show a deep violet colour. The salt can also be dissolved in a solution of chlorine, and mixed with starch; or, instead of

<sup>1</sup> Journ. fur Prakt Chemie, xxi. 308; Berg. Jahresber, xxi. 538.



sulphuric, nitric acid may be used. The distillation of the salt with the oxyde of manganese and sulphuric acid, and intercepting the gases in the starch solution, may occasion disappointment from the circumstance of the chlorine being at the same time evolved, since the chlorine discharges the iodic colour. If the galvanic battery is used, (or only one simple element,) the most easy method is to dissolve the salt, and to put the negative wire into the solution, while at the end of the positive wire a small ball of starch is fastened.<sup>1</sup>—(Steinberg.)

The quantitative estimation of iodine in Cod Liver Oil has as yet only been tried by Herberger and Wackenroder. The latter adopted the method mentioned above. He dissolved the saline residuum in water, precipitated it with nitrate of silver, treated the precipitate with dilute nitric acid, and then with ammonia, to separate the carbonate of silver, as well as the bromide and chloride of silver, washed and dried it. In two cases 30 grammes of brown oil gave him 0·018 and 0·009 grammes iodide of silver=0·324 and 0·162 per cent of iodine. Herberger, who at the same time paid attention to the existence of bromine, dissolved the residuum of the salts in water, precipitated the iodine with sulphate of copper and sulphate of iron as iodide of copper, filtered it, distilled the residuum with oxide of manganese and sulphuric acid, shaking the distilled liquor with ether, and discovered after the evaporation the bromine, as bromide of calcium. It contained the following results:—

<sup>1</sup> Of the ray-fish oil, which either by solution in alcohol yields an iodine combination, the contained iodine of which, on the other hand, by saponification, remains in the mother-liquor (?), Girardin and Preisser have made a quantitative analysis. They proceeded as above, and immediately weighed the residuary salts which remained after the evaporation of the spirituous solution of the soda soap, which they considered as iodide of sodium. They obtained out of one litre, 0·18 grammes of iodide of sodium; on the other hand, out of one litre of the brown Cod Liver Oil, of the usual kind, only 0·15 grammes.



## 1000 Parts of Cod Liver Oil.

	Iodide of Copper.	Iodine.	Bromide of Calcium.	Bromine.
{ Pale from Bremen gave . . . .	1.355	0.903	0.255	0.170
{ Pale from Mayence gave . . . .	...	...	...	...
{ Pale from Manheim gave . . . .	0.439	0.293	...	...
{ Pale from Frankfort gave . . . .	...	...	...	...
{ Light brown from Stutgard gave .	0.563	0.375	...	...
{ Light brown from Manheim gave .	2.347	1.564	0.435	0.290
{ Light brown from Hamburg gave .	...	...	...	...
{ Light brown from Bremen gave .	2.586	1.723	0.441	0.294
{ Brown from Bremen gave . . . .	0.477	0.318	...	...
{ Brown from Cologne gave . . . .	0.618	0.412	0.151	0.101
{ Brown from Bremen gave . . . .	...	...	...	...
{ The ordinary oil from Bremen gave	0.635	0.423	trace	trace

In two other cases the usual Cod Liver Oil contained no iodine, as it happened also in some other cases of the burbot fish oil, of the genus *gadus lotus*. Herberger asserts that the iodine can only be set free by saponification and carbonisation, it is, however, still a question whether iodine exists as iodide of sodium. Bromine, according to him, is found as bromide of magnesium, since from his observations the ashes of all the oils which contain bromine contain also magnesia, whilst that which is free from bromine does not.

From this able survey, and the exposition of the present state of our knowledge of the Cod Liver Oil, the following researches of our author will, at all events, be looked upon with the greatest interest.—*German Trans.*



## INQUIRY INTO THE ORGANIC CONSTITUENTS OF COD LIVER OIL.

I.—*The Watery Extract of the Cod Liver Oil and its Constituent Parts.*

A. QUALITATIVE ANALYSIS.—When the brown oil is properly shaken up with a sufficient quantity of distilled water during some days, an emulsion of a cinnamon-brown colour is produced, from which, by allowing it to stand for twenty-four hours, the greater part of the oil separates after the manner of cream, whilst the emulsion becomes thinner and clearer. After some weeks the oil floats on a nearly colourless and turbid water. The whole is placed in a moistened filter, when the latter runs through turbid and yellow. By frequent filtration it becomes perfectly clear, although it cannot be rendered colourless. The water reacts slightly acid, and smells empyreumatic; evaporated at  $100^{\circ}$  C.,<sup>1</sup> a light brown extract is produced. What remains on the filter still retains its former colour; the smell is, however, less empyreumatic, the taste is still bitter and irritating to the throat, the reaction is also slightly acid.

The light brown Cod Liver Oil, under similar circumstances, gives a grey emulsion, from which first a yellowish brown cream, and at last nearly all the oil, separates. Here also, by repeated filtration, a perfectly clear water is produced, in this case colourless, reaction slightly acid, smelling and tasting of Cod Liver Oil; which, evaporated at a temperature of  $100^{\circ}$  C., gives a hard and brown extract. The filtered oil is paler than before, smell and acid reaction unchanged.

The pale oil gives a milky, almond-like emulsion. A layer of oil soon separates itself, and under this, a layer of cream; the rest, however, for a long time retains the nature

<sup>1</sup> The Thermometric scale used throughout the work is the Centigrade.



of an emulsion. When filtered, the first that comes off is quite milky, and only by repeated filtration a more or less opalescent water is produced, smelling slightly of Cod Liver Oil, almost tasteless; reaction slightly acid, giving by evaporation a hard and brown extract. The separated oil has become clearer and yellower; smell, taste, and reaction are, however, unchanged.

If the Cod Liver Oil is boiled for several hours with distilled water, and the water is drawn off with a syphon, and this is repeated until the water is no more coloured, the combined liquids are yellow and turbid. It can likewise, however, by repeated filtration be rendered clear; the taste and smell is then empyreumatic, acid reaction, and by evaporation leaves a very dark brown, soft, and in a warm temperature, a syrup-like extract. The oil thus treated still retains its colour; the smell is no longer empyreumatic, but has an unpleasant fishy taste, and reaction unchanged.

The light brown Cod Liver Oil, treated in a similar manner, gives a turbid, yellowish, slightly acid water, smelling and tasting of Cod Liver Oil, which likewise, by repeated filtration, becomes clear, and evaporated at a temperature of  $100^{\circ}$  C., furnishes a very dark and hard extract, but fluid at a warm temperature. The oil is thus rendered clearer, but somewhat darker, the smell more unpleasant and repulsive; the reaction is slightly acid.

The pale Cod Liver Oil, on being boiled with water, gives a turbid, colourless, almost tasteless, slightly acid, fish-smelling water, which by repeated filtration becomes clear, and likewise by evaporation produces a very dark, hard extract, becoming at a warm temperature of the consistency of wax. The oil is not changed either in colour or in reaction; it is however clearer, and its smell is more disagreeable. As to all appearance the extract obtained by the treatment of the Cod Liver Oil with cold water does not differ essentially from



that obtained by boiling water, still both methods require much time, when a sufficient quantity of the extract is required to be prepared for the more accurate quantitative analysis. The extract prepared by boiling is alone selected. All three extracts obtained by the latter method are dark brown and hard, becoming soft in a warm temperature, and again hard in cold. They are more or less soluble in water, more so in ether, and entirely so in alcohol, as well as in a dilute alkali assuming a brownish red colour. From the latter solution it is deposited by an acid in light brown flakes. It has a bitter taste and unpleasant smell. A more extended general description can be of little use on account of its complicated nature; the knowledge of the substances which can be separated by the application of ether and alcohol is more essential. It is not altogether in itself so very complicated, but it contains matter which has hitherto neither been found nor suspected to exist in the Cod Liver Oil.

When the watery extract of the brown Cod Liver Oil, after it has been dried at a temperature of  $100^{\circ}$ , raised to  $110^{\circ}$ , is digested with pure ether, it becomes solid, and adheres to the sides of the vessel, without the ether becoming coloured; when however it is heated by boiling, it becomes again fluid; it then separates into small globules by shaking, which, though they adhere to the sides of the vessel, are moveable; it colours the ether brown. If this boiling with an excess of fresh ether is repeated, until the ether is no longer coloured, there remain behind, and adhere to the sides of the vessel, thin layers of a brown substance. If rectified alcohol is poured upon it, a dark brown colour will be produced in a cold temperature. If this is repeated until the rectified spirit takes up no more, there remains a black substance which is entirely soluble in alcohol of  $30^{\circ}$  (Ph. Bat.) In the meantime the latter solution by filtration lets fall a small grey-coloured deposit. The ethereal solution by evaporation produces



a brownish red substance, *a*, in transparent thin layers, smelling and tasting of bile, of a tenacious consistency, which in a warm temperature is fluid, and in cold becoming as hard as resin, and leaves a greasy stain on paper. After some time it shoots into small crystals, the form of which is distinguished with difficulty. It is scarcely soluble in water, though easily so in ether and alcohol. Rectified spirit produces a dark brown scentless bitter substance, *b*, in 100° dry and brittle, when exposed to the air becoming damp and soft, not soluble in ether, hardly so in water, quite so in alcohol. Alcohol of 30° gives a shining coal-black, scentless, peculiar-tasting deposit, *c*, not soluble in ether or rectified spirit, hardly so in water, but easily soluble in alcohol of 30°; the slight grey residuum, *d*, which is produced by filtration of the latter solution is a mixture of inorganic with a little organic matter, which is not extracted by water.

The watery extract of the light brown oil dried in the same way as the former, becomes by saturation with rectified ether likewise hard; still without adhering to the sides of the vessel the ether does not become coloured by long shaking; if it is boiled the extract separates again, as before it adheres to the sides, and the ether acquires a brown colour; when the ether is saturated, rectified spirit gives a brown extract, and deposits a distinct sediment, soluble in alcohol of 30°, which likewise deposits a slight sediment. The substance, *a*, extracted by means of ether; the body, *b*, soluble in rectified spirit; that *c*, which is taken up by alcohol of 30°, as well as the insoluble sediment, *d*, are evidently identical with the four bodies obtained from the brown oil.

The watery extract of the pale Cod Liver Oil is exactly the same, and gives by the successive solution with ether, rectified spirit, and alcohol of 30°, the four substances *a*, *b*, *c*, and *d*. As the watery extracts of the three sorts of oil are perfectly similar in their qualitative relations, so are they



different in the relative proportions of the individual substances which are separated from them, as we shall presently see. The common properties of the substances *a* and *b*, already given, show that the Cod Liver Oil must be mixed with the component parts of bile: this of itself points out the best method for the more exact analysis of these substances. Although a detailed analysis of Fish bile does not exist, we must use for common reference the analysis of the Ox bile by Berzelius.

ANALYSIS OF THE ETHEREAL EXTRACT, *a*.—The ethereal extract must be re-dissolved in ether, to which a solution of carbonate of ammonia is added, and frequently shaken. The fluid separates itself in two layers,—an upper, turbid and yellow, and an under, clear and brown. After some hours, both are divided through a separating funnel. The upper, the ether layer, is dissipated by spontaneous evaporation. After four hours, almost all the ether was evaporated; the residuum consists of a fat substance, little crystalline, and a dark brown, tenacious consistency, tasting and smelling of bile; still the combined quantity was not sufficient for a separate analysis of the three substances. The fatty matter was evidently olein, the crystalline margarin, the brown substance itself combined with the ammonia which exists in the ammonia layer. This last, evaporated under  $100^{\circ}$ , deposits a great deal of a dark brown very bitter substance. The same is again saturated with a small quantity of water as long as it is still yellow and turbid. When the water ceases taking up any more, the undissolved sediment appears dark brown, adhering to the bottom of the vessel. The watery fluid, by repeated filtering, cannot be rendered altogether clear. The same appearance shows, according to Berzelius,<sup>1</sup> also a mixture of fellic and cholic acid combined with ammonia. By the solution of the fellite of ammonia, a

<sup>1</sup> Lehrb. B<sup>d</sup>. ix., s. 256.



part of the cholate floats so delicately on water that it cannot be separated by the filter. The watery fluid is poured back from the insoluble sediment and evaporated again to dryness. The water is drawn off carefully from the sediment by drops, and is always allowed to settle for twenty-four hours, when it is carefully poured off. This is repeated three times until the water ceases taking up any more. The watery fluid is now quite clear. These watery solutions are mixed together and precipitated by muriatic acid, added drop by drop. The white flaky sediment is filtered from the almost colourless fluid, and dissolved in alcohol of 30°. By the evaporation of this solution it separates into a drop of oil, bitter, soluble in ether, which when evaporated is again visible; when this is heated with carbonate of soda, the fluid evaporated, the sediment dissolved in alcohol, the spirituous solution of the combined soda diluted, and the sediment again dissolved in water, a solution is obtained which deposits with the chloride of barium and neutral acetate of lead, a precipitate soluble in alcohol. The oil drop occurs in every case, and is ferric acid, which remains insoluble in water. Part of the ethereal extract adhering to the bottom of the vessel is recognised by its dark brown colour, and it forms a relative great proportion of the component parts. Dissolved in water, and decomposed with dilute muriatic acid, a light yellow flaky sediment is obtained, as well as a brown substance adhering to the sides of the vessel; it is filtered, the muriatic acid washed out, and the whole is dissolved in alcohol. The dark coloured spirituous solution is precipitated by a solution of baryta. Although the precipitate is great, still the filtered liquid is not entirely colourless, but leaves behind, after evaporation, a small quantity of a dark brown distinct body, insoluble in ether and water, easily soluble in alcohol, tenacious, which by spontaneous evaporation of its spirituous solution, is brown, and adherent to the



sides of the vessel, and which is not identical with any of the substances which have been found by Berzelius existing in the bile. The brown deposit of baryta is insoluble in alcohol, it is washed on a filter with water until it passes through colourless. A brown solution is thereby obtained, probably of bilifellate of baryta, and the almost colourless contents of the filter. From this last the baryta is separated by dilute muriatic acid, then the sediment washed with water and dissolved in alcohol. The yellow, bitter tasting solution is decomposed with some carbonate of soda, by which no deposit takes place, it is then evaporated to dryness. The residue is dissolved in water, and this watery solution gave, with the diluted muriatic acid, a white, flaky deposit; with chloride of barium, one soluble in alcohol; with neutral acetate of lead, one insoluble in ether; but hardly so in alcohol. These are, however, the characteristic signs of cholic acid.

EXAMINATION OF THE SPIRITUOUS EXTRACT, *b.*—This spirituous extract is dissolved in wine spirit of 30°. A part of this solution is decomposed by a solution of chloride of barium, by which a dark coloured precipitate is thrown down, whilst the liquid becomes yellow. It is filtered and then washed with alcohol of 30°, by which a dark-brown solution passes through, and chloride of barium remains behind on the filter; there is also no biliverdin present, and the organic substance is only mechanically thrown down with chloride of barium. The remainder of the solution is now precipitated by baryta water, and the sediment filtered off. A dark precipitate (a yellowish-brown filtered substance) is thus obtained. After repeated washing it is dissolved in water. The dark coloured solution is precipitated by neutral acetate of lead. By this a more copious and browner deposit is thrown down, but the solution, however, is not rendered perfectly colourless; subacetate of lead gave a second, yellowish, and lighter deposit, which lays on the first. After



some time it should be filtered, and the contents of the filter then washed with water, mixed with water, and decomposed by sulphuretted hydrogen. The sulphuret of lead is to be afterwards filtered off, by which the fluid passes through slightly coloured. What remains in the filter is treated with moderate heat with alcohol of 30°. The dark brown spirituous solution is filtered and evaporated; the residuum is again dissolved in cold alcohol, and once more filtered. The solution thus obtained gave by spontaneous evaporation a brown residuum, in which reddish-brown crystals of bilifulvin could be readily distinguished by the naked eye. The filtered substance, treated by carbonic acid, boiled, filtered, and evaporated in order to precipitate the baryta, the brown and bitter residuum is again dissolved in hot water, and the solution precipitated by the acetate of lead; the clear brown deposit, (2,) is, however, by no means separated from the coloured filtrates. The precipitate, (2,) is digested for an hour at a moderate temperature, with a solution of carbonate of soda. On filtering it the carbonate of lead remains on the filter; the brown solution of the soda combination is, however, decomposed by sulphuric acid. The dark-brown flaky deposit is partly dissolved in the water in which it is washed. It is dissolved in water and evaporated at a temperature of 100°. The residuum is similar to the brown substance which contained the crystals of bilifulvin. It is insoluble in ether, soluble in alcohol and water; the watery solutions are precipitated by solution of baryta, by the neutral acetate and subacetate of lead, and by corrosive sublimate; not, however, by chloride of barium or nitrate of silver. These substances are in no way similar to the component parts of the bile, according to Berzelius. The filtrate, (2,) is precipitated by subacetate of lead, by which a yellowish deposit, (3,) and a slightly coloured fluid is obtained. The precipitate, (3,) is again decomposed by boiling with carbonate



of soda; the carbonate of lead strained off, and from what was filtered a white flaky precipitate is thrown down by sulphuric acid. This is dissolved in the water in which it is washed. This solution, however, is again precipitated by sulphuric acid, which produces a moderate precipitate. The quantity was too small to institute a more minute analysis; nevertheless it follows by comparing the method of producing it, as well as from the circumstance that the substance precipitated by sulphuric acid, when it does not contain sufficient sulphuric acid, is soluble in water, that here in every case bilifellie acid is present. The slightly coloured filtrate, (3,) is treated with sulphuretted hydrogen and filtered. The filtrate is colourless, and leaves behind after evaporation only a trace of a residuum. The precipitate is dissolved in alcohol. The alcohol leaves behind by evaporation a small quantity of a yellow, bitter, after-taste sweet, and astringent hygroscopic substance, becoming soft in an increased temperature, soluble in alcohol, but not in ether or water, and which, according to Berzelius, is not identical with any of the component parts of the bile.

THE SUBSTANCE, *c*, dissolved in wine spirit of 30°, appears to be also peculiar. It is soluble partly in water (the rest in alcohol of 30°), entirely so in wine spirit, but insoluble in rectified spirit and ether, coal-black, shining, glassy and brittle. In caustic alkali it dissolves in a dark-brown colour, and is precipitated from this solution by dilute mineral acid, and concentrated acetic acid in large brown flakes. It is not soluble by boiling with dilute sulphuric acid; on the contrary, it is so in cold concentrated nitric and muriatic acids. The spirituous solution is precipitated in brown flakes by baryta water, and acetate of lead. It burns with a flame, leaving behind a coal which is with difficulty reduced to ashes, producing scarcely any ashes, by which is evolved a smell of burnt fish.



THE RESIDUUM, *d*, is extraordinarily small in the brown, more decided in the light brown and pale. It has already been mentioned that this is a mixture of organic and inorganic substances; the former are not distinguishable by any imperfect dissolving medium, but that it is present is partly shown by the colour, and also by the fact that the whole mass burns with a flame, giving out a peculiar odour. The residuum was also reduced to ashes, and the ashes first boiled with distilled water. The neutral watery solution gave, with fresh starch water, and nitric acid, no iodine reaction; but with nitrate of silver, a flaky deposit, soluble in ammonia, was precipitated; with chloride of barium and oxalate of ammonia, a slight precipitate; as also by boiling with carbonate of potash; not so, however, with chloride of platina; a platina wire, moistened with the solution, coloured the flame of a spirit lamp yellow. There existed also in the solution, chlorine, sulphuric acid, lime, magnesia, and soda, probably as chloride of sodium, chloride of calcium, sulphate of soda, and sulphate of magnesia. That portion of the ashes insoluble in water was dissolved in heated muriatic acid without effervescence. The solution was precipitated by chloride of barium and by ammonia, and evaporated to dryness; the residuum dissolved in water, and the filtrate decomposed by oxalate of ammonia, a precipitate was thrown down. The insoluble portion of the ashes contained sulphate and phosphate of lime.

B. QUANTITATIVE ANALYSES.—Product by the Watery Extract.

		Quantity of Oil Used. Grammes.	Contained Extract. Grammes.	In 100 Parts. P. C. Ext.
Brown Cod Liver Oil . . . . .	With Cold Water	34.977	0.451	1.288
	With Hot Water	32.062	0.403	1.256
Light Brown Cod Liver Oil . . . . .	With Cold Water	39.085	0.348	0.890
	With Hot Water	38.855	0.330	0.849
Pale Cod Liver Oil . . . . .	With Cold Water	18.277	0.111	0.607
	With Hot Water	40.670	0.209	0.513



The reason why the cold water gives a larger product of extract than the hot, particularly in the pale oil, arises perhaps from the presence of a substance which is only soluble in cold water, for instance, albumen.

In the quantitative analysis of the extract, 5.348 grammes of the brown, 5.622 grammes of the light brown, 4.681 grammes of the pale were employed. The results of the three analyses are contained in the following table:

	Brown Oil in 100 Parts.		Light Brown Oil in 100 Parts.		Pale Oil in 100 Parts.	
	Prod.	Grms.	Prod.	Grms.	Prod.	Grms.
a. Ethereal extract (Felic acid, cholic acid, besides a little oil margaric and bilifulvin) . . . . .	1.277	0.290	0.410	0.062	0.391	0.043
b. Alcoholic extract (bilifulvin, bilifelic acid, and two apparently peculiar bodies) . . . . .	3.733	0.876	2.950	0.445	2.446	0.268
c. Wine spirituous extract (a peculiar coal-black substance) . . . . .	0.164	0.038	0.089	0.013	0.062	0.006
d. Insoluble substance, containing organic matter . . . . .	0.022	0.005	0.016	0.002	0.011	0.001
Salts (sulphuric acid, lime, magnesia, and soda, phosphate of lime, chloride of calcium) . . . . .	0.140	0.037	2.124	0.320	1.742	0.190
Loss . . . . .	0.012	...	0.033	...	0.029	...
	<u>5.348</u>	<u>1.251</u>	<u>5.622</u>	<u>0.842</u>	<u>4.681</u>	<u>0.508</u>

## II.—*Glycerine of the Cod Liver Oil, compared with the Glycerine of the Olive Oil and Hog's Lard.*

As the glycerine obtained by the saponification of the Cod Liver Oil shows some properties, which after the other method we are not in the habit of ascribing to the ordinary glycerine, it appeared to me necessary to compare the glycerine procured from the Cod Liver Oil with that from the olive oil. The result justified the proceeding, and as in each kind of glycerine some peculiar new properties were discovered, the glycerine of an oil rich in stearine was therefore employed in the analysis.



The brown Cod Liver Oil, olive oil, and hog's lard are taken, purified by melting and straining, and saponified by a solution of caustic soda, and after the saponification is perfected, the ley is poured off and filtered. It was, in each of the three cases clear, in the Cod Liver Oil, brown, in the oil and lard, yellow coloured. The liquid was neutralised with dilute sulphuric acid, by which a pungent smell of smoked fish is evolved from the ley of the Cod Liver Oil; from that of the olive oil there was none, whilst from that of the hog's lard there was a slight odour similar to the hog's lard itself. The neutralised fluid should be evaporated until the separation of the salts begin, then allowed to stand in a cold place in order that the sulphate of soda may crystallise. The ley should then be again poured off and evaporated in a water-bath until the salt crystallises, thereupon the rest of the sulphate of soda is precipitated by the addition of wine spirit, the liquid filtered, evaporated to dryness in a water-bath, and dissolved in rectified spirit. The last operation should be repeated, in order to separate the last remaining portion of sulphate of soda, and then lastly the fluid evaporated cautiously to dryness. By evaporation the solution of glycerine becomes always darker, which by no means depends on the mixture of colouring matter, since the pure unmixed glycerine also assumes this appearance. The glycerine thus cautiously prepared, as it is necessary that the greatest care should be used throughout the whole operation, dried at  $100^{\circ}$  has the following properties :

*From the Cod Liver Oil.*—Of the consistence of syrup, dark-brown but clear and transparent, smelling like black bread, sweet, liquid, easily soluble in water and spirit. The watery solution is not precipitated by baryta water or neutral acetate of lead, but copiously so by subacetate of lead. Berzelius expressly states that glycerine is not precipitated by subacetate of lead,<sup>1</sup> it appears also as if this quality belongs to

<sup>1</sup> Lehrb. iii. ; Aufl. B<sup>d</sup>. vi., s. 554.



the glycerine of the Cod Liver Oil ; it will also be perceived that the other sorts of glycerine are likewise precipitated. Dilute nitric and muriatic acids produce no remarkable effect, on the other hand a pungent odour like rancid butter is evolved by saturation with dilute sulphuric acid, with a slight effervescence.

*From Olive Oil.*—Brownish yellow, clear, syrup-like fluid, bears entirely the same relation with respect to the method of solution and precipitation as the oil of the Cod's liver.

*From Hog's Lard.*—Yellowish, in other respects having the already described qualities of the two others.

This result must lead to the supposition, that in all three cases the glycerine is rendered impure by a substance which is precipitated by the subacetate of lead, and therefore its separation is desirable. To this end the glycerine is again dissolved in water, and the solution decomposed by acetate of lead dropped in until nothing more is precipitated. This should be filtered and washed ; it requires, however, many days before the precipitate obtained from 2 grammes of glycerine is sufficiently washed, and that the water in which it is washed does not precipitate any more lead with hydrosulphuret of ammonia. By this the continued precipitation is diminished, and at the last only some carbonate of lead is left on the filter, so that the organic combination with lead is decomposed by the carbonic acid of the air. In the following experiment the precipitate was only washed twice with water, and then pressed between filtering paper. It should then be pulverised, dissolved in water, and decomposed by sulphuretted hydrogen. The filtered sulphuret of lead gives no result with hot alcohol. The colourless filtrate is concentrated at  $100^{\circ}$  ; the sulphuret separated, filtered, and then further evaporated to dryness. During the evaporation the fluid becomes coloured yellow, afterwards brown, and the dried residuum is also brown but clear and transparent, hardly soluble in cold water, more so in hot water, in alcohol, and



ether, as well as in caustic alkaline solution, with a brown colour. The lead precipitate from the filtered glycerine solution, which, in consequence of the formation of carbonate of lead, becomes turbid, is freed from lead by sulphuretted hydrogen, filtered, dried for some time, again dissolved, and then evaporated to dryness in a water-bath. During the evaporation the liquid becomes again yellow and brown, and lastly leaves behind, after the separation of all the free acetic acid (for which indeed a longer time is necessary), a much darker coloured residuum than the glycerine was, before the precipitation by the acetate of lead. The watery solution of this residuum, which, with the exception of the fact that no odour is evolved with sulphuric acid, which glycerine gives off, is entirely precipitated by the subacetate of lead, the same as the original glycerine solution. As this solution is also precipitated with acetate of lead treated exactly as before, the very same appearances were again produced. Everything was observed which corresponded with the three sorts of glycerine.

The three kinds of oil are saponified by boiling with oxide of lead. The separated glycerine solution in all three cases is colourless. It should be filtered, freed by sulphuretted hydrogen from the adherent lead, filtered, heated, again filtered, and lastly evaporated at  $100^{\circ}$ . During this evaporation the solution in all these cases is darkly coloured; from olive oil and hog's lard a yellowish brown sediment is obtained. The glycerine procured from the Cod Liver Oil separates a blackish, pitch-like mass; this is dissolved in water, and filtered. By this there remained on the filter a pitch-like substance, scarcely soluble in cold water, however colouring it brown; soluble in hot water, alcohol, and alkaline ley. The filtrate gave by evaporation a similar result. The glycerine procured in this way from all the three kinds of oil is equally precipitated by the subacetate of lead; and



the liquid filtered from the lead deposit, treated as above, gave by a second evaporation a coloured glycerine, which in fact evolves no odour with sulphuric acid; it is, however, again precipitated by acetate of lead. From this it also occurs, that the solution of glycerine by evaporation in the air, undergoes the same change as the solution of the extract by the formation of apothem. As often as this glycerine solution is precipitated by acetate of lead until it is discoloured, and the colourless filtrate is again evaporated, the colour and precipitation by acetate of lead returns, and this is repeated until all the glycerine in this manner is separated from the fluid. The following experiments prove that the colouring and precipitation by lead are produced by the reciprocal influence of heat and air; but then other appearances are also produced, which are dependent on the formation of two different substances. The coloured solution of glycerine is treated with animal charcoal until it is of a very light yellow, then the one half of it is dried in the air at  $100^{\circ}$ , the other in vacuo over sulphuric acid. The first portion gave a brownish, the second only a pale yellow deposit; the watery solutions of both throw down a copious deposit with acetate of lead. The coloured glycerine solution is now taken, precipitated to discoloration by acetate of lead, and the filtrate evaporated in vacuo over sulphuric acid. The deposit is yellow, and is more deeply coloured than that obtained in the former experiment in vacuo; its watery solution, however, is precipitated by subacetate of lead.

The more minute analysis of the changes which the glycerine undergoes, which have been indicated in the previous experiments, and which affords not only the separation of the products of the decomposition, but also the elementary analysis, would lead one too far from the object of the present analysis; they must, therefore, be given up.

In the quantitative analysis it is to be noticed, that by the



saponification with caustic soda, and the treatment of the ley in the above-mentioned manner, the quantity of glycerine in the three kinds of Cod Liver Oil is contained as follows :—

	Quantity of Oil Used. Grms.	Containing Glycerin. Grms.	In 100 parts.
Brown Cod Liver Oil . . . . .	4·232	0·411	9·711
Light Brown Cod Liver Oil . . . . .	4·847	0·485	9·073
Pale Cod Liver Oil . . . . .	5·719	0·582	10·177

### III.—*Fixed Fatty Acids of the Cod Liver Oil.*

A. QUALITATIVE ANALYSIS.—In order to exhibit the fatty acids of the Cod Liver Oil, a certain quantity of all three kinds should be saponified with caustic soda in a water-bath. This occurs soonest in the brown sort. During and after the saponification an alkaline odour predominates in the light brown and pale oils ; on the contrary, in the brown there is a very disgusting odour. The colour of the soap corresponds with the colour of the oil used. When the saponification is perfected the glycerine is poured off, the soap is dissolved in warm water, and again precipitated by a little soda ley. This is repeated five times, in order to separate every trace of glycerine. The filtered mother ley is thus rendered quite colourless, and the colour of the soap is also somewhat lighter. The soap is now dissolved for the sixth time in hot water, and then the solution is precipitated by neutral acetate of lead ; when it is cool, the ley of lead soap, similar in colour to the soda soap, is poured off, and the former is washed in distilled water with moderate heat, until it no longer reacts with sulphuretted hydrogen. The lead soap thus obtained is dried at 100°, and macerated with ether in a closed vessel for eight days. At the end of this time it is filtered, the contents of the filter washed with ether for some days, and that salt of lead, soluble, as well as that insoluble in ether, is now analysed for itself.



The lead salt, insoluble in ether, affords a grey mass, easily pulverised after drying. It should be triturated, dissolved in water, and decomposed by heat with sulphuric acid. It separates into a stiff brown oil, which in the cold soon becomes concreted, which is filtered from the yellow mother liquor, and washed with tepid distilled water until the washing, rendered acid by muriatic acid, ceases to become turbid with chloride of barium; then the contents of the filter are boiled with wine spirit of  $30^{\circ}$ , and the insoluble sulphate of lead is separated by filtering. From the brown filtrate a firm coloured fat is crystallised by the cold. The alcohol is filtered, and the contents of the filter are washed with cold alcohol, and again dissolved in hot alcohol; the fatty acids are allowed to crystallise, and this is repeated until snow-white crystals shoot from a colourless mother liquid. This is dissolved in carbonate of soda with the assistance of heat, the solution is evaporated to dryness, and the residuum boiled with alcohol. The spirituous extract solidifies on cooling in a gelatinous form, and becomes again liquid by heat. It is heated to the boiling point, and then precipitated with a spirituous solution of acetate of lead, likewise boiling. The abundant white precipitate is separated by means of a warmed filter; and goes again into perfect solution by washing with hot alcohol. The filtrate is rendered turbid on cooling, and deposits a snow-white precipitate, which is washed in cold alcohol, and three times dissolved. It is then dried at  $100^{\circ}$ , and burnt with oxide of copper and chloride of Calcium.

The results were as follows:—

BROWN COD LIVER OIL.

- I. 0.685 Grammes of Lead Salt gave 1.37 Carbonic Acid and 0.54 Water.
- II. 0.611 Grammes of Lead Salt gave 1.121 Carbonic Acid and 0.480 Water.
- 0.656 Grammes of Lead Salt gave 0.194 Oxide of Lead.

LIGHT BROWN COD LIVER OIL.

- III. 0.813 Grammes of Lead Salt gave 1.631 Carbonic Acid and 0.658 Water.
- IV. 0.710 Grammes of Lead Salt gave 0.410 Carbonic Acid and 0.576 Water.
- 0.790 Grammes of Lead Salt contains 0.233 Oxide of Lead.



## PALE COD LIVER OIL.

- V. 0.549 Grammes of Lead Salt gave 1.100 Carbonic Acid and 0.438 Water.  
 VI. 0.722 Grammes of Lead Salt gave 0.450 Carbonic Acid and 0.570 Water.  
 0.695 Grammes of Lead Salt gave 0.207 Oxide of Lead.

This gave in 100 parts.

	I.	II.	III.	IV.	V.	VI.
C	55.302	55.256	55.472	54.912	55.402	55.531
H	8.763	8.728	8.992	9.014	8.864	8.771
O	6.362	...	6.043	...	5.950	...
Pb O	29.573	...	29.493	...	29.784	...
	<u>100.000</u>		<u>100.000</u>		<u>100.000</u>	

Calculation from the formula:— $C_{34} H_{66} O_3 Pb O$  affords

C	55.234
H	8.752
O	6.377
Pb O	29.637
	<u>100.000</u>

The salt of lead found to be contained in all three kinds of Cod Liver Oil is margarate of lead. The purified margaric acid from the brown and pale oil fused at + 60°, from the light brown at + 59, 5° C.

With regard to the lead combination, which is soluble in ether, it is not distinguished so much by the colour as the insoluble combination; they are in the three kinds of oil equally brown coloured. The ether is distilled off, the brown residuum dissolved in water, and decomposed by heat with dilute sulphuric acid; by which it separates on the surface into a nearly black-coloured oil. By means of a separating funnel this is separated from the watery liquid and the sulphate of lead, and repeatedly washed with hot distilled water until it is free from sulphuric acid. In order then to set it free from the mixed colouring matter, it is dissolved in alcohol, digested with animal charcoal and filtered, and this is six times repeated. The solution appears now only yellow. However it is evaporated, the oleic acid containing oil is separated with a similar dark colour as before. This, as well



as the fact that this occurs exactly the same in the pale Cod Liver Oil itself, proves that there exists a substance which is really colourless, but which, under certain circumstances, becomes coloured, which can be separated by animal charcoal only as far as the colour is concerned, whilst the unchanged portion is not separated but is again in part changed during evaporation. By frequent evaporation and frequent solution, and treating with animal charcoal, we can at last obtain a knowledge of this questionable substance; still it would be too circumstantial, and therefore the shorter way is preferred. Lastly, the oleic acid is saponified by heat with caustic soda ley. The soap was brown, the strong alkaline ley almost black; the latter is separated, the soap dissolved in water, precipitated again by caustic soda, and this repeated four times. By this at first is obtained a coloured ley, by a later operation, however, a nearly colourless one, and the soap is only a little lighter. In this manner also it happens, when a similar large proportion of colouring matter goes over in the alkaline ley, a perfect purification cannot be obtained. The brown soda soap is dried at  $100^{\circ}$ , dissolved at the boiling point in wine spirit of  $30^{\circ}$ . The solution in cooling does not separate anything, but when it is brought to a temperature under  $0^{\circ}$ , a precipitate is deposited, which is decidedly less coloured than the original soap, whilst the ley appears nearly black. It is filtered, the precipitate washed with cold alcohol dissolved anew in a little hot alcohol, the solution is again cooled, by which a small quantity of coloured precipitate is deposited, and this is repeated once. By a careful operation a pure white salt of soda is in the end obtained. This is dissolved in alcohol.<sup>1</sup> The solution is boiled, and decomposed by a spirituous solution of acetate of lead likewise in a boiling state. A slight precipitate is thrown down, which is again dissolved by boiling; it is filtered, and after it is perfectly

<sup>1</sup> The following only relates to the brown oil.



cool a slight yellowish semi-fluid adhesive precipitate is thrown down, which is separated from the supernatant fluid, washed with cold distilled water, dried at  $100^{\circ}$ , and then fused with oxide of copper and chloride of calcium.

- I. 0.801 Grammes of Lead Salt gave 1.685 Carbonic Acid and 0.606 Water.  
 0.589 Grammes of Lead Salt gave 0.150 Oxide of Lead.  
 II. 0.653 Grammes of Lead Salt gave 1.377 Carbonic Acid and 0.495 Water.  
 0.355 Grammes of Lead Salt gave 0.091 Oxide of Lead.

	This gave in 100 parts.			Calculation.
	I.	II.		
C	58.167	58.308	44	59.585
H	8.406	8.422	78	8.623
O	7.961	7.637	4	7.087
Pb O	25.466	25.633	1	24.705
	<hr/>	<hr/>		<hr/>
	100.000	100.000		100.000

The difference between the analysis and the calculation is attributed to the adhesive quality of the salts of lead, which are very difficult to wash; they will, however, accord better in the analysis of the baryta salts. In the above given method, the purified salts of soda from all three kinds of oil are therefore dissolved in hot water. The solution after cooling is slimy, diluted sufficiently with water, and chloride of barium added, until no further deposit takes place. The snow-white precipitate is filtered and washed with distilled water until it is no longer rendered turbid by sulphuric acid. The washings come off very easily. The precipitate is then pressed between filtering paper and dried in a sand-bath, by which it is so drawn together that the water which is mechanically mixed with it is forced on the surface by drops. After it is perfectly dried the combination appears brown and transparent as amber. In this state it is analysed.

BROWN COD LIVER OIL.

- I. 0.621 Grms. of Baryta Salt gave 1.450 Carbonic Acid<sup>1</sup> and 0.525 Water.  
 0.855 Grms. of Baryta Salt gave 0.237 Sulphate of Baryta=0.1555 Baryta.  
 II. 0.625 Grms. of Baryta Salt gave 1.457 Carbonic Acid and 0.530 Water.

<sup>1</sup> Taking into consideration the carbonic acid retained in the baryta.



## LIGHT BROWN COD LIVER OIL.

- III. 0.451 Grms. of Baryta Salt gave 1.053 Carbonic Acid and 0.333 Water.  
 0.882 Grms. of Baryta Salt gave 0.242 Sulphate of Baryta=0.1588 Baryta.  
 IV. 0.639 Grms. of Baryta Salt gave 1.490 Carbonic Acid and 0.547 Water.

## PALE COD LIVER OIL.

- V. 0.508 Grms. of Baryta Salt gave 1.185 Carbonic Acid and 0.430 Water.  
 0.537 Grms. of Baryta Salt gave 0.150 Sulphate of Baryta=0.0984 Baryta.  
 VI. 0.422 Grms. of Baryta Salt gave 0.980 Carbonic Acid and 0.360 Water.

	This gave in 100 parts.						Oleate of Baryta, according to Varrentrapp.	
	I.	II.	III.	IV.	V.	VI.		
C	64.563	64.469	64.559	64.475	64.500	64.212	44	64.593
H	9.393	9.422	9.435	9.511	9.405	9.478	78	9.347
O	7.853	...	8.000	...	7.764	...	4	7.683
Ba O	18.191	...	18.006	...	18.331	...	1	18.377
	<u>100.000</u>		<u>100.000</u>		<u>100.000</u>			

There, therefore, can be no doubt that oleate of baryta is present.

Consequently, the fixed fatty acids of the Cod Liver Oil are margaric and oleic acids.

B. QUANTITATIVE ANALYSIS.—The proper quantity of all three kinds of Cod Liver Oil is subjected to entirely the same treatment (the change into salt of lead and separation by ether). The oleic acid is not, however, separated from the colouring matter as this is not possible without loss. The numbers for the oleic acid include also that colouring matter which in the following division is more accurately analysed.

	Employed.	Contained		Margaric Acid	Oleic Acid
		Marg. Acid.	Oleic Acid.	in 100 parts.	in 100 parts.
	Grms.	Grms.	Grms.	Grms.	Grms.
Brown Cod Liver Oil . . . . .	5.302	0.846	3.700	16.145	69.785
Light brown Cod Liver Oil . . . . .	4.040	0.623	2.899	15.421	71.757
Pale . . . . .	5.095	0.599	3.772	11.757	74.033

IV.—*Brown Substance of the Cod Liver Oil—Gaduine.*

It has hitherto been a question concerning the nature of the substance which adheres so pertinaciously to the oleic acid of the Cod Liver Oil, and which accompanies it through the whole process of saponification and separation. By this it is shown



that by the saponification of the impure oleic acid with an excess of soda, the greatest part of it goes over in the alkaline ley. When this latter is separated by cooling from the solidified soap, filtered, and then neutralised by dilute sulphuric acid, carbonic acid is evolved, and brownish-yellow flakes are separated, rise upwards, and collect together in a thick film, a faint odour of fresh tanned leather is, at the same time, evolved. This film is filtered, well washed with distilled water, then dissolved in some spirit of  $30^{\circ}$ , and the solution diluted; a brown substance is then obtained, which, indeed, is of the very same compound nature, and in the three kinds of oil have perfectly the same qualities; dried at  $100^{\circ}$  for some hours, it shows the following characters:—

In the mass it is of the consistence of wax, and of a dark brown colour; spread on glass in thin layers, it forms a brittle, transparent, brownish-red film, easily turning into a brownish-red powder. It smells of Cod Liver Oil. Dissolved in water it is almost perfectly blanched with chlorine gas. It burns with a clear flame, and leaves behind a coal which is with difficulty reduced to ashes. It is insoluble in water, partly soluble in ether, and once dried it is no longer perfectly soluble in wine spirit. The solution is dark brown; by evaporation it gives a residuum of the above qualities, which dried at  $100^{\circ}$  is not again perfectly soluble in ether or alcohol. If this solution in wine spirit is repeated in small quantities, and evaporated very often, that point will be gradually attained, in which the residuum cannot be separated either in a soluble or insoluble portion. This latter perfectly soluble portion shows a very small relation to the original substance employed; it is brown, has a repulsive odour, burning with a clear flame, and leaves a grease-spot on paper. The chief constituent part of the brown substance has also this peculiarity, that it becomes insoluble by evaporation.



The brown substance is now dissolved in the wine spirit of 30°. The insoluble part is filtered, the filtrate evaporated, the residuum is again dissolved in alcohol, and this repeated four times. By the combination of all the solutions and all the precipitates, both soluble and insoluble, a sufficient quantity of the soluble as well as the insoluble portions for a more extended analysis is thus obtained.

The alcoholic solution is at once precipitated by a spirituous solution of acetate of lead, and the copious brown precipitate filtered. The yellow filtrate leaves behind, by evaporation, a brownish-yellow substance, having a disagreeable odour, from which, by hot water, the excess of acetate of lead is separated. It exists then as a mixture of several organic salts of lead. By treating it with ether it is precipitated in an insoluble portion, *a*, and a soluble portion, *b*, and the latter again precipitated by ether into a soluble substance, *c*, and an insoluble, *f*.

The substance, *a*, is dark brown, insoluble in water, alcohol, and ether, pulverulent, burning with a clear flame, leaving behind an oxide of lead. By comparison it follows that this combination of lead is identical with the precipitate which is thrown down immediately by the acetate of lead from the spirituous solution of the brown substance. The substance, *b*, soluble in ether, remains, after the evaporation of the ether, as a brown adhesive mass, burning with a flame, and leaving behind the oxide of lead. By boiling alcohol at 30°, it is divided into two parts. That part, *c*, soluble in alcohol, deposits, on the cooling of the solution, a grey-coloured precipitate, while the solution remains yellow. By evaporation, the solution leaves behind an adhesive brownish residuum, not soluble in water but perfectly so in alcohol and ether. When this is decomposed by sulphuric acid, the drops of oil are immediately visible. It is filtered in a moistened filter, the contents of the filter washed with water, then dis-



solved in alcohol, and the latter evaporated; thus is obtained a substance containing oil, staining paper, perfectly combustible with a flame, soluble in alcohol and ether, forming a solid soap with soda, soluble in water. One has here, in every case, to deal with a small quantity of reserved oleic acid.

The portion, *d*, insoluble in alcohol, is very dark-coloured, and adheres firmly to the sides of the vessel. It is insoluble in water; by ether, however, it is separated into two parts. The insoluble part, *f*, was too small to analyse more accurately, the soluble part, *e*, however, remains after evaporation of the ether, as a brown substance, adhering firmly to the sides of the vessel, of the consistence of wax, transparent, burning with a flame, and leaving behind oxide of lead; when this is decomposed by dilute sulphuric acid, there appears, at a superficial glance, a brown, very adhesive substance, soluble in ether, insoluble in alcohol and water, which, in consequence of its small quantity, could not be further examined.

The lead precipitate from the spirituous solution of the brown substance, is first washed with alcohol, until it passes through colourless, and then with water, until it no longer reacts with lead. It is then boiled with water, alcohol, and ether; neither of the three, however, yield anything. It is thence dried at 100°, and fused with oxide of copper and chloride of calcium.

## BROWN COD LIVER OIL.

- I. 0.446 Grms. Lead combination gave 0.310 Carbonic Acid and 0.216 Water.  
0.441 Ditto, Ditto, gave 0.161 Sulphate of Lead=0.1184 Oxide of Lead.
- II. 0.374 Grms. Lead combination gave 0.700 Carbonic Acid and 0.136 Water.
- III. 0.3265 Grms. Lead combination gave 0.611 Carbonic Acid and 0.166 Water.

## LIGHT BROWN COD LIVER OIL.

- IV. 0.365 Grms. Lead combination gave 0.679 Carbonic Acid and 0.185 Water.  
0.363 Ditto, Ditto, gave 0.137 Sulphate of Lead=0.1008 Oxide of Lead.

## PALE COD LIVER OIL.

- V. 0.346 Grms. Lead combination gave 0.6595 Carbonic Acid and 0.169 Water.  
0.400 Ditto, Ditto, gave 0.149 Sulphate of Lead=0.1096 Oxide of Lead.



This gave in 100 parts.							Calculation.
	I.	II.	III.	IV.	V.		
C	52.159	51.753	51.438	51.425	52.704	35	52.004
H	5.381	5.525	5.649	5.631	5.427	44	5.336
O	15.605	...	...	15.182	14.468	8	15.553
Pb O	26.855	...	...	27.762	27.401	1	27.107
	<u>100.000</u>			<u>100.000</u>	<u>100.000</u>		<u>100.000</u>

In the further analysis of the component parts, the following experiments were made with the substance procured from the brown Cod Liver Oil.

The lead combination was digested with carbonate of soda, filtered after the precipitation of the carbonate of lead was effected, the reddish-brown liquid decomposed with dilute sulphuric acid, the brown precipitate filtered and washed thoroughly with water, then dissolved in alcohol, and the spirituous solution precipitated by a mixture of alcohol, ammonia, and nitrate of silver. The precipitate was placed on a filter, washed first with alcohol, then perfectly washed with water, dried at  $100^{\circ}$  and analysed, 0.238 grammes gave 0.436 carbonic acid, and 0.115 water; further, 0.3245 grammes left behind 0.0835 silver = 0.0897 oxide of silver.

This gave in 100 parts.			
	Experiment.		Calculation.
C	50.654	35	51.433
H	5.368	44	5.278
O	16.343	8	15.382
Ag O	27.635	1	27.907
	<u>100.000</u>		<u>100.000</u>

It only remains now to exhibit and to analyse in a free state the bodies contained in the lead and silver combinations. A part of the lead salts is decomposed by carbonate of soda, and the fluid filtered from the carbonate of lead, and treated with dilute sulphuric acid. The precipitate is filtered, freed from water, from sulphuric acid, and sulphate of soda, then dissolved in wine spirit of  $30^{\circ}$ , and the filtered liquid evaporated. The residuum is dried at  $140^{\circ}$ , and sub-



jected to the elementary analysis; 0.160 of the substance leaves behind 0.001 ashes = 0.625 per cent. 0.2102 of the residuum gave 0.527 carbonic acid, and 0.142 water.

This gave in 100 parts.		
Experiment.		Calculation.
C 69.324	35	69.266
H 7.506	46	7.432
O 23.170	9	23.302
100.000		100.000

The free substance is, therefore, an hydrate, and the formula of the bodies free from water contained in the lead and silver salts =  $C_{3.5} H_{4.4} O_8$ ; the atomic weight = 3739.8812. It will be shown at a future period in how far this formula is correct. The substance under examination is otherwise dark-brown, free from smell and tasteless, insoluble in water, partly soluble in alcohol and ether. The solution always leaves by evaporation a sediment which, after being dried at  $100^\circ$ , is again partly soluble. The present substance is the cause of the peculiar relations of the brown body above examined.

From the spirituous solution it remains, after evaporation, as a brittle, glass-like, shining, and transparent body. It is easily reduced into a brownish-red powder. In dilute and concentrated nitric acid it is insoluble at a moderate heat as well as in sulphuric acid; on the other hand, it gives, with hot concentrated sulphuric acid, a blood-red solution, from which it is entirely precipitated by water, carbonic acid, and caustic alkali. It is insoluble in dilute or concentrated muriatic acid, but soluble in alkali, and precipitable again from this solution by acids. Dissolved in water it is bleached by chlorine. It burns with a flame and a smell, first of acetic acid, and afterwards of Cod Liver Oil, and leaves behind a small quantity of ashes.

THE MODIFICATION OF THE BROWN SUBSTANCE INSOLUBLE IN ALCOHOL.—As it always remains behind, when a spirituous solution of the latter is evaporated, the residuum dried at



100°, and then digested with alcohol, is brownish-black, of a shining fracture, gives a brownish-red powder, is insoluble in water, ether, alcohol, and dilute sulphuric acid. In concentrated sulphuric acid, it is converted into a black powder without colouring the acid. It shows exactly the same reaction towards muriatic acid, only in the latter case it immediately colours the acid greenish-yellow. In dilute nitric acid, the powder on being heated puffs up into large flakes, and is dissolved by the continued application of heat, and at last with the increasing concentration of the acid. On diluting the solution it is precipitated in flakes, which, by repeated concentration, is again dissolved. Caustic alkali dissolves the substance with a reddish-brown colour; the solution is precipitated by mineral and acetic acids. The substance burns with a flame, which first smells of acetic acid, and afterwards of Cod Liver Oil. The substance boiled with water, ether, and alcohol, and dried at 110°, gave by calcination the following results:—

- I. 0.244 Grms. leaves behind 0.002 grms.—0.822 p. c. ashes.  
 0.1567 Grms. of the substance gave 0.375 Carbonic Acid and 0.100 Water.  
 II. 0.1736 Grms. of the substance gave 0.416 Carbonic Acid and 0.110 Water.

This gave in 100 parts.

	I.	II.		Calculation.
C	66.171	66.260	39	66.164
H	7.000	7.040	52	7.202
O	26.739	26.700	12	26.634
	<hr/>	<hr/>		<hr/>
	100.000	100.000		100.000

From this analysis doubt having arisen concerning the purity of the substance analysed, it was thought to be in consequence of the soluble modification having been dried at 140°; the whole substance employed in the above analysis was therefore dried at 110°. More probably the difference may have originated from a volatile body first going off above 110°; another portion was, therefore, dried at 140°. Now,



0.177 grammes of this substance, after the abstraction of the ashes, gave 0.446 carbonic acid, and 0.116 water.

This gave in 100 parts.			
	Experiment.		Calculation.
C	69.674	35	69.266
H	7.281	46	7.432
O	23.045	9	23.302
	100.000		100.000

This is altogether the composition of the soluble modification in a free state.

The existing body mixed with it, fluid at a temperature above  $110^{\circ}$ , either existed previously in the Cod Liver Oil, or was introduced during the analysis. In the latter case it could only have been either by the alcohol, the ether, or the acetic acid employed in the precipitation of the lead salt. The odour of the acetic acid which is evolved at the commencement of the fusion of the soluble as well as the insoluble modification, would rather favour the supposition of the last. The formula completely establishes the opinion, for  $C_{3.5} H_{4.4} O_8, H_2O + C_4 H_6 O_3$  is  $= C_{3.9} H_{5.2} O_{12}$ . The substance dried at  $110^{\circ}$  can also be viewed as a combination of the bodies  $C_{3.5} H_{4.4} O_8$ , free from water, with the hydrated acetic acid. By a higher temperature the latter first gives off its water, and then escapes, acetone and carbonic acid being formed. When the substance is evaporated to dryness in a sand-bath, moistened litmus paper should be placed in the entrance of the tube; at  $130^{\circ}$  it already becomes red, and reaches to  $138^{\circ}$ . The combination of an organic substance with acetic acid is not singular in its kind. The xanthil of Couërbe,  $= C_4 H_{10} O S + C_4 H_6 O_3$ , affords an analogy. It is remarkable, however, that this combination cannot be decomposed either by alkali or by sulphuric acid.

Both of the analysed bodies, the soluble and the insoluble, are likewise only the two equally divided modifications of the same body. The formula of the same in a free state



is =  $C_{35}H_{46}O_9$  in combination =  $C_{35}H_{44}O_8 + RO$ . This is expressed by  $7(C_5H_6O)$ ,  $H_2O$ ,  $RO$ , and  $7(C_5H_6O)$ ,  $2H_2O$ ; so that the combination is the oxide of a radical  $C_5H_6$ , of which 7 atoms are combined with 2 atoms of water as a base.

From these two water base atoms, only one can be replaced by a metallic oxide. The whole substance free from water will be this,  $7(C_5H_6O)$ , or  $C_{35}H_{42}O_7$ , and its atomic weight = 3627.4016. In the mean time the combination must be first discovered and analysed, in which both water-atoms are restored by a metallic oxide, before this assumption can be considered as correct.

As, indeed, this substance is found in every case to be a peculiar one, the proposal does not appear unreasonable to call it, from *gadus*, *gadvine*.

The brown substance of the Cod Liver Oil cannot be determined by the quantitative analysis, because a perfect separation of the oleic acid is not possible. Its quantity, therefore, is, as has been before mentioned, included in the calculation for the oleic acid.

#### V.—*The Volatile Acids of the Cod Liver Oil.*

A. QUANTITATIVE ANALYSIS.—When the Cod Liver Oil, without distinction as to kind, is saponified with caustic soda, the soap decomposed by dilute sulphuric acid, (by which the smell of fresh liver is evolved,) the acid fluid filtered from the separated fixed oleic acid, and subjected to distillation, an acid reacting, peculiar, and disgusting smelling distillate is obtained. If the slightly coloured filtrate which is obtained from this fluid is saturated with caustic baryta, there remains, notwithstanding an excess of baryta employed, the unpleasant odour, although somewhat weaker.

The fluid is freed from the excess of baryta by carbonic acid, and evaporated; the colour is always darker, and in the



end leaves a dark brown, unpleasant smelling residuum. This is dissolved in a little water, and the solution is treated with animal charcoal; it will be thus discoloured, and then leave behind by evaporation a light-yellow barytic salt. This is perfectly soluble in water, and only partly so in rectified alcohol.

The barytic salt, soluble in alcohol and water, remains behind by the evaporation of its alcoholic solution as an amber yellow mass. It has a penetrating smell of rancid butter, and this smell remains a long time on the hands. The taste is harsh and peculiar, with a corresponding odour. The salt is very deliquescent, and in the heat puffs up strongly. At a temperature of  $100^{\circ}$  it is slowly decomposed; at least there appears, whenever the lid of the sand-bath is raised, a blue smoke, and the salt, when it was scarcely changed externally, still was not dissolved without a sediment. By decomposition with the mineral acids a yellow oily body, swimming on the fluid, is separated, which has the same smell as the barytic salt, easily soluble in alcohol and ether, hardly so in water. For the elementary analysis, the substance should be quickly dried in vacuo in a small vessel over sulphuric acid, immediately weighed, and put into the combustion tube. On account of the small quantity of the substance, only one slight analysis could be instituted.

Baryta salt of the light-brown Cod Liver Oil—0.256 gave 0.287 carbonic acid and 0.101 water; 0.191 gave 0.136 sulphate of baryta = 0.0893 baryta.

This gave in 100 parts.

Experiment.		Calculation.	
C	30.999	8	29.746
H	4.383	14	4.249
O	18.044	4	19.458
Ba O	46.574	1	46.547
	<hr/>		<hr/>
	100.000		100.000

The calculation is made after the formula for the simple



butyrate of baryta with 1 atom of water, by which the butyric acid =  $C_8 H_{12} O_2$  is formed.

Baryta salt of the pale Cod Liver Oil—0.277 gave 0.334 carbonic acid and 0.150 water; 0.561 gave 0.229 sulphate of baryta = 0.1503 baryta.

This gave in 100 parts.

Experiment.		Calculation.	
C	33.341	16	33.929
H	6.016	36	6.232
O	33.853	12	33.292
Ba O	26.790	1	26.547
	<hr/>		<hr/>
	100.000		100.000

The formula is a double butyrate of baryta with 6 atoms water.

Baryta salt of the brown Cod Liver Oil—0.2825 gave 0.352 carbonic acid and 0.145 water; 0.266 gave 0.332 carbonic acid and 0.134 water; 0.412 gave 0.216 sulphate of baryta, = 0.1417 baryta.

This gave in 100 parts.

	i.	ii.	Calculation.	
C	34.417	34.511	13	35.484
H	5.703	5.597	24	5.347
O	25.474	...	7	24.997
Ba O	34.406	...	1	34.172
	<hr/>			<hr/>
	100.000			100.000

This latter formula is by no means a rational one, and has no reference to any butyric acid salt. Since, however, the baryta salt of brown Cod Liver Oil has the same qualities as the baryta salt of the two other kinds, namely, the smell of rancid butter, so is the difference to be found in the separation of its component parts, and we therefore assume that in general, one of the volatile acids of Cod Liver Oil is butyric acid.

The baryta salt, which is soluble in water, but not in alcohol, remains behind after the evaporation of the watery



solution of a yellow colour. It is odourless; of a harsh taste; far less deliquescent than the baryta salt, which is soluble in alcohol. By decomposition with the mineral acids, no oil is separated. The quantity of the salts was so insignificant, and was so diminished by the washing, that from each kind of Cod Liver Oil only sufficient for one analysis could be obtained. Unfortunately it failed for that purpose; for in the analysis of the salt obtained from the light-brown Cod Liver Oil, as well as that procured from the pale Cod Liver Oil, the water was dissipated. The results are the following:—

I. 0.349 salt from the brown oil gave 0.215 carbonic acid and 0.105 water; 0.507 gave 0.403 sulphate of baryta = 0.2645 baryta.

II. 0.286 salt from the pale oil gave 0.171 carbonic acid; 0.403 gave 0.333 sulphate of baryta = 0.2185 baryta.

This gave in 100 parts.				Calculation.	
	I.	II.			
C	17.034	165.52	4	16.753	
H	3.342	...	10	3.419	
O	27.458	...	5	27.397	
Ba O	52.166	54.228	1	52.431	
	<hr/>			<hr/>	
	100.000			100.000	

The baryta salt of the Cod Liver Oil soluble in water and alcohol is *acetate* of baryta, with 2 atoms of water, a quantity of water which has not yet been remarked—since, according to Mitscherlich, acetate of baryta exists with 1 or with 3 atoms of water.

Since neither butyric nor acetic acids have been found by previous commentators to exist in the Cod Liver Oil, and as the author also was totally unable to detect the phocenic acid which was discovered by Chevreul in the oil of the dolphin, and which, according to others, existed also in the Cod Liver Oil, the hypothesis does not appear, therefore, unlikely that the phocenic acid of Chevreul is a mixture of acetic and butyric acids. Chevreul mentions on the one hand,



that the odour of this acid is intermediate between the smell of acetic acid and rancid butter ; on the other hand, however, he has not attempted the analysis by saturating it with a base, and distilling it with alcohol.

B. QUANTITATIVE ANALYSIS.—A weighed quantity of Cod Liver Oil is saponified with pure caustic potash, the soap decomposed by pure dilute sulphuric acid ; the acid solution and the fixed fatty acids, after sufficient washings with hot-water (until no peculiar smell is present), are then separated with a pipette. All the fluids are put together in a closed still, and evaporated to dryness in a water-bath. The acid distillation is saturated with baryta, the excess of baryta removed by carbonic acid, the filtrate evaporated to dryness in a water-bath, and the residuum dissolved in rectified alcohol—that which is insoluble in alcohol being dissolved in a little water. Both solutions are then evaporated in platina crucibles, the residuum dried in vacuo over sulphuric acid for eight days and weighed, then reduced to ashes over a spirit-lamp, the residuum by excess of sulphuric acid changed into sulphate of baryta: this is fused and weighed. From the sulphate of baryta, the baryta should be calculated and abstracted from the total weight of the salt.

The results with the brown and pale Cod Liver Oil (the analysis of the light-brown in this experiment totally failed) were the following :—

I. 19.590 brown Cod Liver Oil gave 0.129 baryta salt, of which 0.058 are soluble in alcohol, 0.054 insoluble ; the former gave 0.041, the latter 0.045 sulphate of baryta = 0.0311 butyric acid, and 0.0245 acetic acid.

II. 16.405 pale Cod Liver Oil gave 0.046 baryta salt, of which 0.024 are soluble in alcohol, 0.018 are insoluble ; from the former, 0.018, from the latter, 0.016, sulphate of baryta = 0.0122 butyric acid, and 0.0075 acetic acid.



It therefore contains in 100 parts—

	Butyric Acid.	Acetic Acid.
Brown Cod Liver Oil	0.15875	0.12506
Pale Cod Liver Oil	0.07436	0.04571

The light-brown oil, as far as it relates to the containing the volatile acids, approaches very near to the pale.

#### ANALYSIS OF THE INORGANIC CONSTITUENTS.

##### I.—*Iodine*.<sup>1</sup>

A. QUALITATIVE ANALYSIS.—The method of Sarphati was at first tried. From 300 to 400 grammes of the brown Cod Liver Oil were carbonised in a closed iron crucible, the charcoal fused, and, after cooling, dissolved in alcohol. The extract leaves behind after evaporation a small quantity of residuum, which is dissolved in water. The watery solution decomposed by starch-water gave no colour either with nitric acid or with chlorine gas. This being repeated with from 600 to 700 grammes of oil, no other result was obtained. The method by saponification was now proceeded with. From 300 to 400 grammes of the same oil were saponified with caustic potash, which was quite free from iodine; the soap carbonised in a closed iron crucible; the charcoal fused; after cooling, dissolved in alcohol, the alcohol evaporated, and the residuum again dissolved in water. With starch-water and some drops of nitric acid, a copious dark precipitate was obtained. After this method the light-brown and pale were analysed with exactly the same result; indeed, the precipitate of iodide of starch was even still richer in this than in the brown oil.

From this inquiry it invariably follows that the real Bergen Cod Liver Oil always contains iodine; not, however,

<sup>1</sup> In the historical part, the iodine contained in the Cod Liver Oil has been already mentioned.



as free iodine, because by the mere carbonisation of the oil without saponification no iodine was detected even in the purest Cod Liver Oil. When, however, after the method of saponification no iodine whatever is detected, it is impossible that it can be pure Bergen oil. The observations of Stein which relate to this have already been mentioned in the historical introduction to the chemical section.

B. QUANTITATIVE ANALYSIS.—The quantitative determination of iodine contained in the different sorts of the Cod Liver Oil is, therefore, chiefly important in order to enable one to decide whether the active therapeutic principle of the Cod Liver Oil is dependent on the iodine or not. Since it appears from the Treatise of Sarphati,<sup>1</sup> that by the method of Fuchs,<sup>2</sup> Rose,<sup>3</sup> and Planiava,<sup>4</sup> and even by that of Berzelius,<sup>5</sup> improved by Soubeiran,<sup>6</sup> it was impossible to make a perfectly accurate determination of iodine; only the two methods of Sarphati were tried (which precipitates the iodine by a muriatic solution of chloride of copper,<sup>7</sup> as iodide of copper), and that of Lassaigne,<sup>8</sup> which precipitates the iodine with nitrate of palladium, as iodide of palladium.

<sup>1</sup> Commentatio ad Questionem Chemicam in Acad. Lugd. Bat. 1834, Propositam.

<sup>2</sup> Rose, *Analyt. Chemie*, 4te. Aufl. Bd. ii., s. 577. Fuchs precipitates the iodine, as iodide of silver, by an ammoniacal solution of chloride of silver.

<sup>3</sup> Rose, s. 578. The precipitation in common of chlorine, iodine, and bromine, by nitrate of silver, and the changing of the fused precipitate by chlorine gas into pure chloride of silver.

<sup>4</sup> *Pharm. Centralbl.* 1834, s. 558.

<sup>5</sup> Rose, *Analyt. Chemie*, 4t. Aufl. Bd. ii. s. 894. The precipitation of the iodine, as ioduret of copper, by a mixture of sulphate of copper and sulphate of iron. According to Sarphati, there is always some iron thrown down.

<sup>6</sup> *Ibid.*

<sup>7</sup> This is prepared, while the chloride of copper fuses, until no more chlorine escapes, the residuum is dissolved in muriatic acid, and the brown solution allowed to stand with copper filings in a closed flask. The solution loses its colour. For use it is diluted with 12 parts water, and muriatic acid added, until the chloride of copper which separates, is taken up. Rose, *Analyt. Chemie*, 4t. Aufl. Bd. ii. s. 895. *Centralbl.* 1837, s. 748.

<sup>8</sup> *Centralbl.* 1839, s. 80.



The method of Sarphati is very faulty in this respect, that the chloride of copper is precipitated with water by dilution of its muriatic acid solution, and is also precipitated in connection with it, when the precipitant is used in excess. Sarphati does not say how much muriatic acid must be added to the liquor to be precipitated in order to avoid this evil. Neither does he mention whether the precipitate should be first washed with pure water or dilute muriatic acid. This negligence renders this method, which would, but for this, be very good, liable to gross error, as appears from the following experiments:—

First, 0.522 grammes chemically pure iodide of potassium, prepared from pure iodine and potash, is dissolved in water; the solution is acidulated with muriatic acid, and precipitated by the chloride of copper, prepared according to Sarphati; the precipitate is collected on a weighed filter, and washed with water as long as there is no further reaction with chlorine. After drying, it weighed 0.657 grammes, whilst, according to calculation, it should only have weighed 0.598. The precipitate, therefore, contains 0.059 grammes of chloride of copper thrown down with it (in part first by the washing with water separated on the filter), by which a mistake of 8.98% occurs in the iodine determination. A dilute muriatic acid was prepared that was not precipitated by a solution of chloride of copper. It has a sp. gr. 1.015 + 18.5°; in this acid the iodine combination was dissolved, and the precipitate of the iodide of copper first washed with it. In this manner no chloride of copper could exist in the precipitate; and the method would be so far correct if, unfortunately, the iodide of copper was not in some degree soluble in muriatic acid. Three experiments proved that an exact determination after this method is, on that account, impossible. A weighed quantity of pure iodide of potassium was dissolved in the above given muriatic acid; the solution



decomposed with Sarphati's chloride of copper added drop by drop until no further precipitate was thrown down; then the precipitate was taken from the weighed filter, and the strained liquor immediately tested with starch-water for iodine. There appeared no trace of colour. It was then washed with dilute sulphuric acid, and the washing gave a distinct iodine reaction. It happened, in one particular experiment, that the iodide of copper was insoluble in a mixture of chloride of copper and muriatic acid; but in dilute muriatic acid it is quite soluble.

It is, therefore, evident, from the method of Sarphati, that by washing with water the determination is, in all cases, too high; on the contrary, by washing in the muriatic acid, it must fall too low. The method of Lassaigne gave far more accurate results. According to him, the perfectly neutral solution of the iodine combination is precipitated by an equally neutral solution of nitrate of palladium; 100 parts of the washed and dried iodide of palladium correspond to 95.25 parts of iodide palladium free from water, and the latter contains  $70.34\%$  iodine. The following experiments show how accurate the method is:—Out of 0.886 iodide of potassium, in which there is 0.67628 iodine, 1.004 hydrated iodide of palladium was obtained, = 0.0593 anhydrous iodide of palladium, = 0.67267 iodine. Out of 0.914 iodide of potassium, which contains 0.69766 iodine, 1.030 hydrated iodide of palladium was obtained, = 0.98107 iodide of palladium, = 0.69009 iodine.

C. QUANTITATIVE ANALYSIS.—A quantity of weighed Cod Liver Oil is saponified in an iron crucible with caustic potash, the soap carbonised, and the carbonised mass, after cooling, dissolved in rectified spirit, put into a displacement apparatus stopped with wool, the extract evaporated, the residuum dissolved in water, the alkaline solution carefully neutralised with dilute sulphuric acid, then precipitated



with nitrate of palladium; the precipitate filtered, washed, dried at 100°, and weighed.

Thus is obtained out of—

	Hydrated Iodide of Palladium.	=	Iodide of Palladium.	=	Iodine.
590 Brown Cod Liver Oil . . .	0.260	=	0.24565	=	0.174197
645 Light brown Cod Liver Oil	0.391	=	0.37243	=	0.261966
591 Pale Cod Liver Oil . . .	0.330	=	0.31433	=	0.221096

There is therefore contained in the

Brown Cod Liver Oil . . .	0.0295 per cent. iodine.
Light brown Cod Liver Oil	0.0406 per cent. iodine.
Pale Cod Liver Oil . . .	0.0374 per cent. iodine.

## II.—*Bromine.*

According to Balard, the bromine is discovered in Cod Liver Oil in the following manner:—500 or 600 grammes of Cod Liver Oil were saponified with caustic potash, the soap carbonised, the fused mass extracted with alcohol, the spirituous extract evaporated, the residuum dissolved in water, filtered, and treated with chlorine gas. The solution is then shaken with ether, which colours it brown. It is then treated with potash ley, by which it is deprived of colour. This solution is dried, the residuum moistened with sulphuric acid, and heated in a retort. The fumes of iodine arise, which are condensed in the neck, and besides, distinct fumes of bromine, which colour brown the first water-drops condensed in the receiver. All three kinds of Cod Liver Oil, by a similar treatment, gave the same result; so that all pure Cod Liver Oil assuredly contains bromine, although in a very small quantity. The quantitative analysis was therefore, on that account, not persevered in, as there is no sufficiently certain method for the accurate separation of bromine and chlorine; neither did the method



of Berthelot<sup>1</sup> sustain the opinion which had been formed respecting it.

### III.—Chlorine.

A weighed quantity of Cod Liver Oil is saponified with chemically pure lime, the soap carbonised, and the fused carbon put with hot water into a displacement apparatus. The watery extract is concentrated, acidified with nitric acid, and precipitated with nitrate of silver; the precipitate washed, dried, and weighed. From this weight must be deducted the given weight of iodide of silver, for the quantity of iodine. The remainder is, therefore, chloride of silver, with a little bromide of silver; the latter is not to be further considered, but the calculation is to be made as if chloride of silver alone existed. From the small quantity of bromine existing, the error cannot be considerable. This analysis of chlorine cannot, indeed, be called perfectly accurate; however, it is quite sufficient for the end proposed.

The results obtained were the following:—

	Gave Precipitate.	Of which there was Iodide of Silver.	Remained Chloride of Silver.	In which there was Chlorine in- cluding Bromine.
54 Grms. Brown Cod Liver Oil	0·213	0·029	0·184	0·04593
32 Grms. Light brown ditto	0·230	0·024	0·206	0·05082
31 Grms. Pale ditto	0·209	0·022	6·187	0·04613

It contains therefore chlorine, including bromine.

The Brown oil . . .	0·0840 p. c.
The Light brown oil . . .	0·1588 p. c.
The Pale oil . . .	0·1488 p. c.

<sup>1</sup> The precipitation by nitrate of silver, the decomposition by sulphuretted hydrogen, the heating of the filtrates, the saturation with the carbonate of mercury, the treatment with a solution of chloride of lime, (by which only the chloride of mercury, but not bromide, is decomposed), the evaporation to dryness, and the solution of the residuum in rectified alcohol which takes up the existing bromide of mercury.



IV.—*Phosphoric and Sulphuric Acids.*

For the analysis of these acids a weighed quantity of Cod Liver Oil is saponified with caustic lime, free from sulphuric acid; the boiling soap is, however, decomposed by pure muriatic acid. After the whole has been boiled for a long time with an excess of muriatic acid, and frequently shaken, the acid fluid is taken up with a pipette, and filtered through a filter freed from sulphuric acid; then the separated fatty acids are boiled six times more with a quantity of dilute muriatic acid, until the separated fluid evaporates without leaving a residuum. The contents of the filter should be washed once with muriatic acid. The liquids are united, and now the phosphoric acid should be first estimated. A nitric acid solution is added to a weighed quantity of metallic iron, (from which by a separate experiment 100 parts require 44.189 parts of acid to be taken up to oxidise it,) and then ammonia in excess, by which phosphate of iron, together with all the oxide of iron in excess, is precipitated. The precipitate is filtered, washed with water, and dried together with the filter, the weight of which is noted, reduced to ashes in a platina crucible, and the residuum weighed.

From this, united with the washings and from one-third of the evaporated filtrate, the sulphuric acid is precipitated by the nitrate of baryta, the precipitate is allowed to settle for twenty-four hours collected on a weighed filter, washed, dried at  $100^{\circ}$ , and weighed. The results were the following:—

## BROWN COD LIVER OIL.

I. 40.096 grammes gave 0.514 oxide of iron + phosphoric acid, of which 0.493 oxide of iron; remains 0.0209 phosphoric acid: further, 0.016 sulphate of baryta, in which there is 0.0044 sulphuric acid.

II. 41.286 grammes gave 0.516 oxide of iron + phosphoric acid, of which 0.493 oxide of iron; remains 0.0229 phosphoric



acid : further, 0.014 sulphate of baryta, in which 0.00385 is sulphuric acid.

## LIGHT BROWN COD LIVER OIL.

I. 35.026 grammes gave 0.545 oxide of iron + phosphoric acid, of which 0.5161 oxide of iron ; remains 0.0289 phosphoric acid : further, 0.108 sulphate of baryta = 0.0297 sulphuric acid.

II. 35.666 gave 0.548 oxide of iron + phosphoric acid, of which 0.5212 oxide of iron ; remains 0.0268 phosphoric acid : further, 0.113 sulphate of baryta = 0.03109 sulphuric acid.

## PALE COD LIVER OIL.

I. 37.966 gave 0.5575 oxide of iron + phosphoric acid, of which 0.5220 oxide of iron, remains 0.0355 phosphoric acid : further, 0.100 sulphate of baryta = 0.0275 sulphuric acid.

II. 34.361 gave 0.5495 oxide of iron + phosphoric acid, of which 0.5190 oxide of iron ; remains 0.0305 phosphoric acid : further, 0.087 sulphate of baryta = 0.0696 sulphuric acid.

This gave in 100 parts.

	Phosphoric Acid.			Sulphuric Acid.		
	I.	II.	Mean.	I.	II.	Mean.
Brown Cod Liver Oil	0.0521	0.0552	0.05365	0.0109	0.0093	0.01010
Light brown ditto . . . . .	0.0825	0.0753	0.07890	0.0848	0.0871	0.08595
Pale ditto . . . . .	0.0940	0.0887	0.09135	0.0724	0.0696	0.07100

V.—*Phosphorus and Sulphur.*

De Brij is of opinion that the Cod Liver Oil contains phosphorus in an unoxidised state ; and since several kinds of animal fat contain phosphorus and sulphur, either free or combined with animal matter, the inquiry must therefore be directed to this point. A weighed quantity of Cod Liver Oil is oxidised by treating it with nitric acid. The



first experiment did not altogether succeed. In the cold the nitric acid evidently did not operate in any way on the Cod Liver Oil; as soon, however, as it was heated, such an escape of gas occurred that part of the contents was poured out of the vessel. The Cod Liver Oil must therefore be added in a small quantity to the nitric acid in a flask, and no more should be added till the reaction is over. Too great an effervescence is also prevented by artificial cooling. After the reaction is finished the temperature is gradually raised to the boiling point, and this heat is continued during twelve days, in order to compensate for the acid lost by evaporation, although it was discontinued during the nights. On the mornings of the second, third, and fourth days a small cake of fat floated on the acid, but which was immediately dissolved as soon as the heat was again applied. On the morning of the fifth until the eighth day a layer of oil appeared on the surface of the acid, which was also again dissipated. After twelve days the liquid was poured into a basin, and, after the flask was washed with nitric acid, it was reduced by evaporation to one-third.<sup>1</sup>

It does not immediately deposit; but after standing twenty-four hours the residuum was precipitated in a snow-white crystallised mass, sandy to the touch; to this water is added, and with the aid of heat a perfectly clear liquid is again obtained.

Being desirous of estimating the phosphoric acid in the above solution by saturating it with the solution of nitrate of iron, it became only brownish, and ammonia gave a like coloured precipitate; this is filtered and washed, and the

<sup>1</sup> If the evaporation is continued until still less nitric acid is present, a white substance is precipitated, which gradually becomes brown coloured. If it is carried still further, until no nitric acid fume is any longer evolved, there arises a very peculiar gas, smelling like oleic acid, (*acidum sebaceum*), exciting cough and a flow of tears. The brown residuum fuses easily and perfectly, and burning with a flame after the separation of the nitric acid, and concretes on cooling into a black mass of a repulsive odour.



filtrate is then evaporated; at last it becomes gradually of a blood-red colour, and reagents prove the existence of iron. The process now is somewhat different from the previous one. The sulphuric acid is first precipitated by nitrate of baryta from the blood-red solution, filtered, the filtrate together with the washings evaporated to dryness, the residuum heated to fusion, extracted with nitric acid; the rest of the iron is precipitated from this acid solution by caustic ammonia, in which it probably existed as cyanide of iron. The results were as follows:—

## BROWN COD LIVER OIL.

I. 43.963 gave 0.626 oxide of iron + phosphoric acid; later 0.007 phosphoric acid, of which 0.6012 oxide of iron, remains 0.0318 phosphoric acid: further, 0.013 sulphate of baryta = 0.003577 sulphuric acid.

II. 45.715 gave 0.621 oxide of iron + phosphoric acid; later 0.009 phosphoric acid, of which 0.5983 oxide of iron, remains 0.0317 phosphoric acid: further, 0.021 sulphate of baryta = 0.005778 sulphuric acid.

## LIGHT BROWN COD LIVER OIL.

I. 39.237 gave 0.558 oxide of iron + phosphoric acid; later 0.008 phosphoric acid, of which 0.522 oxide of iron, remains 0.044 phosphoric acid: further, 0.144 sulphate of baryta = 0.031366 sulphuric acid.

II. 40.300 gave 0.5365 oxide of iron + phosphoric acid; later 0.0100 phosphoric acid, of which 0.5032 oxide of iron, remains 0.0433 phosphoric acid. The estimation of the sulphuric acid did not succeed.

## PALE COD LIVER OIL.

I. 36.293 gave 0.565 oxide of iron + phosphoric acid; later 0.0065 phosphoric acid, of which 0.522 oxide of iron,



remains 0.0495 phosphoric acid: further, 0.098 sulphate of baryta = 0.02696 sulphuric acid.

II. 38.076 gave 0.570 oxide of iron + phosphoric acid; later 0.005 phosphoric acid, of which 0.5205 oxide of iron, remains 0.0545 phosphoric acid: further, 0.097 sulphate of baryta = 0.02669 sulphuric acid.

These two estimations gave therefore in 100 parts:—

	Phosphoric Acid.		Previous		Difference.	Phosphorus.
	Medium.	Medium.	Medium.	Medium.		
Brown Cod Liver Oil	0.0723	0.0693	0.07080	0.05365	0.01715	0.00754
Light brown ditto . . . . .	0.1121	0.1074	0.10475	0.07890	0.02585	0.01135
Pale ditto . . . . .	0.1363	0.1431	0.13970	0.09135	0.04835	0.02125

	Sulphuric Acid.		Previous		Difference.	
	Medium.	Medium.	Medium.	Medium.		
Brown Cod Liver Oil	0.0081	0.0126	0.01035	0.01010	+	0.00025
Light brown ditto . . . . .	0.0799	...	0.07990	0.08595	—	0.00605
Pale ditto . . . . .	0.0742	0.0700	0.07210	0.07100	+	0.00110

It follows, therefore, that in all Cod Liver Oil, besides the phosphoric acid, there exists still a small quantity of phosphorus in another state, which is not the case with regard to the sulphur.

#### VI.—*The Bases.*

Lime, magnesia, and soda are easily proved as to their qualitative existence by the usual reagents. In regard to their quantitative analysis a weighed proportion of Cod Liver Oil is carbonised in a closed iron crucible, and the carbon extracted with muriatic acid; then, first, all the phosphoric acid is precipitated by the nitrate of iron and ammonia in excess, the precipitate filtered and washed; the filtrate is decomposed by oxalate of ammonia, and set at rest in a warm place for twenty-four hours, from which the oxalate of lime is filtered, dried on a filter the weight of which is noted, and by fusion changed into carbonate of lime, out of which the lime is calculated. The filtrate should be



concentrated, united with the washings, and the magnesia precipitated by phosphate of ammonia as a double salt; the precipitate, however, collected on a weighed filter, which is noted, washed, dried, and by fusion changed into phosphate of magnesia, out of which the magnesia is calculated. From the contents of the filter with the washings, the phosphoric acid of the phosphate of ammonia added in excess, is first separated by nitrate of iron and ammonia in excess, the precipitate filtered and washed; the contents of the filter, however, with the washings, are then acidified with sulphuric acid, and evaporated to dryness in a weighed platina crucible; the residuum, however, is fused: as the Cod Liver Oil contains no potash, it is to be considered as sulphate of soda. Thus is obtained:—

Out of 104·650 Grammes Brown Cod Liver Oil.

0·152 Carbonate of Lime	= 0·0855	Lime	= 0·0817 p. c. Lime
0·011 Phosphate of Magnesia	= 0·0040	Magnesia	= 0·0038 p. c. Magnesia
0·043 Sulphate of Soda	= 0·0188	Soda	= 0·0179 p. c. Soda

Out of 98·313 grammes Light Brown Cod Liver Oil.

0·297 Carbonate of Lime	= 0·1671	Lime	= 0·1678 p. c. Lime
0·033 Phosphate of Magnesia	= 0·0121	Magnesia	= 0·0123 p. c. Magnesia
0·153 Sulphate of Soda	= 0·0670	Soda	= 0·0681 p. c. Soda

Out of 112·200 Grammes Pale Cod Liver Oil.

0·302 Carbonate of Lime	= 0·1700	Lime	= 0·1515 p. c. Lime
0·027 Phosphate of Magnesia	= 0·0099	Magnesia	= 0·0088 p. c. Magnesia
0·142 Sulphate of Soda	= 0·0622	Soda	= 0·0554 p. c. Soda

Potash was not discovered, for by testing the watery solution of the carbonised oil with chloride of platinum no precipitate was produced. In testing the watery extract in order to detect iron, the carbonised Cod Liver Oil is dissolved in muriatic acid, the acid solution concentrated by evaporation, and tested with sulphocyanide of potassium and ferrocyanide of potassium. In the light-brown and pale Cod Liver Oils there was no reaction; on the other hand, in the brown it



was slight; the latter also contained only a trace of iron, perhaps from the boiling of the livers in iron vessels.

## THE GENERAL SUMMARY.

100 parts of Cod Liver Oil contain,

	Brown.	Light Brown.	Pale.
Oleic acid with brown substance, (Gaduine and two peculiar bodies) . . . . .	69·78500	71·75700	74·03300
Margaric acid . . . . .	16·14500	15·42100	11·75700
Glycerine . . . . .	9·71100	9·07300	10·17700
Butyric acid . . . . .	0·15875	...	0·07436
Acetic acid . . . . .	0·12506	...	0·04571
Fellic and cholic acids, with some oleine, margarine, and bilifulvin . . . . .	0·29900	0·06200	0·04300
Bilifulvin and bilifellinic acid, and two peculiar substances . . . . .	0·87600	0·44500	0·26800
A peculiar substance, soluble in alcohol of 30° . . . . .	0·03800	0·01300	0·00600
A peculiar substance, insoluble in water, alcohol, and ether . . . . .	0·00500	0·00200	0·00100
Iodine . . . . .	0·02950	0·04060	0·03740
Chlorine with some bromine . . . . .	0·08400	0·15880	0·14880
Phosphoric acid . . . . .	0·05365	0·07890	0·09135
Sulphuric acid . . . . .	0·01010	0·08595	0·07100
Phosphorus . . . . .	0·00754	0·01136	0·02125
Lime . . . . .	0·08170	0·16780	0·15150
Magnesia . . . . .	0·00380	0·01230	0·00880
Soda . . . . .	0·01790	0·06810	0·05540
Iron . . . . .	a trace	...	...
Loss . . . . .	2·56900	2·60319	3·00943
	100·00000	100·00000	100·00000

If we compare these results with those which the analyses of the Cod Liver Oil by Spaarmann and Marder have afforded, it will be seen that the green soft resin and brown hard resin, the reddish-yellow viscous substance, the peculiar colouring matter, and the phocenic matter of the older authors are wanting; whilst these again recognise neither the component parts of the bile, the acetic and the butyric acids, nor the peculiar brown substance (gaduine).

These discrepancies are easily explained. Marder concludes from this that the solution of the watery extract of



Cod Liver Oil gives, with the infusion of galls, a reddish-yellow precipitate, insoluble in water, alcohol, and ether, from the contained lime, without noticing the fact, that in the Cod Liver Oil obtained spontaneously from the livers no lime whatever exists. In the brown boiled oil lime is certainly present; the resemblance, however, of the precipitate obtained from the watery extract of this oil, with that procured from the two other kinds of oil, shows it to be so much of the same nature, that even here the presence of lime may be doubtful. The soft resin of Marder is evidently nothing more than a mixture of the substances of the bile with some oil and margarine; and the hard resin soluble in alcohol consists simply of bilifulvin and bilifellinic acid. The substance C. from the watery extract is very like a black resin.

The peculiar colouring matter of former authors is assuredly nothing more than the brown substance, principally consisting of gaduine; and that the phocenic acid is only a mixture of butyric and acetic acids has before been shown to be probable.

No less difference exists in the analysis of the inorganic component parts. It has been sufficiently proved that the difficulty of discovering iodine can only arise from the employment of a wrong process, or of an impure oil. When Marder pretends that he found neither phosphoric acid nor phosphorus in a free state, the reason must have been that he never sought for it.

If we now turn to the comparison of the three kinds of Cod Liver Oil, it is shown, first, that the lighter kinds are richer in inorganic substance (as well as in iodine<sup>1</sup>), than the brown kind; whilst, on the contrary, the latter is richer in the component parts of the bile, butyric and acetic acids. In general, the light-brown and the pale oil agree in every respect, much more than the brown, by which it is

<sup>1</sup> Entirely opposed to the general opinion.



established that the light-brown is only a pale oil which has become old.

It is to be regretted that the gaduine cannot be estimated quantitatively, neither can a correct estimation of oleic acid be obtained, if we admit that the same quantity of gaduine is present in all three kinds. We must allow that the quantity of margaric acid contained (and also of margarin), is the same as the quantity of the oleic acid (and as also of oleine)—that the united mass of the fixed oils are nearly alike in all three kinds of oil. The admission, that the like quantity of gaduine exists in the three kinds of oil cannot be opposed on the ground of the difference of colour; for analysis has shown that the gaduine most probably is colourless, and under the influence of the atmosphere and heat, goes over in the coloured and insoluble modification. The great quantity of salts, iodine, and phosphorus contained in the light kinds of Cod Liver Oil, must be thus explained—that the richest oil when flowing off quickly, takes up and dissolves the smallest quantity of these substances contained in the livers; while on the other hand, the last oil, which comes off with the assistance of heat, appears to dissolve the substance of the bile somewhat more copiously.

With regard to the question why the brown oil contains more butyric and acetic acids than the pale? the answer depends on the fixed fatty acids becoming volatile, especially when in combination. We know that fresh butter contains only a small quantity of butyric, and it is invariably found in it when it becomes rancid. In every case the long operation of heat on the brown oil contributes to a more copious formation of volatile acids; perhaps, however, it was accidental that the kind of brown Cod Liver Oil under examination was much older than the lighter kinds.

The small portion of iron contained in the brown oil is



merely casual, and is derived from the iron kettles in which the livers are boiled or roasted.

In general, however, it appears from this chemical analysis, that the three kinds of Cod Liver Oil of commerce, so different in their appearance, perfectly agree in respect to the nature of their component parts, and that any variety existing between them is determined only by their quantitative proportions.

#### APPENDIX.

Whilst this was in the press, the Treatise on the "Ol. Jecoris Aselli, or Cod Liver Oil, as a Therapeutic Agent," &c., by John Hughes Bennett, (London, Edinburgh, Dublin, 1841, 8vo.,) was published. In this work we find some information on the source, origin, and preparation of the Cod Liver Oil, which is here given as a supplement, whilst the chemical part affords nothing whatever new, with this exception, that Wilson has also discovered iodine in the Scotch Cod Liver Oil.<sup>1</sup>

The species of gadus, which affords the Cod Liver Oil, observes Bennett, we, as well as G. Brosmé, have mentioned, comes from the Scotch coast. It is likewise their opinion that the Cod Liver Oil of commerce is, for the most part, procured from the different species of gadus. Bennett, without sufficient reason, makes four kinds of Cod Liver Oil, namely, —pale, yellow, red, and brown; according to him, it is difficult to find in France or England perfectly pure and clear Cod Liver Oil. That of the Paris hospitals, obtained

<sup>1</sup> B. Santen (Mechlenb. Medic. Carov. Bl. 1841. No 8), who considers the light brown the most powerful, found in 240 ounces of this sort,  $\frac{3}{4}$  grammes of iodine, the same quantity in 720 ounces of the pale, and in 360 ounces of the brown, as well as in 480 ounces of Newfoundland and South-Sea oil. B. Santen found in fat pork, iodine, which probably was derived from the common salt used in salting. From this circumstance, however, we would not exactly recommend roast pork as a substitute for Cod Liver Oil.



from the Bureau Central de Pharmacie, is thick, turbid, and dark-brown, of a nauseous taste. At Messrs. Le Bretons & Co., only, did the author find a clear yellow-red oil, prepared from the fish at St. Malo. In Edinburgh the red Cod Liver Oil of Newhaven is alone known (evidently the light-brown). In London the best of the Newfoundland oil is from Messrs. Jones & Co. A letter received from Dr. Faye, in Christiana, on the preparation of Cod Liver Oil in Norway, confirms altogether the original information contained above; he mentions also one obtained by expression, which turns out light-brown. The Irish Cod Liver Oil is procured by heating the livers in iron pots, and expressing the masses of oil collected in canvas bags. By once again heating the residuum, and expressing it, a darker kind is obtained. The Scotch fishermen, on the contrary, macerate the livers in cold water, cut them up, throw them in an iron pot with cold water, and apply heat only until the oil is separated, which being taken off, is purified by shaking with water. This oil is very mild, greenish, and thick as *Ol. Ricini*.<sup>1</sup> Donovan says, you may obtain a paler yellow oil, perfectly mild, agreeably tasted, not the least rancid, of sp. gr. 0.934, by heating the stock-fish livers with water in an iron pot, constantly agitating them, until they have assumed a pappy state, and the mass has obtained a temperature of 90°. It should then be strained through a cloth, allowed to stand twenty-four hours, the oil floating on the surface poured off, and filtered through paper. Donovan lays much stress on the freshness of the livers, which on being spoilt, might generate, under certain circumstances, poisonous properties.

So long, indeed, as it is left undecided to which constituent

<sup>1</sup> A notification made from Dr. Gonzee to the effect that in Antwerp a clear Cod Liver Oil is obtained from the exposure of the livers of the *Raya Pastinaca* to the sun. Delcour also mentions the Ray oil in the *Gaz. Med. de Paris*, 1841, No. 39.



part the Cod Liver Oil owes its efficacy, we would not advise the consideration of its agreeable qualities to be urged too far. A well-tasted Cod Liver Oil may be prepared in the above-mentioned manner, but it will be found wanting in the component parts of the watery extract (biliary matter), and probably also in the volatile acids, together with the gaduine. That poisonous properties are generated by the staleness of the livers is not probable; because by the constant use in Holland of the brown oil, which is frequently obtained from the stale livers, such an effect would have been observed. According to Meebold (Wurtemberg Correspond., Bl. xi. 259) the pale oil known to us, with few exceptions, is an extremely disagreeable brown oil bleached with chlorine and, therefore, less efficacious. It has a mild taste of good Cod Liver Oil. We cannot give our sanction to either of these opinions.

#### THE FORM OF PRESCRIBING THE COD LIVER OIL.

The unpleasantness in taking the Cod Liver Oil, particularly with children,<sup>1</sup> has been the cause of various plans being proposed for administering it. The correctives most recommended are lemon-juice, wine, and brandy; a portion of Madeira wine is particularly serviceable in disguising the taste of Cod Liver Oil. According to Bennett and Macfarlane, a small quantity of the ethereal oil of peppermint, aniseed, or cinnamon is best. And to correct the after-taste, a little liqueur (or a spoonful of crushed sugar, or some ripe fruit, &c.) may be given: peppermint drops usually excite eructations, and recal the taste of the oil. When the oil, in spite of everything, is thrown up, it should be given freely in the form of clyster in decoction of starch. In these cases, or where, for the reasons above-mentioned, it is inadmissible, the following forms may be useful:<sup>2</sup>

<sup>1</sup> They often take it very readily.

<sup>2</sup> Bull de Therap. xiii., 156.



## Syrupus Olei Jecoris of Duclou.—

Ol. Jecoris, ℥viiij.  
 Gummi acaciæ, ℥xij.  
 Aq. ℥xij.  
 Syrup. simp. ℥ij.  
 Misce, ft. Emulsio solvendo leni calore.  
 Sacchari ℥xxvj.  
 Cola et tunc adde.  
 Aq. Flor. Aurantii, ℥ij.

Cod Liver Soap of Deschamps,<sup>1</sup> obtained by the saponification of 600 grammes of Cod Liver Oil, with 80 of caustic soda, and 20 grammes of water. For internal use formed into a pill mass, with tragacanth, the pills dipped in honey, and rolled in tragacanth powder; externally as a liniment, with spirit, or as an ointment, with the addition of water and iodide of potassium. For external use, particularly in exanthema, it is combined with the acetate of lead, according to Brefeld, and is much prized :

Ol. Jecoris, ℥ss.  
 Liq. Plumb. Acet. ℥ij.  
 Vitellum Ovi.  
 Adipis suillæ, ℥iij.

When it can be given in its pure state, it is always best to do so; and it is as well, perhaps, on account of existing indigestion, not to combine it with the bitter infusions. The recommendation of Panck should not be neglected, to combine it with castor oil when it produces constipation; which, however, is seldom the case.—*German Trans.*

<sup>1</sup> Gazette der Hôpitaux, v., No. 49.



### SECTION III.

#### AN INQUIRY INTO THE MEDICINAL AND THERAPEUTIC PROPERTIES OF THE THREE KINDS OF COD LIVER OIL.

##### I. *Historical Notices of the Medicinal Use of Cod Liver Oil.*

IN the year 1771, Percival<sup>1</sup> was already acquainted with the Cod Liver Oil as a remedy in chronic rheumatism. Michaelis<sup>2</sup> further mentions that shortly after this period it was used with the greatest success in the hospital at Manchester by Ray and Bardsley. Katsenberger<sup>3</sup> also remembers to have heard from his father, a centenarian, that in the commencement of his professional career in Westphalia, it was known as a valuable remedy in gout. It is even now in many places mixed with red wine or brandy, and is used as a popular remedy under the name of gout-oil. Schenk has obtained for himself the merit of having first directed the attention of the profession to this remedy. This occurred in the year 1822, by the publication<sup>4</sup> of sixteen cases of chronic rheumatism which he had successfully treated with the Cod Liver Oil.

These cases, as well as twenty others which he published<sup>5</sup>

<sup>1</sup> Repertorium Chir. et Med. Abhandlungen, B<sup>d</sup>. 1, s. 298; Sammlung auserlesener Abhandlungen für praktische Aerzte. B<sup>d</sup>. 14, s. 350; Capuron, Bulletin des Sciences Médicales, T. 2, p. 439.

<sup>2</sup> Dierbach, die neuesten Entdeckungen in der Materia Medica, s. 274.

<sup>3</sup> Hufeland's Journal, 1824, st. 2, s. 3, and st. 5, s. 118.

<sup>4</sup> Ebend. B<sup>d</sup>. 35, st. 6, s. 31.

<sup>5</sup> Ebend. B<sup>d</sup>. 62, st. 3, s. 3. Praktisch Tijdschrift door Mollen Van Eldick, 5; Jaarg, 1826, p. 542.



four years later, established anew the virtues of the Cod Liver Oil in chronic rheumatism, and first excited medical men to examine for themselves what were the virtues of this medicine, the reputation of which since the year 1815 had been in vain bruited from the banks of the Rhine, from Westphalia, and from the mountains of Scotland.<sup>1</sup>

Of the above-stated thirty-six patients which Schenk treated, the greater part suffered from violent chronic rheumatism, for which every known remedy had in vain been prescribed, even to the use of the Cod Liver Oil. There are also cases of general and local rheumatism, some with contractions and impeded motions of the limbs, others of retrocedent rheumatism, which sometimes presents itself under the form of cardialgia, at other times appears as a violent rheumatic affection of the chest or bowels. Schenk tried it in rickets and other scrofulous affections, as well as in chronic rheumatism, and he relates, amongst others, a case of scrofulous caries which was perfectly cured by the Cod Liver Oil. Its efficacy in rheumatism, gout, and scrofulous affections were so fully established, that Schenk held it to be as specific in these diseases as quinine in ague, and mercury in syphilis. He preferred the light to the dark-coloured Oil.<sup>2</sup>

In the year 1823, when the Cod Liver Oil began to be more used by the profession, it was tried in the Charité at Berlin without success.<sup>3</sup> There is no doubt that the Oil could not have been genuine, for sometime afterwards<sup>5</sup> caries of the bones and other scrofulous affections were most successfully treated by the very same means.

<sup>1</sup> Medical and Philosophical Comment by a Society in Edinburgh, vol. vi. Part 1, p. 94. The Scotch also use the oil obtained from the livers of Ray-Fish (Raja Batis) Ebend.

<sup>2</sup> Ruft's Magazin für die gesammte heilkunde, B<sup>d</sup>. 18, heft 2, p. 360.

<sup>3</sup> Jahresberichte über das Charité-Krankenhaus, zu Berlin, 1832; Vom Strab-sarzt (Kukk), in Ruft's Magazin für die gesammte heilkunde. <sup>5</sup> B<sup>d</sup>. 43, Heft. 1, p. 52.



Two years later, in 1824, Günther,<sup>1</sup> after an experience of many years, confirmed the great success of the Cod Liver Oil in chronic gout, and remembers that it was owing to the great praise which in his youth he had heard bestowed on it, as a popular remedy, that induced him to use it. In the same year, Spiritus,<sup>2</sup> Monnig,<sup>3</sup> Kolkmann,<sup>4</sup> Schütte,<sup>5</sup> Hufeland,<sup>6</sup> and Wesener,<sup>7</sup> published their observations on the Cod Liver Oil. Spiritus, Wesener, Kolkmann, prescribed it only in chronic gout and rheumatism, whilst the others gave it also in rickets and other scrofulous diseases. Wesener relates a most remarkable case of the perfect cure of gout by the use of the Cod Liver Oil, in which every remedy had been in vain adopted for eight years, after which the disease was still at its height. A complete cure was then effected by taking four bottles of the Cod Liver Oil. The cases related by Schütte are also valuable. Five patients with confirmed rickets, and an equal number with extensive scrofulous caries, were in a short time cured by this remedy. It appears to have been also very useful in a case of fungus articularis in a scrofulous diathesis. Spiritus has never known, from his own observation, any injury to have occurred to the digestive organs.

In the same year Katsenberger prescribed it in the form of enema with the very best results.<sup>8</sup>

In the the year 1825 Van der Bosch published a work at Utrecht,<sup>9</sup> in which the Cod Liver Oil was again recommended. He used it by the advice of Dr. Bodel, of Dortrecht, who had

<sup>1</sup> Hufeland's Journal, B<sup>d</sup>. 59, st. 2, s. 3; Harles Jahrbücher, B<sup>d</sup>. 9, st. 1.

<sup>2</sup> Hufeland's Journal, B<sup>d</sup>. 59, st. 2, u. 5; Horn's Archiv. für Med. Erfahrung. Aug. 1824; Ruft's Magazin, B<sup>d</sup>. 16; Heft 3, s. 566.

<sup>3</sup> Ruft's Magazin, B<sup>d</sup>. 16; Heft 3, s. 567.

<sup>4</sup> Hufeland's Journal, B<sup>d</sup>. 59, st. 5.

<sup>5</sup> Horn's Archiv. für Med. Erfahrung, 1824, ss. 79, 92.

<sup>6</sup> Hufeland's Journal, B<sup>d</sup>. 58, st. 5, s. 74.

<sup>7</sup> Ebend.

<sup>8</sup> Ebend, B<sup>d</sup>. 59, s. 118.

<sup>9</sup> Geneeskundige waarnemingen, Utrecht, 1825, pp. 447—450.



for a length of time prescribed it with success in rickets, he gave it first in this affection in 1817, and when he had once proved its efficacy he never afterwards adopted any other remedy. This confidence in its use was established by the details of many cases of rickets which he had before treated by every means in his power without success, and which eventually had been cured by the Cod Liver Oil alone. In the same year it was also recommended by Rust,<sup>1</sup> Beckhaus,<sup>2</sup> Kirkhof,<sup>3</sup> and Osberghaus.<sup>4</sup> Rust cured a case of sciatica, which had been under treatment for seven months, and which had been supposed incurable. Beckhaus knew of gouty and rheumatic palsy cured by the Cod Liver Oil, and Osberghaus confirmed what Spiritus had mentioned, that it never injured the digestion except when it was given in too large a dose. He assures one also that it is only when the bowels have been constipated, that the evacuations are more frequent by its use, although the secretion from the skin and kidneys are more or less increased.

In 1826 Schenk published his second series of observations which was followed by three inaugural dissertations by Elberling,<sup>5</sup> Reder,<sup>6</sup> and Spaarmann.<sup>7</sup> In these dissertations, which contain the authors' own remarks, what has hitherto been known of the Cod Liver Oil, is also made the subject of comment. Elberling treated more particularly of the natural history of the different sorts of the genus *Gadus*; Reder, of the action of chemical re-agents towards Cod Liver Oil; and Spaarmann, of the chemical analysis itself. In the same year are also dated the observations of Alexander and Spitta. The

<sup>1</sup> Ruft's Magazin, B<sup>d</sup>. 20; Heft 3, s. 54.

<sup>2</sup> Ebend, B<sup>d</sup>. 20; Heft 3, s. 189.

<sup>3</sup> Geneeskundige waarnemingen, von Dr. van der Bosch, Utrecht, 1825, p. 147.

<sup>4</sup> Ruft's Magazin, B<sup>d</sup>. 20; Heft 3, s. 562; Hufeland's Journal, 1825, Sept. s. 131.

<sup>5</sup> Dissertatio Inauguralis de Oleo Jecoris Aselli, Berolini, 1826.

<sup>6</sup> Ibid, Rostochii.

<sup>7</sup> Ibid.



former published in the year 1832<sup>1</sup> the observations he had made in 1826, which proved the success of the Cod Liver Oil in chronic rheumatism; the latter discovered that not only this affection, but also gouty cholic, scrofulous coxalgia,<sup>2</sup> and incontinence of urine, could be cured by the use of Cod Liver Oil.

In 1827, à Roy<sup>3</sup> and van der Bosch<sup>4</sup> established its virtues in chronic rheumatism and rickets. The latter made known cases of scrofulous affections, amongst which was pædarthrocace, which Ludus had met with in the clinic at Kiel, and had cured with Cod Liver Oil.

In 1828 the virtue of Cod Liver Oil in rheumatism and rickets was extolled by Fehr,<sup>5</sup> Günther, and Gumpert.<sup>6</sup> Fehr used it frequently, and praised the rapidity of its healing powers in rickets, which often, after the space of fourteen days were already apparent; he was not however so successful in its use in gout and rheumatism as others had been. Günther, who in 1824 had recommended it in gout and rheumatism, now discovered its virtues in scrofula; Rumpert had also treated it in scrofulous abscess, with extreme emaciation, the patients being generally restored three months from the commencement of the treatment.

In the year 1829 it was recommended by Busch, not only in the slight cases of scrofula and in rickets, but also in exostosis and caries, with a scrofulous taint.<sup>7</sup> He remarked in all cases, in which there were affections of the bones, the results of repressed acute or chronic exanthemata that a cure

<sup>1</sup> Verhandeling over de Levertraan, door Dr. Galama, 1832, pp. 41—47.

<sup>2</sup> Das Medicinische Klinikum zu Rostock; Erster Bericht v. Dr. Spitta, 1826, s. 66.

<sup>3</sup> Nieuwe Verhandelingen der serste klasse van het königlijk Nederlandsch Instituut. Amst. 1827, 1 Decl.

<sup>4</sup> Med. Chir. Zeit. 1827, No. 90, s. 205.

<sup>5</sup> Verhandlungen der vereinigten ärztlichen Gesellschaften der Wurzburg, v. F. B. Friedreich, 1828, B<sup>d</sup>. 1, st. 1.

<sup>6</sup> Hufeland's Journal, B<sup>d</sup>. 66, st. 6.

<sup>7</sup> Busch Systematisches Repertorium, 1829, Heft 2, s. 193.



was effected after a sufficiently long perseverance in the Cod Liver Oil.

Fehr<sup>1</sup> also mentions that in this year he had remarked a greater success in rheumatism and gout than he had previously done, and Ameling<sup>2</sup> again recommends it in sciatica. Finally, Riecke<sup>3</sup> prizes it highly in the different varieties of hæmorrhage.

In 1830 some very important cases were published by Sattinger,<sup>4</sup> Hahnekrot,<sup>5</sup> Basse,<sup>6</sup> Kittel,<sup>7</sup> and Schupmann.<sup>8</sup> Sattinger restored in the space of fourteen days a girl of eighteen years of age, labouring under an obstinate attack of sciatica, which had lasted six months, and for which, besides moxas and the actual cautery, every remedy had been in vain tried. Hahnekrot dissipated a tumour of the testicle, and saw caries and softening of the bones similarly benefited. Basse cured a woman of forty-four of an abscess, who was nearly sinking from chronic rheumatism; a perfect cure of the rheumatism resulting. Kittel often observed that internal suppuration, and the consequent hectic fever, was subdued by the Cod Liver Oil. Schupmann finally mentions two cases of paralysis of the lower extremities from protracted labour, successfully treated. He remarks, however, in reply to Schenk, that this remarkable power belongs only to the brown-coloured oil, the light-coloured losing much of its virtue in its purification. In this year also Rust<sup>9</sup> mentions that he had given the Cod Liver Oil with the best success in diseases of the joints.

In 1832 Guerand<sup>1</sup> established its external use as a

<sup>1</sup> Hecker's Annalen, 1829, Juli.

<sup>2</sup> Hufeland's Journal, B<sup>d</sup>. 67, st. 5, s. 102.

<sup>3</sup> Neue Untersuchungen in Betreff der erblichen Neigung zu tödtlichen Blutungen, Frankfurt, 1829.

<sup>4</sup> Hufeland's Journal, B<sup>d</sup>. 71, st. 9.

<sup>5</sup> Sanitätsbericht des königl. Medic. Collegiums zu Münster, 1830.

<sup>6</sup> Ebend, s. 103. <sup>7</sup> Summarium, 1830, i. p. 63; ii. p. 444. <sup>8</sup> Ebend, ii. p. 366.

<sup>9</sup> Theoretisch-praktische Handb. der Chir., Berlinw Wien, 1830, B<sup>d</sup>. 2, p. 353.

<sup>1</sup> Horn's Archiv. für med. Erfahrung, Jahrg, 1831, Mai, Juni.



decided remedy in scrofulous eruptions. He cured tinea by rubbing in the Cod Liver Oil after he had unsuccessfully given it internally for a long period, and in one instance, for the space of one year.

In 1832 Knood von Helménstreit<sup>1</sup> published, besides two cases of rheumatism, successfully treated, his first case of coxalgia, cured by Cod Liver Oil. Although an abscess had formed, from which flowed daily from four to six ounces of acrid pus, still a complete cure was effected after quinine, rubia tinctorum, and asafœtida had been in vain tried. On the other hand he relates one case of gout, and another of softening of the bones in a soldier, in which the Cod Liver Oil was unsuccessfully given. This does not, however, diminish its virtues in rickets, for it does not follow that all diseases of the bones are true rickets. Should any doubts have existed as to its being the best antidote for rickets, they have been completely removed by the observations of Schmidt,<sup>2</sup> which were published this year. He treated twenty-one cases of scrofula, the greater part of which suffered from rickets. Of these twenty-one cases thirteen were completely cured, four were convalescent, and the remainder, which he had treated but a short time, exhibited the most promising appearances. With no less success Rhades prescribed it. Schmidt never knew the Cod Liver Oil injurious to the digestive organs, but on the contrary, without exception, it had in every instance a beneficial influence.

Lastly, Knood von Helmenstreit bestowed the greatest praise on the brown-coloured oil, in opposition to Schenk's opinion. The prize was this year awarded to the treatise of Calama<sup>3</sup> on the Cod Liver Oil, by the Society of Arts and Sciences at Utrecht.

<sup>1</sup> Hufeland's Journal, Bd. 74, st. 5.

<sup>2</sup> Ruft's Magazin, Bd. 35; Heft 1, s. 33.

<sup>3</sup> Calama, Verhandeling over de Levertraan, Utrecht, 1832.



In the year 1833, Heinecken<sup>1</sup> became an advocate of the light-coloured (purified) oil in scrofula. According to him, scrofulous patients suffering from emaciation and disorder of the digestive organs required this particular kind of oil, and he at the same time strongly recommends a strict regulated diet as necessary for those who are using this remedy for the cure of indigestion. In this year Hankel<sup>2</sup> was first made aware of the virtues of Cod Liver Oil in tubercular phthisis. In this year there also appeared an inaugural dissertation on the Cod Liver Oil, by G. A. Balin,<sup>3</sup> in which its efficacy in coxarthrocace was confirmed by his own experience.

In 1834, the observations of Moll,<sup>4</sup> Most,<sup>5</sup> Hacker,<sup>6</sup> and Münzenthaler,<sup>7</sup> confirmed what had already been known of the virtues of the Cod Liver Oil. Münzenthaler found it particularly useful in the cure of cardialgia and hemicrania, which had hitherto resisted all remedies.

In 1835, Richter<sup>8</sup> recommended the Cod Liver Oil not only in scrofulous, but also in non-scrofulous eruptions; he had prescribed it with the best success, especially in chronic eruptions, when it was given in sufficient doses (six to eight ounces daily) and persevered in sufficiently long. He also extolled it in tubercular phthisis, and declared the brown-coloured to be the most powerful, whilst to the light he denied any power whatever.

In this year there also appeared the first work which treated of the Cod Liver Oil in a more extended sense,

<sup>1</sup> Beobachtungen and Gefahrungen auf dem Wege der prat. Heilkunde, Bremen, 1833.

<sup>2</sup> Medic. Zeitung, 1833, No. 49, Beilage.

<sup>3</sup> De Oleo Jecoris Aselli, praesertim in coxarthrocace efficacia, Berolini, 1833.

<sup>4</sup> Moll en van Eldik, praktisch Tijdschrift, 1833, Jan., Febr.

<sup>5</sup> Allgemeine Med. Zeitung, 1834, No. 35.

<sup>6</sup> Med. Zeitung vom Verein für Heilkunde in Preussen, 1834, No. 30.

<sup>7</sup> Hufeland's Journal, 1834, st. 15.

<sup>8</sup> Med. Zeitung vom Verein für Heilkunde in Preussen, 1835, No. 26.



by Brefeld;<sup>1</sup> the former part, which contains its chemical composition, is somewhat superficial, while the latter, or medical part, is most elaborately written.

In 1837, Hanff<sup>2</sup> relates the history of a patient who had for a long period suffered from herpes, and had used in vain every known remedy, who was perfectly cured by the Cod Liver Oil. There appeared also a dissertation on the Cod Liver Oil by Potempa,<sup>3</sup> which afforded nothing new, but was merely a collection of those observations which had been already made known. It has been before mentioned that he discovered no iodine in Cod Liver Oil.

In 1838, Hafer<sup>4</sup> also bore testimony of its virtues in scrofulous phthisis, and Alexander relates the history of a severe affection of the lungs<sup>5</sup> which was cured by Cod Liver Oil, although he was not able to state with certainty whether tubercles existed or not. Smeets<sup>6</sup> also in this year proved that the combination of Cod Liver Oil with hydriodate of potash, rendered superfluous every other remedy in confirmed tubercular consumption. Richter,<sup>7</sup> who, in 1835, had before denied the power of the light-coloured oil, acknowledged that he had prescribed it this year with the very best success.

In 1839, Schenk again published<sup>8</sup> five extraordinary cases treated with Cod Liver Oil, amongst which was one of tubercular phthisis, which was cured. Pruys van du Hoven,<sup>9</sup> De

<sup>1</sup> Der Stockfisch-Leberthran in Naturhistorisch-Chemisch-Pharmaceutischer, Hinsicht, besonders aber seine Heilwirkungen in Rheumatischen und Scrophulösen krankheiten; Hamm. 1835.

<sup>2</sup> Wurtemb. Correspondenzblatt, 1837, B<sup>d</sup>. 8.

<sup>3</sup> Dissertatio Inauguralis de Oleo Jecoris Aselli, Lipsiae, 1837.

<sup>4</sup> Hufeland's Journal, B<sup>d</sup>. 86, Jan. s. 103; B<sup>d</sup>. 87, Aug. s. 106.

<sup>5</sup> Ebend., B<sup>d</sup>. 86, Jan. s. 5.

<sup>6</sup> Moll en van Eldik, prakt. Tijdschrift, 17 Jaarg. B<sup>d</sup>. 16.

<sup>7</sup> Vereins Zeitung, 1838, No. 33.

<sup>8</sup> Hufeland's Journal, B<sup>d</sup>. 18, Febr. s. 35, 39.

<sup>9</sup> De Arte Medicâ, lib. ii. part 1, p. 317.



Lavacherie,<sup>1</sup> and Tortual,<sup>2</sup> came forward as its advocates in scrofula.

Although in 1840 Donovan<sup>3</sup> mentioned nothing new, he, however, confirmed the virtues of Cod Liver Oil, as well as Dyk,<sup>4</sup> who recommended it as a decided specific against gout.

In 1842, there appeared two works on Cod Liver Oil. One a dissertation by Lubach,<sup>5</sup> and another entitled "A Physiological and Pathological Examination of the Operation of the Cod Liver Oil on the Animal System," by Klenke.<sup>6</sup>

[A great number of treatises and pamphlets on the Cod Liver Oil have been overlooked by the author. Whatever has been written on the subject up to the year 1840, has been carefully preserved by Riecke—"Die neun Arzneimittel, 2<sup>te</sup> Ausgabe, 1840," s. 537. The following publications have not been mentioned: Suringar, diss. de Oleo Jecoris Aselli, Ludg. Bat., 1824; Novati, diss. de Oleo Hepatis Aselli, Pavia, 1831; Volky, diss. de Oleo Gadi Morrhuæ, Pest, 1833; Stens, diss. de Oleo Jecoris Aselli, Bonn, 1841; Treatise on the Oleum Jecoris Aselli, or Cod Liver Oil, as a Therapeutic Agent, &c. By John Hughes Bennett, M.D., etc.; Lond., Edinb., and Dubl., 1841, 8vo.; Bredow, Ueber die Skrofelsucht, Berlin, 1843, s. 135 ff. Besides articles on the subject from the periodicals; Caron du Billards in Schmidt's Jahrbuch, B<sup>d</sup>. 5, s. 147; Kopp, Denkwürdigkeiten, B<sup>d</sup>. 4, s. 258—266; Thierfelder, Summarium, 1839, B<sup>d</sup>. 10, 8 heft; Knolz, Hufel Journal, 1839, st. 4, s. 94; Feldmann, Jahresbericht badischer

<sup>1</sup> Annales de la Société de Médecine de Gand, 1839, p. 123. Schmidt's Jahrb. B<sup>d</sup>. 29, s. 281.

<sup>2</sup> Moll en van Elbik, praktisch Tijdschrift, 18 Jaarg. Bl. 163.

<sup>3</sup> Dublin Journal, No. 51, 1840; Schmidt's Jahrb. B<sup>d</sup>. 29, s. 281.

<sup>4</sup> Dissertatio inauguralis de Rhachitide, Trajecti ad Rhenum, 1840.

<sup>5</sup> Dissertatio inauguralis de Oleo Jecoris Asselli, Groningæ, 1842.

<sup>6</sup> Der Leberthran als Heilmittel auf Grundlage vieler Thatsachen und Ber-suche an Thieren vom physiologisch-pathologikteschen standpun. Lpz. 1842.



Aerzte, 1836; Taufflieb et Priffard, *Gaz. Med. de Paris*, 1839, No. 44 et 45; and Schmidt's *Jahrb.*, B<sup>d</sup>. 27, s. 29; Beiel Casper's *Wochenschr*, 1839, No. 6; Rayé, *Annales de la Soc. des Sciences Nat. de Bruges*, 1839; Haller *Medic. Jahrb. des osterr Staats*, B<sup>d</sup>. 21, st. 1: Schwarz, *Heidelb. Medic. Ann.*, B<sup>d</sup>. 5, Hft. 2; Lion Gasper's *Wochenschr*, 1841, No. 4; Eichborn, *bair Medic. Correspondenzbl.*, 1842, No. 49; Baur in Hafer's *Archiv.*, B<sup>d</sup>. 1, heft 1; und *Würtemb. Medic. Correspondenzbl.*, B<sup>d</sup>. 10, No. 20; Hobeke Schmidt's *Jahrb.*, B<sup>d</sup>. 33, s. 136; Muller *Heidelb. Medic. Ann.*, B<sup>d</sup>. 3, heft 4; Dieffenbach. *Hufel Journ.* 1841, s. 99; Panck; Oppenheim's *Zeitschr*, B<sup>d</sup>. 20, heft 3; Stacquez, *Ann. de la Soc. de Méd. de Gand*, 1842, p. 133; Delcour, *ibidem*, 1841, and *Gaz. Med. de Paris*, 1841, No. 39; Meebold, *Würtemb. Med. Correspondenzbl.*, 1841, s. 259; Mayer, *Würtemb. Corresp.*, B<sup>d</sup>. 12, s. 171; Hinzl, *Zuricher Gesundheitsbericht*, 1842; Von Wirer (die Fette in Therapeutischer Hinsicht) *Verhandl. d. arztl. Gesellsch. zu Wien*, B<sup>d</sup>. 1, s. 414. Lastly, the new and valuable work of Haas (*Erfahrungen über die Wirksamkeit des Leberthrans*) in den *Medic. Jahrbüchern für das Herzogthum Nassau*, 1843, heft 1, s. 52—85. There should be also mentioned those who are sceptical of the efficacy of the Cod Liver Oil: A. Sachs in *Dulks' Dandw. der Prakt. Arzneimitt.*, B<sup>d</sup>. 2, Abth. 2, s. 693; Cramer in *der Nuen Zeitschr. für Geburtsk.*, B<sup>d</sup>. 7, heft 1; and Burchard in *der Medic. Centralzeitung*, 1841, No. 22.

Many more names might have been added to the number of authors already quoted, but as so much has been written on the subject of the Cod Liver Oil, and which has been so extensively circulated in all the periodicals, it would scarcely have been possible but that some names should have been omitted.

The following works I have seen quoted, but have never read them:



Dissertatio inauguralis de Oleo Jecoris Aselli, auct. Weber, Ratisbonae, 1831.

Dissertatio inauguralis de usu Olei Jecoris Aselli medico, auct. Buyze, Ludg. Bat. 1824.

Heilbellerger, meb. Annalen. Bd. 6, heft 3 (Puchett u Falker).

Ibid. heft 4 (Osius).

Dr. Segni zu Gelnhausen. Der Berger. Leberthran in seiner Lichtund Gehattenseite. Summarium, 1841, s. 41.

Häfer's Archiv. Bd. 11, heft 1 u 2 (Rosch).

Gine Abhandlung über den Leberthran von. v. Santen im sonversat Blatte des me burgischen ärztlichen Bereins, 1841, s. 105.

As the plan of this work has succeeded so far in affording a practical history of the Cod Liver Oil, and in furnishing materials for the settlement of the question, which oil is the best, it would be useless to bring forward the whole of the contents of all the late works in the following pages, from which the reader would profit but little. The more important observations and interesting results, however bearing on the merits of the case, will be added in notes to each separate division of the following section, in order that we may give a perfect synopsis of all the essential points.—*German Trans.*



II.—*On the Diseases in which the Use of the Cod Liver Oil is recommended.*

Before I bring forward my own comparative observations, it would appear necessary, for the sake of perspicuity, to mention the diseases in which the Cod Liver Oil has been prescribed by others with success—and so much the more as in the comparison which I have instituted on the three kinds of oil, I have not had the opportunity of employing this remedy in all cases in which its virtues have been extolled.

*Rheumatismus Chronicus.*—All medical men agree in extolling Cod Liver Oil as a remedy in chronic rheumatism. Alexander, Knood von Helmenstreit, Rust, Amelung, à Roy, Brefeld, Basse, Fehr, Calama, Molt, Mönig, Münzenthaler, Michaelis, Osberghaus, Schenk, Schütte, Sattinger, Spitta, Wesener, in short, all who have made known the results of their observations, concur in the opinion that this remedy in its efficacy in chronic rheumatism is not only superior to any other, but surpasses them all, the most hitherto celebrated anti-rheumatic remedies not excepted.

This opinion is not founded on mere assertion, but it is established by innumerable cases of undoubted cure, in which patients had suffered many years from rheumatic disease, and after in vain trying every means, had eventually been restored by Cod Liver Oil.

[We should not, however, fail to mention here, that Delcour is opposed to the fact of rheumatism being cured by Cod Liver Oil; this, however, only proves that the diseases of the spine and vertebræ may often be mistaken for rheumatism. Segnitz thinks that the Cod Liver Oil can afford relief only in those cases where no deposit or change has taken place in the periosteum. Haas is of opinion, after the experience of forty-two cases, that the virtues of the oil are much more limited in



rheumatism than in scrofula. In general fever, Cod Liver Oil is contra-indicated, not however in that form of fever which is the consequence of local inflammation. The oil generally relieves most where rheumatism exists in a scrofulous diathesis, or in a cachectic habit of body. The external use of the Cod Liver Oil will also be found very beneficial.]—*German Trans.*

*Ischias Rheumatica.*—This form of chronic rheumatism requires to be mentioned on account of its usual obstinacy, in which the Cod Liver Oil is as powerful as in the other forms, as the observations of Knood von Helmenstreit, Rust, Amelung, Münzenthaler, Sattinger, and Spitta, sufficiently attest.

*Cardialgia and Hemicrania.*—Münzenthaler cured both these affections in the same patients with the Cod Liver Oil; they are both, without doubt, symptoms of chronic rheumatism.

*Prosopalgia Rheumatica.*—In the last century, Conspruch<sup>1</sup> prescribed with success the Cod Liver Oil in this severe form of rheumatism, although at that time it was only known as a favourite popular remedy.

*Arthritis Chronica.*—On the efficacy of the oil in this disease, the profession is not agreed. Many, it is true, allow that it has the same power in gout as in rheumatism; and Osberghaus considers it of more value in gout than in the latter disease (which opinion Osius also shares); still there are some who do not think so, and deny to the Cod Liver Oil all power over this disease. Beckhaus, Fehr, Günther, Hacker, Katsenberger, Kolkman, Mönning, Osberghaus, Schenk, Schütte, Spiritus, Spitta, recommend it in gout as strongly as Knood von Helmenstreit and Brefeld oppose it.

[Delcour and Taufflieb will not allow that it has any virtue in gout. Segnitz and Haas have only seen good results from

<sup>1</sup> Taschenbuch für angehende Aerzte, 1796. Th. 2.



it when it was unattended by sweating ; the latter, however, has witnessed its efficacy, after a perseverance in its use during the space of a year, certainly assisted, in some measure, by the baths of Wiesbaden. However, he does not find it very powerful in the removal of the enlarged absorbent glands, the oil acting only in correcting the mal-assimilation of the food. Von Wirer, on the contrary, prized it exceedingly in gout.]—*German Trans.*

As these opinions are so directly opposed to each other, they cannot both be right ; but, as satisfactory evidence of the virtues of the Cod Liver Oil in gout is still wanting, we should examine, in a rational manner, which opinion is the most likely to be correct.

In the first place, we find that eleven medical men have been induced, by their own observations, to recommend the Cod Liver Oil in gout. Two, on the other hand, supported the opposite opinion ; it was not to be supposed that these eleven had been in fault—that two had been correct ; although we cannot deny that rheumatic inflammation of the joints has by many physicians been mistaken for gout. We further observe, that Knood von Helmenstreit has found the Cod Liver Oil as efficacious in the different forms of gout, among which he very properly includes chronic gout, contractions, chronic swellings and pain, which he considers only as the consequences of gout, as in chronic rheumatic affections. There are also two cases of true gout which Brefeld mentions, in which he prescribed the oil unsuccessfully, for these reasons—that one patient did not persevere in its use, and, in the other case, the medicine was probably not taken regularly, or its favourable operation was influenced by some undiscovered cause. It is surprising that Brefeld, being so convinced of its utter inefficacy in gout from these two unsuccessful cases, did not think it necessary to institute further experiments with it. Lastly, we should add, that Brefeld in his late



work relates three cases of rheumatismus universalis treated successfully with the oil; the first case excepted, in which its use had been suspended; but as all these cases appear to have borne the character of gout, it is but natural that we should look upon the opinion of Knood von Helmenstreit and Brefeld as incorrect.

There may be, however, doubtful cases which are considered gout, and in which the oil is found to be altogether nugatory. When this occurs, it will be found that there exists some other disease, or a complication with some other affection. This very circumstance I observed myself in the hospital at Utrecht, where a woman suffered the most severe symptoms of gout. After she had taken the oil for a long time without success, she was again examined, and the treatment being again recurred to by Zittmann, she was perfectly cured. These cases occur oftener than is imagined, and frequently lead the most experienced into error.

*Paralyses Rheumaticæ sive Arthriticæ.*—I understand by this, that immoveability of the limbs, which is so often observed as a symptom of chronic rheumatism or gout, and in which, by the swelling and stiffness of the muscles, the tendons and ligaments become affected. This will be cured by the oil as long as no change has taken place in the cellular texture, in the tendons and muscles, or that no ankylosis exists. Under this name is also included true palsy, the consequence of a nervous affection, which is brought on by atmospheric influence, a common chill. The Cod Liver Oil is as efficacious in this disease, of which Brefeld gives some cases, as it is in every other nervous affection.

We thank Brefeld for this distinction; and there is no doubt that all cases of rheumatic palsy which have been cured by Cod Liver Oil, and mentioned by Beckhaus, Reinhart, Schenk, Schutte, and Spitta, are to be considered of this



spurious kind of palsy, since not a third of these two perfectly different kinds are supposed to exist. Again, when atmospheric influence, as cold, can bring on first a nervous attack, and then produce palsy, may it not also in rheumatic diathesis bring on rheumatism in the sheaths of the nerves, which are of a fibrous nature? When this is the case, is it not possible for swelling of the sheaths of the nerves, causing pressure on the nerves, to cause palsy? This kind of palsy can, with reason, be called rheumatic, which is caused by a truly secondary abnormal affection of the nerves; and in this the Cod Liver Oil is to be considered most powerful, when the case has not lasted too long, and when there exists no permanent lesion in the diminished space of the spinal sheath.

Here should be mentioned a communication which was made by Alexander at the assembly of Natural Philosophy, which was held at Strasburg in 1842. Aronsohn himself praised the virtues of Cod Liver Oil in paraplegia, the consequences of the affection of the theca vertebralis, and mentioned two cases which confirmed its great success. Stöber, Ubersaal, and Erdman, eulogised it for its great value in the treatment of chronic rheumatic affections. Stöber mentions at the same time the difficulty of discriminating between the affection of the meninges and the spinal marrow itself, on which point Aronsohn expresses himself more accurately.

[In opposition to the above-mentioned evidence, which without doubt is borne out by these numerous observations, Puchell speaks of a case of true palsy of the lower extremities (Heidelb. Med. Ann., Bd. 6, Heft 3), the consequence of onanism, which was cured by Cod Liver Oil. Osius gives similar cases to Aronsohn.]—*German Trans.*

*Diathesis Scrophulosa.*—Although there are very many cases in which the remarkable virtues of the Cod Liver Oil in the most severe form of confirmed scrofula is established, still there are wanting those to prove its efficacy in the true



scrofulous diathesis. This has not arisen, because the Cod Liver Oil has not been brought into use in this diathesis, but rather because authors are in the habit of making known only their most severe and serious cases.

Still, we are of opinion that the scrofulous diathesis is the basis on which, under the operation of unfavourable causes, the numerous and often dangerous forms of scrofula are developed, and that the Cod Liver Oil is almost an acknowledged specific in all, even in the severest forms; it is evident, therefore, that a remedy such as this, which has the power of correcting that disposition, is invaluable.

Brefeld, after having described the scrofulous diathesis, with regard to the operation of the Cod Liver Oil, says, "The Cod Liver Oil eradicates completely the first trace of scrofulous disease, and removes the disposition when it is not hereditary; which, when it is, it only alleviates to a certain extent. It also prevents the development and formation of disease, and accomplishes more than any other remedy." Calama also observes that the Cod Liver Oil is more efficacious in the scrofulous diathesis than in its more developed form.

[Bredow had not, however, seen any effect produced even in the very cases so much extolled by Brefeld, without, however, having had reason to doubt the activity of the oil. Segnitz explains himself very distinctly and decidedly on this point, that he has given the Cod Liver Oil in the newly established disease, in slightly scrofulous diathesis, or only on the supposition of an hereditary disposition, and even to children as a prophylactic. By its use the formation of scrofula may often be produced, and in young children it may bring on atrophy; in these cases the teeth were invariably decayed.]—*German Trans.*

*Scrophulosis perfecte Evoluta.*—I would here particularly state what power the Cod Liver Oil possesses in the individual forms, among which the perfectly developed scrofula



enters. I may, however, previously mention, in the words of Brefeld and Kopp (for I shall only relate a few), what is the virtue of the Cod Liver Oil in this disease. Brefeld says, "There is no remedy which at all approaches the Cod Liver Oil in its therapeutic properties in scrofulous disease, it is an undoubted powerful medicine, operating in a peculiar specific manner, and affording relief where, to all appearance, and according to former experience, it was beyond the reach of medicine." Kopp says, "The first time the Cod Liver Oil is prescribed for a scrofulous patient, its favourable effects are soon apparent, and which can alone be attributed to its use, frequently acting in a truly wonderful manner. It is especially efficacious in scrofula which has not existed long—it effects a change in the general appearance, the cachectic colour is lost, the flabby flesh becomes firm, the chain of swollen glands diminish and separate, ulcers and even fistulas put on a healthy character and heal. The enlargement of the epiphyses of the bones becomes less visible. I even found that scrofulous caries was, by its use, brought to a favourable issue."

All who have prescribed Cod Liver Oil in every form of scrofula, have publicly and unanimously acknowledged its virtues, and bestowed upon it the highest praise, which has secured it the first place amongst anti-scrofulous remedies. [Wirer and Haas have also witnessed the most splendid results from it. Stacquez and Bredow's experience is altogether opposed to this. Krenzwald also, in his translation of Negrier, on the treatment of scrofula with walnut leaves, relates many cases of an unsatisfactory nature. Bennett also remarks that a difference should be made between the florid and atonic scrofula; in the latter the oil is of essential service, whilst in the former it is not by any means so efficacious.]—*German Trans.*

We shall now consider the operation of the Cod Liver Oil



in the individual forms of disease. I shall begin with the simple cases, and proceed to the more dangerous and severe forms.

*Intumescencia Glandularum Lymphaticarum.* — Scrofula exists more frequently in the internal lymphatic glands; for instance, in the mesenteric, it comes on generally in infancy, and is attended with that general emaciation, which is called atrophy of infants. This disease, however, belonging as it does to the more severe scrofulous affections, will be treated of later; what comes under this head is only the swelling of the lymphatic glands which lie immediately under the skin, in the neighbourhood of the throat, neck, axillæ, and inguinal regions. These swellings of the subcutaneous glands are for the most part connected with the severe forms of scrofula. They, however, sometimes appear alone, and are then dependent on the scrofulous diathesis, are considered the first and infallible symptom of the perfectly developed scrofula, and often the precursor of the more severe forms. These swellings, after some time, form hard, uneven, immoveable, insensible tumours, which becoming sensible and inflamed, the surrounding cellular membrane and the superjacent skin itself runs into inflammation. The Cod Liver Oil is a certain and undoubted remedy in this form; but, in order to correct the scrofulous disposition, and to effect a perfect cure, it must be given for a long period. Its internal use can be much assisted by its external application, by rubbing it in on the inflamed and painful tumours, although this method of application is by no means to be substituted for the internal use. The Cod Liver Oil proves itself as efficacious in the scrofulous swelling of the lymphatic glands, as it appears powerless when this occurs as the sequelæ of small-pox, scarlet fever, and measles, or in the syphilitic or carcinomatous taint. In those cases, when the swelling of the lymphatic glands arises in non-scrofulous



eruptions of children, which, on account of its peculiar quick dispersion, was named by Sauvage, the flying scrofula (*scrofulæ fugaces*), the external, and not the internal, use should be adopted. [Haas has remarked very little improvement result from the use of the oil in the so-named indolent scrofulous glandular swellings: he was in the habit of combining with it the external application of iodine. According to Bennett, also, among all the forms of scrofula, the Cod Liver Oil was less successful in external glandular affections, particularly when no ulceration had as yet set in. On the other hand, the Cod Liver Oil is especially powerful, according to the general received opinion, in atrophy combined with the swelling of the mesenteric glands.]—*German Trans.*

*Ulcers Scrofulosa.*—The effects of the Cod Liver Oil are more quickly remarked in scrofulous ulcers than in the above-mentioned swellings of the lymphatic glands, which are often large, flabby, with inverted edges, and most difficult to heal. They are produced by the swollen glands which inflame and suppurate, or from other swellings which are often found in all parts of the body in scrofulous constitutions, and which gradually increase, and run into suppuration. Another cause of scrofulous ulcers arises from wounds and other injuries received by those in whom the scrofulous idiosyncrasy is already perfectly developed. A remarkable example of this kind will be mentioned in the following chapter. The internal as well as the external use is recommended in scrofulous ulcers. Brefeld prescribed an ointment for this purpose, which, with the addition of the acetate of lead, is applied to the ulcer.<sup>1</sup>

However, in the cases treated by us, the Cod Liver Oil was taken internally only, with the best effects. Scrofulous

<sup>1</sup> R. Ol. jecor. aselli, ʒβ  
Acet. saturn. ʒij  
Vitell. ovi. s. Adip. suill. ʒ iij  
M. D. S. for external use.



swellings, as I have before mentioned, are to be altogether discriminated from the simple swelling of the glands; these, however, will be equally cured by the oil, when prescribed at the proper moment, before they go into ulceration, although they are healed even when in this state. Brefeld and Gumpert declare that these ulcers are gradually improved, and then dried up by the internal, as well as the external use of the Cod Liver Oil. [Haas has seen the best results from the external use of the Cod Liver Oil in the above ulcers of the extremities, and from other causes, as, for example, after scabies, burns, and in consequence of abdominal plethora. Scrofulous ulcers were invariably cured.]—*German Trans.*

*Exanthemata Chronica.*—In scrofulous habits chronic exanthemata assume a scaly, furfuraceous, pustular and vesicular character, and which we find arising in those in whose present or former appearance only a slight trace of scrofula could be detected. It is, therefore, difficult to determine what is generally understood by scrofulous eruptions. In my opinion there is no eruption which especially deserves that name, as we may give that appellation to every eruption, under whatever form it may exist, where the habit and the previous state of the patient shows that the eruption depends upon a scrofulous diathesis. In these last eruptions, whether on the scalp or other parts of the body, the Cod Liver Oil is as powerful as it is in every other kind of developed scrofula.

Some have prescribed it internally, while others have done so externally with the best success. The external use was first tried by Guérard in tinea favosa; it was especially recommended by Brefeld, who at the same time observes, that the internal use of the Cod Liver Oil is not efficacious in scrofulous eruptions; in the so-called milk scab, which so often occurs in well-nourished infants, without any symptoms of scrofula, and which Brefeld considers as the transition to the true scrofulous eruption; further, an eruption, which is



observed in the earlier years of infancy on the scalp, and mostly consists of pustules, which, running together, form scabs, and which cover not only the scalp, but often the whole face (in Germany this eruption is called haarwurm, in Holland daauworm); again, the tinea favosa, which often lasts until puberty—in short, Brefeld has seen all the scrofulous eruptions, in whatever part of the body they appear, cured by the external use of the Cod Liver Oil, and, indeed, in some, after they had taken it internally, without benefit. Brefeld has shown by experience that the internal, as well as the external use of the Cod Liver Oil, is inefficacious in tinea maligna, hereditaria vel contagiosa, even when combined with the oil of turpentine, as Martens<sup>1</sup> advises. Its inefficacy in psoriasis and syphilitic eruptions has also been shown.

Hauff<sup>2</sup> relates a case of a severe irritable humid tetter, which for a long time had resisted all remedies, which was, however, cured by the local application of the Cod Liver Oil; it is not mentioned, however, whether its internal use had been tried.

Brefeld's experience is opposed to that of Richter's,<sup>3</sup> that the internal use of the Cod Liver Oil is inefficient in chronic eruptions. After this manner he has cured not only the scrofulous eruptions, but declares that he has also given it with success in non-scrofulous exanthemata, and even in chronic scabies, in dyscrasia furunculosa, as well as syphilitic eruptions. Before, however, it is proved by future experience whether in those cases which had been taken for scabies, and cured by Cod Liver Oil, the acarus scabies was actually present, and that the eruptions in those who had suffered from syphilis were truly syphilitic, or connected with it, we

<sup>1</sup> Annalen für die gesammte Heilkunde unter der Redaction der Mitglieder der gross herzogl. Badischen Sanitätscommission, Jahrg 11, Heft 2.

<sup>2</sup> a a O.

<sup>3</sup> Ibid.



consider the therapeutic powers of the Cod Liver Oil in psoriasis and syphilitic eruptions, taking into consideration what we have before said of the scrofulous eruptions in general, highly problematical. It is, however, established beyond all doubt by the observations of Richter, that the internal use of the Cod Liver Oil has proved itself successful in the scrofulous exanthemata; we should, however, observe, that Richter gave it in large doses in chronic eruptions,  $\text{ʒvj}$  to  $\text{ʒviij}$  daily, in which doses Brefeld never prescribed it.

Schenk<sup>1</sup> also relates a case of herpes faciei, vesiculosus crustaceus, ulcerosus, from which the patient had suffered for many years. At the commencement, the internal use of the Cod Liver Oil produced an aggravation of symptoms; still, after a perseverance of four months, a perfect cure was effected. It is to be regretted that Schenk never mentioned whether the usual method or that of Richter's had been adopted.

Haas has met with the best success in the generality of cases of chronic eruptions, particularly in psoriasis, herpes, porrigo scutulata and decalvans, occurring as the sequelæ of scabies, or as the consequence of syphilis, with the Cod Liver Oil, assisted, in some measure, by the baths of Wiesbaden. Although the acne rosacea in women at the age of puberty was not benefited, the scrofulous eruptions, in general, were, for the most part, cured. [Haas, however, remarks on this, that the external use of the Cod Liver Oil should never be commenced in the exanthemata, until its powers, when internally given, have been ascertained, as it will then only act as a palliative, and the eruption will be disposed to return. Klencke and Rosch are of the same opinion.]—*German Trans.*

In our treatment of a humid tetter (the history of which is contained in our first list of comparative observations), we

<sup>1</sup> Hufeland's Journal, B<sup>d</sup>. 88, Febr. 1839. a a O.



combined the internal with the external use, and with such excellent results, that in the space of three months the cure of the eruption, which had lasted ten years, was perfected.

*Ophthalmia Scrophulosa.*—We have a few observations to make on the virtues of the Cod Liver Oil in this form of decided scrofula, which, however, relate more particularly to blepharophthalmia (inflammation of the eye-lid); all, however, showing the very best results. Schutte<sup>1</sup> relates a case of caries, with blepharophthalmia and intolerance of light, in which the inflammation of the lids and the intolerance of light were cured ten days after the commencement of the treatment. The same happy results attended the internal use of the Cod Liver Oil (four to five ounces daily) in all cases of conjunctivitis corneæ, in which Ammon<sup>2</sup> prescribed it, in spite of the dyscrasia, on which he considered the inflammation depended. Brefeld, who prescribed the Cod Liver Oil only in inflammation of the lids with intolerance of light, not having had the opportunity of observing its effects in scrofulous conjunctivitis, extolled its external use even in this form. His method is to besmear the edges of the lids with the pale oil twice or three times a day, with the aid of a camel-hair pencil, or a small feather. Two cases out of the twelve did not terminate favourably, the oil not being persevered in, in consequence of erysipelalous inflammation of the eye-lid occurring, which, however, he did not consider was produced by the oil. Generally, however, it appeared to him that the virtues of the oil in inflammation of the lids were more to be depended on in chronic than in acute cases.

At the Congress of Strasburg, Bertini asserted that, according to a communication made by Alexander, the use of Cod Liver Oil was, in Italy, confined to cases of tinea capitis.

[Two cases of inflammation of the eye-lids, with acute

<sup>1</sup> a a O.

<sup>2</sup> Zeitschrit für die Ophthalmologie, B<sup>d</sup>. 1, Heft 3.



conjunctivitis and corneitis chronica—the results of scrofulous affections—are contained in this chapter, which were cured by the internal use of the Cod Liver Oil. Caron du Billards prescribed the Cod Liver Oil externally, with success, in chronic inflammation of the conjunctiva, with specks on the cornea. Ammon gave it internally, with the very best results, in obstinate inflammation of the cornea, with disposition to degenerate into pannus, even when the origin was not strictly scrofulous. Haas has cured even chronic ophthalmia with Cod Liver Oil. Bennett has done the same. Meebold, in one case, was unsuccessful.]—*German Trans.*

*Atrophia Infantum.*—Amongst the severe forms in which scrofula is met with in infancy, belongs principally that which is known by the name of scrophula miseraica, or, on account of the general emaciation which necessarily prevails, atrophia infantum. In this disease, from which the lowest class of people in our northern districts suffer, and which destroys so many children, the mesenteric glands are in the same state as the subcutaneous lymphatic glands are found in scrofula. It is not, therefore, to be wondered at, that, in the disordered state of the system by which the assimilation of the chyle and the component parts of the blood are formed, the assimilation and blood itself, and, as a natural result, the nourishment of the body, should be affected. This happens in no form of scrofula so much as in this; and it is produced in consequence of the food which is given to the children, and which is so injurious to their digestions. Old features, hollow eyes, pale and grey skin, which hang in wrinkles on the scarce-covered bones; flabby, powerless muscles; the belly swollen, often very hard, and sometimes allowing the enlarged glands to be felt through the abdominal parietes, craving for farinaceous food and mealy vegetables, which they devour with true voracity, which are, however, always badly digested, and the consequences of which are sour eructations, flatulence, and



often vomiting. Hectic fever, which is characteristic of this frightful form of scrofula, generally accompanies these symptoms. It would appear improbable that the Cod Liver Oil is so efficacious in these affections, did not the observations of Brefeld, Tourtual, Calama, Hinecken, Heyfelder, Kopp, Schmutt,<sup>1</sup> as well as my own, go to prove that very many cases had been cured which were considered hopeless. Brefeld says: "Cod Liver Oil cures this affection in all stages where the powers of life have not been reduced too low. Care, however, should be taken that it should not be confounded with other forms of disease, as ulceration of the bowels, dropsy, &c. By its valuable aid, it has often happened that I have been enabled to snatch from the yawning grave the little sufferer."

Internally is the usual method of giving the Cod Liver Oil in this form of scrofula, although Brefeld asserts that the external application, namely, the daily often-repeated rubbing in on the tumid belly, accelerates the cure. Should the belly be tender or painful, the rubbing should be made with the oil, moderately warmed. If, however, it is not very sensitive, he recommends a camphorated liniment to be prepared, in which Cod Liver Oil is to be substituted for common oil.<sup>2</sup> In the use of the Cod Liver Oil in the atrophy of children, we must recollect (which Brefeld also mentions); that, now and then, acute affections of the bowels occur—which are known by fever and other local symptoms. In this case, the Cod Liver Oil is discontinued until, by leeches and other suitable remedies, this irritation is removed; it can then be again commenced with the like probability of success.

[Klencke and Rosch do not recommend the Cod Liver Oil in children of too tender an age; the former pretends to have seen from the use of the Cod Liver Oil before the end of the seventh month an aggravation of symptoms, and a

<sup>1</sup> a a O.

<sup>2</sup> Ibid., p. 133.



disposition to atrophy brought on. Segnitz also comes to the same conclusion. Haas, however, in some particular cases of scrofulous eruptions, has given it to very young infants, one teaspoonful night and morning without any injury.]—*German Trans.*

*Rachitis.*—Another form of scrofula very commonly accompanies the atrophia infantum, which consists of a softening and enlargement of the bones. If to the symptoms of atrophy we add swollen joints, bent ankles and crooked legs, we have the character of rachitis in its most severe form. Happily, however, we do not find rachitis always so developed, neither is it always combined with the severe symptoms of atrophy, particularly in more elderly children. However, whether the disease be at its commencement, or whether it be at its height, the Cod Liver Oil will supersede every other means of cure in this affection, and will accomplish whatever can be expected or hoped for from any medicine.

Pruys van der Hoeven<sup>1</sup> mentions in his work, “*De Arte Medicâ*,” where he treats of the virtues of the Cod Liver Oil—“I acknowledge that formerly I was prejudiced against this remedy, knowing from experience how little dependance can be placed on the encomiums which are bestowed on a new medicine; and because the Cod Liver Oil appeared to be set up in opposition to the preparation of iron; the virtues of which I had so often tested. Since, however, I have, by long experience discovered its power, I confess that I know of no remedy against rachitis which at all approaches it.”

Brefeld, who has treated upwards of a hundred cases of rachitis with Cod Liver Oil, gives the following beautiful description of the operation of this remedy in his monograph: “The healing virtues of the Cod Liver Oil in this form of disease is as incredible as it is unlimited in its effects. Even in the very extremity of life, where the patient appears to be sinking,

<sup>1</sup> Page 317.



and death is inevitable, it affords relief as a matter of certainty; I know nothing to controvert this, except an intervening attack of acute fever and the termination of life, the death-struggle itself. It moderates slow fever and diarrhœa as well as the other symptoms of rachitis, which one after the other are gradually dispersed. It improves digestion and the consequent nourishment of the body, the motions becoming regular and of a darker colour; the tumid belly softens and diminishes in size as the emaciated extremities begin to recover their rotundity. The old features become again natural and childish; the skin moist and browner, the powers of life are restored, the eyes are again full of life and brightness, the slow fever disappears, the childish gaiety establishes itself again with a return of healthy sound sleep and removal of that anxious nightly starting and shrieking which render the night so wretched to the infant; with the increasing strength the desire and ability to stand and to walk return. The unnatural state of the bones, both in form and strength, by degrees is corrected, the discoloured shaking teeth become firm and improved in appearance, the bones lose their flexibility, and the epiphises are no longer enlarged; the deformity does not increase, but on the contrary is more or less repaired by the powers of nature and increasing growth, although there are some remains which are not entirely effaced. As an anthelmintic the Cod Liver Oil is a most excellent adjuvant, by which the nests of worms found in the tumid belly are dislodged, both mildly and effectually. The internal use of the Cod Liver Oil is in itself sufficient to effect a cure in rachitis in from three to four months, if you allow somewhat more for the repair of the newly-formed bones; cleanliness, regular diet, and regimen, as well as warm baths, will expedite the cure, while, on the contrary, unfavourable circumstances, however slight, will equally retard it.”<sup>1</sup>

<sup>1</sup> a a O, pp. 140, 141.



This may suffice to establish fully the eminent services of the Cod Liver Oil in rachitis; and we can easily conceive from the narration of the observations of Busch, à Roy, Fehr, Calama, Hahnekrot, Kopp, Most, Osberghaus, Rhades, Rosch, Schmidt, Schenk, Schmidt, van den Bosch, and von Kirckhof,<sup>1</sup> which we again repeat, the reason why all these physicians have given the preference to this remedy above every other.

[It is one of the most acknowledged qualities of the Cod Liver Oil, that it is particularly efficacious in affections of the bones arising from scrofula. Haas, Bennett, Delcour, and Segnitz, all allow this, although the latter considers the operation of the Cod Liver Oil as secondary. In these cases the Cod Liver Oil is greatly to be preferred to iodine. Bennett further adds, from observations made at Heidelberg by Nägele, Steinhauser, and Kobelt, that the Cod Liver Oil was only efficacious in scrofulous rachitis; on the contrary, in simple rachitis in fat and gross children, it was of no advantage whatever.]—*German Trans.*

*Osteomalacia.*—Besides the true scrofulous softening of the bones which is peculiar to rachitic children, a similar affection occurs at a more advanced age, the cause of which is unknown; some consider gout and syphilis among the causes, it is however difficult to understand how these affections, which for the most part produce fragility of the bones, should here have such different results. Others ascribe the cause to the scorbutic and carcinomatous diathesis, without reflecting that it has sometimes been observed where no trace of either has been found. It may be questioned, however, whether in many cases of this softening of the bones a scrofulous taint did not really exist, and which, although it may have been for some time dormant, will at last have shown itself under this or some other form. In this way alone it is possible to explain why the Cod Liver Oil is so

<sup>1</sup> a a O.



often efficacious in this disease, and as often perfectly useless. Knood von Helmenstreit was of opinion that the Cod Liver Oil was inefficacious in the softening of the bones in adults, whilst Hahnekrot and Schenk<sup>1</sup> esteem it as a true specific. Puchelt relates the astonishing case of a man of forty-three years of age cured of osteomalacia by the Cod Liver Oil. The patient took seven table-spoonsful daily. Nägele and Bennett have seen excellent results from the Cod Liver Oil in malacosteon. Hoebeke, Delavacherie, and Simon must have been completely deceived in supposing that Cod Liver Oil produces malacosteon.—*German Trans.*

*Caries Scrophulosa.*—The Cod Liver Oil is as powerful in malacosteon, as it is in the ulcerative stage of rachitis, that is, in caries, whether it has its seat in the periosteum (*caries peripherica scrofulosa*), or in the substance of the bones (*caries centralis scrofulosa spina ventosa*). The enlargement of the bone, for the most part, is not exactly defined, and is commonly the first symptom of this disease, and gradually gives way to the use of the Cod Liver Oil, even when it is on the point of suppurating. Should suppuration, however, have taken place, the carious ulceration will be clearly detected by the probe, and by the nature of the existing discharge; these soon diminish, and, at last, entirely disappear, and whilst the periosteum, which formerly covered the carious part of the bone and the subjacent part quickly heals, the ulcer of the skin will also cicatrise, though it requires a longer time.

In this form, Brefeld recommends both the internal and external use of the Cod Liver Oil. Besides him, Busch, Hahnekrot, Kopp, Schenk, Schütte, and Tortual,<sup>2</sup> have made known their valuable observations on this subject. As also, a very important case, which will be found in the third series of my observations. It was a case of caries of the thigh-bone, accompanied by hectic fever, in that stage, that it seemed

<sup>1</sup> a a O.

<sup>2</sup> Ibid.



absolutely necessary to proceed to amputation. The patient, however, would not submit to the operation, and he was put under my care, and was perfectly restored by the use of the Cod Liver Oil.

Alexander lately communicated to me a case of the greatest interest, which happened in a young man who suffered from scrofulous caries of the thigh-bone. From the use of the Cod Liver Oil his constitution was so much improved, that, although the diseased bone to the extent of four inches exfoliated, the cure was accomplished, and very little deformity remained. [Knolz is a staunch supporter of Cod Liver Oil in caries; he relates three of the most desperate and shamefully neglected cases, which were subsequently cured by Cod Liver Oil. Haas saw the best effects result from the employment of Cod Liver Oil, judiciously combined with its external use, and with the baths of Wiesbaden, in many cases of caries, not of a scrofulous nature, particularly two cases, one after rheumatism and the other after scabies.]—*German Trans.*

*Tumor Albus.*—In this serious disease of the knee-joint, the ligaments, cartilages, and bones, are all concerned; and in those cases in which the diseased soft parts put on a fungous character of the severest form, where the end of the long bones are destroyed by caries, the patient is hastened to a miserable end by an exhausting ichorous discharge, with all the symptoms of hectic fever. Although it may occur in many cases, from a cachectic habit of body, when it appears in the soft parts, particularly in the ligaments, it depends upon a rheumatic disposition; on the contrary, when it appears in the bones, it arises from a scrofulous diathesis. This distinction, first proposed by Rust, although important in itself, is not here of any moment, as the Cod Liver Oil is of acknowledged value as an established remedy in both diatheses. It is perfectly indifferent by what name the disease is to be



designated, whether tumor albus, when the soft parts are attacked, or arthrocase when the bones are diseased; when the different joints are individually affected, as pædarthrocase (inflammation of the ankle joint); gonarthrocase (inflammation of the knee-joint); coxarthrocase (inflammation of the hip-joint); omarthrocase (inflammation of the shoulder-joint); olecranarthrocase (inflammation of the elbow-joint): the same causes existing equally in each case. Let the case, however, be ever so dangerous, particularly in its highest grade, in which amputation may be thought necessary, and inevitable, it will be combated with success by the Cod Liver Oil, even where the hectic fever already announces the near approach of death.

Knood von Helmenstreit, Rust, Behr, Heineken, Kittel, Lüders, Münzenthaler, and Schmidt, confirm the virtues of Cod Liver Oil in coxarthrocase, even when the last stage has set in; van den Busch in pædarthrocase; Calama and Schutte in tumor albus, and gonarthrocase: Brefeld in all these cases, in olecranarthrocase and spondylarthrocase (inflammation of the spine). With the internal use, Brefeld combines the rubbing in of the warmed oil in every stage of the disease, nor does he ever intentionally neglect the usual diverting remedies. If, in the first stage, violent inflammation, and acute fever, arises, the oil is discontinued, to be again persevered in as soon as this state is removed. As the destruction of parts, the consequences of this advanced stage of disease, cannot be restored by Cod Liver Oil, ankylosis is formed.

*Phthisis Tuberculosa.*—It is not here the intention of entering into a discussion, whether or not tubercular phthisis is one of the forms of developed scrofula; we must, however, bring it under notice, because it belongs to that class of diseases, in which the use of Cod Liver Oil is generally attended with the most happy results.

Alexander relates a case of a very severe affection of the



lungs, complicated with a vomica—which, after the fruitless trial of different remedies, was cured by the Cod Liver Oil. Whether in this case tubercles really existed, Alexander could not discover, neither by the stethoscope, or with certainty from the nature of the sputa, although they did appear to be constitutional. He promised that as soon as the opportunity was afforded him, he would make trial of the Cod Liver Oil in tubercula cruda. Brefeld,<sup>1</sup> who, when scrofula is present, admits a connexion between this and phthisis of the lungs, and even sometimes an union between the two, recommends the use of the Cod Liver Oil, under these circumstances, and has often prescribed it with success in these cases. He, however, allows that these observations are of no great value, because, on the one hand, in some the symptoms were not sufficiently marked; on the other, because he does not place entire reliance on the virtues of the Cod Liver Oil, but prescribes other remedies with it.

The case which Calama<sup>2</sup> relates appears to have been a scrofulous affection of the bronchial glands (*vera phthisis scrofulosa*, according to Newmann); he treated it successfully with Cod Liver Oil,—this affection should not, however, be confounded with true tubercular phthisis. Hankel<sup>3</sup> has found from experience, that the healing powers of the Cod Liver Oil are not so great in the perfectly developed tubercular phthisis as in the commencement of the disease, on which account, he is of opinion, that the further development of tubercles may be prevented by the use of this remedy.

Haser,<sup>4</sup> who, in 1838, had prescribed the brown Cod Liver Oil in thirty-four cases of tubercular phthisis, on the strength of his experience, asserts: “That the Cod Liver Oil surpasses

<sup>1</sup> a a O.

<sup>2</sup> Im Angefuhrten Werke, p. 86—90.

<sup>3</sup> Med. Zeitung, 1833, No. 49, Beilage.

<sup>4</sup> Hufeland's Journal, B<sup>d</sup>. 86, st. 1.



all other remedies, even the sal ammoniac in the crude, not as yet softened tubercle, or even in that state when about to become softened." He then mentions some cases which bear out his opinion. In the cases which Kolkman<sup>1</sup> has related, in which in a scrofulous diathesis, rheumatic pains of the chest and back, and also asthmatic symptoms, were present, and where there was no reason to infer that phthisis existed, the Cod Liver Oil appeared to have operated as an anti-scrofulous and anti-rheumatic remedy. Richter<sup>2</sup> gave it with success where he suspected the presence of tubercles. Schenk<sup>3</sup> relates in his series of observations, published in 1839, a case of a scrofulous girl, of eight years of age: she complained of slight pains in the chest, constant, easily excited cough, and other symptoms which caused the suspicion of the existence of tubercles in the lungs. After three years' perseverance in the oil the patient was so completely restored, that no symptom whatever of her former disease remained. Smeets,<sup>4</sup> who admits of two kinds of tubercular phthisis,—the acquired (where tubercles are the symptoms of other diseases), and the hereditary (the true scrofula of the lungs,)—relates three cases which belong to the latter class, and which he had cured with potassæ hydriodatis combined with Cod Liver Oil. He is of opinion that this combination surpasses all other remedies in tubercular phthisis. My own observation is confined to one case of tubercular phthisis in the advanced stage of this disease. It occurred in one Henry van Frank-enbuizen, a young man, nineteen years old, whose parents and forefathers had always been healthy, although four brothers and two sisters suffered from scrofula. After he had taken the Cod Liver Oil for a short time, the night sweats disappeared, the hectic fever left him (so that the pulse which,

<sup>1</sup> Ebend, B<sup>d</sup>. 59, s. 6.

<sup>2</sup> Vereins Zeitung, No. 26, 1835.

<sup>3</sup> Hufeland's Journal, B<sup>d</sup>. 88, st. 2.

<sup>4</sup> Moll en van Eldik, praktisch. Tijdschrift, Jaarg 17, Bl. 16.



towards evening, generally beat 145 and 155, after taking it for the three weeks, was reduced to 100 and 110 beats), the cough was less troublesome, the expectoration freer, whilst the quantity of expectorated matter still remained the same, and the patient, although he fancied that he daily found himself better, sunk, after he had used the remedy three months.<sup>1</sup>

Lest it should not have been made sufficiently evident from what has been mentioned in how far the operation of the Cod Liver Oil has been successful in tubercular phthisis, I considered it worth my while to collect the opinions of some of the most celebrated physicians of our country, as well as the results of their observations; this appeared so much the more important, as the tubercular phthisis was so frequent in our neighbourhood; on this account I applied to Suermann, Schroder van der Kolk, Loucq, and Alexander, in Utrecht; Pruys van der Hoeven, in Leyden; Sebastiani, in Groningen; and Suringar, in Amsterdam; and have correctly reported what the four first of them mentioned to me; of what the three latter wrote I have given briefly only that which particularly relates to the present question.

Suermann.—“The Cod Liver Oil has proved most serviceable in phthisis pulmonalis when the patient was of scrofulous parents, or was himself scrofulous. It was sometimes evident that the further development of the tubercles by these means was checked. Therefore, I consider that the Cod Liver Oil is the very best means by which we can restore those who unfortunately suffer from tubercular phthisis, at that age when it is most dangerous to them. Even when the disease is more developed, and has made greater progress, this remedy has proved itself very efficacious. Sometimes I have pre-

<sup>1</sup> R. Hydriod. potass. ℥j  
 Aqu. Laurocerasi, ℥j,  
 M. D. S. Mxxx. 4<sup>ta</sup> horis.



scribed the oil for patients who came to me from the country, and whose recovery did not appear possible, and it afforded them at least a rational means of palliation, even when it could not be attended with complete success. Of these, there were many when they came to me again after some time, had become so improved that I scarcely knew them ; still, I must confess, that this amelioration was mostly temporary. Independent of the real value which this remedy possesses, it has been the means of supplanting those of a more dangerous nature, and of preventing the public from using others which were both new and contra-indicated in phthisis."

Schröder van der Kolk.—“ Of the value of the Cod Liver Oil in the tubercular phthisis, I may mention the following cases :—

“ 1. A young man, 24 years of age, of delicate constitution and phthisical frame, suffered for a long time from a dry cough, besides symptoms which showed the existence of crude tubercles in the lungs. I recommended him the Cod Liver Oil, and advised him to be careful of the state of his general health ; he persevered in it nearly half-a-year without discontinuing it. After he had taken it for some time, the dry cough not only disappeared, but his colour became florid and his figure more robust. After one year's perseverance in its use, the state of his bodily health was so much improved, that in this case there was every reason to hope, that the disposition itself to phthisis was altogether removed.

“ 2. A woman, 30 years of age, evidently suffering from tubercular phthisis, with a vomica in the right lung. When I was consulted, in February, 1839, the symptoms were emaciation, circumscribed redness of the cheeks, hectic fever, night-sweats, constant cough, decided purulent expectoration, in which the tuberculous matter could be recognised. She took for a long time the lactuca virosa with ipecacuanha, which means I had often found the best palliative in these



affections; it improved the symptoms, softened the severity of the cough, notwithstanding neither this, the night-sweats, or the purulent expectoration, could be kept under. In these desperate circumstances, I prescribed the Cod Liver Oil; and in the space of two months after the commencement, the state of the patient was so much improved, that, although a perfect cure could not be effected, still, life was prolonged. The emaciation was arrested, nor was there left a trace of the night-sweats or the hectic fever. The cough ceased almost entirely, a slight occasional cough alone remained, which showed that the disposition to it still existed, but which diminished daily; the expectoration not only decreased, but its nature was so changed that only a little mucus was occasionally brought up without any effort. The vomica which was before observed in the right side, could still be recognised by the stethoscope. After some weeks, the brown oil, on account of its nauseous taste, was changed for the white, which the patient used with the same results. She persevered in the use of the oil, under these favourable circumstances, the whole of the summer and part of the autumn: however, by the change of weather and perhaps from other circumstances, the cough again recurred, which was again benefited by increased doses of oil and the lactuca virosa. The state of the patient was little improved since the last summer; still I hoped to overcome this,—but in November of the same year, a violent hæmorrhage from the lungs suddenly occurred, in which the patient was suffocated, as is often the case where a decided vomica exists, in which the inflammation is reduced or is almost entirely subdued.

“3. This case is very similar to the former. A girl, 10 years of age, of a family in which many had already died of tubercular phthisis, suffered from hectic fever, with circumscribed redness of the cheeks, night-sweats, cough, expec-



toration of tuberculous matter, with daily increasing emaciation, on which account I mentioned to the friends that her death was fast approaching. As I already knew the virtues of the Cod Liver Oil in these affections, I had recourse to it, hoping that it might at least relieve the symptoms. I recommended the use of the white oil, and it proved itself not less powerful than in the previous case; indeed, it effected more than could have been expected or even hoped for. Not only did the emaciation disappear, but the figure became stouter and the complexion clearer as the nourishment was again taken up, whilst the cough and the remaining symptoms altogether disappeared. The patient enjoyed this improved state of health for a long period; but the last time she was able to leave the house, she exposed herself in various ways, and even ventured to leave off the oil. The cough and expectoration suddenly returned, and, after a short time, the patient died, with all the symptoms of phthisis, in its severest form, accompanied by inflammation of the peritoneum."

From these three cases the virtues of the Cod Liver Oil is evidently proved, and experience shows that this remedy given at the proper moment and persevered in, at the same time avoiding all exciting causes, has not only the power of entirely subduing all disposition to phthisis, but also apparently arresting the development of tubercles, whilst it is the best palliative means of allaying the urgent symptoms in the last stage of tubercular phthisis.

Loncq:—"I have never prescribed the Cod Liver Oil, which I consider the most powerful means in rachitis and in chronic rheumatism, in the advanced stage of fully developed tubercular phthisis, though I have done so in the commencement of the disease. In the latter cases the results were always unfavourable; in the former, on the contrary, they were generally successful. All the phthisical patients to whom I



gave this remedy, died, with the exception of one which during this year was under my treatment. The greater number appeared to derive benefit by the improvement of the general health, and by retarding the development of the tubercles. The disease remained stationary some months, a year, and even longer, or advanced imperceptibly. I however observed in those who used the Cod Liver Oil, an evident connexion existing between the age of the patient and the progress of phthisis, for the younger they were, the sooner they died. I would not venture to bring forward the power of this remedy in the slowly advancing disease, if the following cases did not bear out the probability.

“A young man, 18 years of age (whose parents died of phthisis, and who, some months previously, had lost two elder brothers, who had died so suddenly from tubercular affection of the lungs, that from the first appearance of the disease until its termination, only ten months elapsed), suffered from slight dyspnœa, dry cough, and burning of the hands and feet. I gave the Cod Liver Oil, which so far succeeded, that after thirteen months the symptoms began to improve. Notwithstanding, this, however, the unfortunate patient died before the expiration of many months.

“I observed a similar case in a delicate girl, 24 years of age, with an hereditary tendency; she became the subject of phthisis, but its progress was so retarded by the use of the Cod Liver Oil, that she reached her twenty-seventh year ere she died, whilst her three sisters, in the eighteenth or nineteenth year of their ages, apparently quite healthy, were seized with a violent cough, attended with hæmorrhage, and died in a few months. Lastly, a man with a spare frame, about thirty years of age, of a phthisical tendency, after suffering for three months from a cough, was seized with hæmorrhage, for which he consulted me in 1836. His symptoms were emaciation, hectic fever, hurried respiration, almost



constant cough, purulent expectoration streaked with blood, difficulty of lying on the right side. The respiratory murmur in the upper part of the right lung was very weak, and there was, besides, humid râle and distinct pectiloquy. The rest of the lungs appeared healthy. After I had applied a blister on the spot corresponding to the vomica, I gave at first the decoction of marsh mallow, with aqua laurocerasi, decoctum album Sydenhami, and milk with Selzer water. Later, however, nearly three weeks afterwards, when the cough lessened, the respiration had become easier, and the other symptoms were removed, I ordered the Cod Liver Oil, which the patient took for five months. After this period there was no pectiloquy, no expectoration, no fever, seldom any cough; his appearance improved, the strength was so restored that he considered himself cured, and gladly returned to his work. After two years he again came under my treatment, extremely thin, suffering from a severe diarrhœa, with acute pain in the bowels. He, however, had no cough, and he mentioned that for five months his bowels were confined, and a short time afterwards diarrhœa commenced. As to the affection of the chest, he never suffered from it; on the contrary, for the space of nineteen months he had found himself better. Leeches were applied to the anus; farinaceous diet, opium, bland nourishment, were tried in vain, the patient died a short time after. On the post-mortem examination, in the right upper lobe of the lung, which here and there was adherent by false membrane to the pleura costalis, many tubercles were discovered, partly crude, partly chalky, and the cicatrix of a vomica nearly an inch long. The under part of the right, as well as the left lung, were free from tubercles, the heart small and flabby. The mesenteric glands were hard and enlarged, some suppurating, others filled with crude tubercular matter; the mucous membrane of the small intestines, particularly the ileum, was covered with broad though not deep ulcers; in the



cellular tissue, under the mucous membrane, were innumerable tubercles, the rest healthy.

“In the fourth case I knew a man of the age of 34, whose parents and many brothers and sisters had died of phthisis, and who, in November, 1839, showed such symptoms of phthisis that a rapid termination was threatened. By perseverance in the use of the Cod Liver Oil for upwards of a year, he recovered his former health. However, in April, 1840, by my advice he travelled to Rizza, in Italy, where he remained nearly thirteen months, perfectly well. Though I attributed much to the Cod Liver Oil, still, I think more was to be ascribed to the climate. He returned home healthy and well; but it was uncertain whether the disposition to tubercular disease was entirely removed; soon afterwards, however, as I understood, he died of nervous fever.”

Alexander:—“On the virtues of the Cod Liver Oil in the commencement of tubercular phthisis, I will not venture to pass judgment. The disposition to this disease is indeed frequent amongst the young soldiers. They came mostly under my treatment in the Military Hospital at Utrecht, when phthisis had made some progress, and when all attempts at cure from medicine were unsuccessful. Once only I was fortunate enough to prevent the further progress of phthisis. Whether, however, this case was one of tubercular phthisis, I will not venture to maintain. I have related it in the *Belgian Journal of Letteroefeningen*, and in the *Journal of Hufeland*, V., 86, part vi., p. 3.”

Pruys van der Hoeven:—“In answer to the question as to what is my knowledge of the Cod Liver Oil in tubercular phthisis, I can say that it has been successful in retarding the progress of this disease. I have prescribed it in different stages and under various circumstances.

“First,—I have given it to boys, whose form of chest, delicate skin, and disposition to catarrh, showed a phthisical



habit; and it has in conjunction with dietetic and gymnastic rules, not only improved that delicate appearance but has removed the obstinate cough.

“Further,—I have given it to young men, who grew tall exceedingly quickly, by which, in scrofulous constitutions, phthisis very often gradually declares itself by the accession of symptoms of general fever. Under these circumstances the Cod Liver Oil is the most powerful restorative. But also where the phthisis is fully developed in the stage of softened tubercles, it appeared to me to improve the general health so much that the patient who kept his bed and was worn out with night sweats and hectic fever, in a short time was enabled to get up, and life was prolonged for many months.

“Besides these, I treated a young man who suffered from hectic fever, with every symptom of advanced phthisis. After a perseverance of one month in the use of the Cod Liver Oil, the fever disappeared, the powers of assimilation were restored, and with it the strength returned. As often, however, as the weather changed, the earlier symptoms were again remarked, particularly in those cases in which the oil was discontinued. I will not venture to decide whether the Cod Liver Oil is efficacious in the cure of phthisis or not, because I never afterwards saw the patients whom I successfully treated for it; still there is no doubt that it is a very powerful remedy.”

Sebastiani:—“The Cod Liver Oil is a useful medicine in tubercular phthisis, when there exists neither hectic fever or diarrhœa; it is of no avail in the last stage, though it may be in the first and second. Furthermore it should not be prescribed in phthisis florida, and is altogether contra-indicated when phthisis is accompanied by bloody expectoration.

“I have found the Cod Liver Oil to be most serviceable in cases of hereditary phthisis, where the parents or other relations (uncles, aunts, brothers, or sisters) were scrofulous, had had gout, had died from phthisis, or were suffering from it.



When patients from such families are labouring under a susceptibility of the organs of respiration, and consequently subject to frequent attacks of cough or angina pectoris; when the breathing is hurried on the ascent of stairs, or by running quickly, sometimes combined with palpitation of the heart; when particularly in the morning or evening a dry cough comes on, although all the other catarrhal symptoms are absent; when in females who suffer from this disease there is a disposition to leucorrhœa, sometimes pain in the back or spasm in the bowels, where also the powers of assimilation is defective—the Cod Liver Oil has proved itself an excellent remedy. On the other hand, its use must be abstained from when the catarrh is acute, or much congestion of the lungs exists with fever; when, however, these symptoms are relieved, the Cod Liver Oil should again be recurred to.

“In these cases when patients have followed my advice, and have allowed themselves to be directed in the path which I have pointed out to them (not only in respect to the taking the oil, but also in their mode of living), I have never once known the disease to make any progress, or the patient to be laid up. I have patients under treatment who have used the Cod Liver Oil two or three years, others who have taken it for nearly four or five years. In all these cases I have seen the cough lessen and at last disappear, and the susceptibility of the respiratory organs diminish; whilst at the same time, the appetite improves, the motions become regular, the nutrition better, the strength increases, and a favourable change takes place in the general appearance.”

Suringar:—“I have prescribed the continued use of Cod Liver Oil when the symptoms evidently alone depended either on the existence, or as the result, of tubercles. It cannot be denied, however, that I have seen many patients sink under this disease to whom I have given this remedy for the space of one year, and even for a longer



period. Its virtues in this disease appear to me to consist in this, that the expectoration diminishes, the emaciation is checked, while the disease itself does not appear to make such rapid advances ; so that in many cases life seems to have been thus prolonged.

“As far as relates to the phthisical patients which were cured by me either permanently or temporarily, I am of opinion that the favourable results should not be attributed in all cases (though it may be in the greater number) to the Cod Liver Oil alone, but to the seton which I applied on the chest. I have often remarked, that this last remedy is of essential service in phthisis. When extreme emaciation, continued fever, or colliquative symptoms are present, the Cod Liver Oil should not be prescribed. The experiments made to prove the virtues of Cod Liver Oil in tubercular phthisis will always give uncertain results, as long as the commencement of the tubercular formation is not discovered, or while it remains undecided whether tubercular formation and scrofula are identical. This identity, which has often been acknowledged, I myself much doubt.”

If we compare the opinions of different persons in different places, which in the main all agree with what we have already said on the subject, we can form a pretty correct judgment on the virtues of the Cod Liver Oil in tubercular phthisis. This medicine may be called the grand restorer of health ; for the successful operation of any remedy whatever against so formidable a disease, may indeed deserve that appellation. Should the disposition to phthisis be present, the use of the Cod Liver Oil will prevent the further development of the disease, sometimes permanently ; generally, however, for a considerable period. Whereas when it is given in the already developed form of phthisis, although the perfect cure cannot be accomplished, life will be prolonged and rendered more supportable. This



is, indeed, all that can be expected from any remedy in the present imperfect state of our knowledge of tubercular phthisis.

Haller,<sup>1</sup> principal physician of the Imperial House of Correction in the lower Austrian provinces, has prescribed the Cod Liver Oil in seven cases of tubercular affections of the lungs. The first happened in an apparently strong and hitherto healthy servant girl of twenty-four years of age, who had been condemned to four years' imprisonment. After two months' residence in the institution, without any particular cause, she was seized with acute pleuritis and inflammation of the lungs, which was subdued by an active anti-phlogistic treatment; it, however, left behind an obstinate cough, and a form of chronic pleuro-pneumonia, in which case tubercles are so readily developed. The patient at this time took the Cod Liver Oil in gradual doses, increased to two table-spoonful daily; her symptoms did not, however, improve, and the author was about giving up the treatment, when all at once there appeared over the whole skin, particularly on the extremities, a dark-red papular eruption, which continued increasing in redness for fourteen days, grew pale, and disappeared, falling off in scales. A later eruption on both arms lasted a still shorter time. With the commencement of this eruption, an improvement in the symptoms began and continued uninterruptedly, so that the patient, who had taken the Cod Liver Oil for some time, was shortly after this perfectly cured. From this time a year had passed without her having suffered from relapse. Another patient, who had also suffered from repeated attacks of hæmoptysis, and whose whole lungs were more or less hepatised, and who had taken the Cod Liver Oil for some months, was seized with a similar papular itching eruption on the back of both hands, which was attended with a decided remission of all the symptoms, and which spread over the whole body. According

<sup>1</sup> a a O.



to the author, this eruption probably depended upon the efforts of nature, in affections of the lungs, to cause a critical diversion to the skin, which, perhaps, was in some way accelerated by the use of the Cod Liver Oil. In three other cases it only afforded a temporary relief; and in two others the dyspeptic symptoms required that the medicine should be discontinued. Both afterwards died of the disease, and on the post-mortem examination, besides the total destruction of the lungs, tubercular ulceration of the intestines was discovered.

Haller did not altogether agree in the emphatic encomiums which had been lavished on the Cod Liver Oil in crude tubercles; still from his experience this remedy appears hitherto to have been useful in those cases of tubercular lungs, the result of chronic pneumonia or congestion, where the cellular tissue of the lungs near the tubercles is more or less condensed, but where no further change has taken place, and where no large or numerous cavities have as yet been formed. It is also important in phthisical patients that the state of the digestive organs should be strictly attended to; where they are disordered, the Cod Liver Oil is contraindicated, particularly when decided symptoms are already present, that the tubercular inflammation is at the same time progressing in the intestinal canal.

Thierfelder,<sup>1</sup> in Misnia, has likewise used the Cod Liver Oil in many cases of phthisis, often with success, but he observes that it does not possess sufficient power as a medicine to crush the tubercular phthisis in the bud. Wherefore he thinks the medicine has been too highly praised, and he relates some cases of confirmed phthisis in which no result whatever followed its use; indeed, it scarcely acted as a temporary palliative.

[Bennett relates a series of cases of Ozann, Wolf, and Schonlein. Schenk, Taufflied, Kopp, and others, all speak

<sup>1</sup> a a O.



of it in the most favourable terms. All these remarks tend to prove the virtues of Cod Liver Oil in the commencement of the disease. Haas also is of the same opinion, that decided cures are effected only when the tubercles are not as yet softened. Klenke cured a female with confirmed tubercles and hectic fever, by the usual treatment with the oil, and the inhalation of air impregnated with the steam of oil, in the space of four months. Haas has remarked, that the symptoms of the second stage have been arrested only in those cases where the digestion was unimpaired, and the mucous membrane was still unaffected. In the metastasis to the mucous membrane of the bronchia, the Cod Liver Oil may sometimes be serviceable. In tubercles of the mucous membrane of the intestines (diarrhœa of phthisical patients) and disposition to congestion, the Cod Liver Oil is always contra-indicated. Haas, as well as Puchelt, has known hæmoptysis to be arrested by Cod Liver Oil.]—*German Trans.*

The derangements in the functions of the mucous membranes must be considered more as a symptom of the scrofulous diathesis than as a peculiar form of scrofula, for it is usually found to exist more or less in all patients, and it sometimes either appears before the other symptoms, or in so unusual a situation, that it deserves, if not the exclusive, at least the especial attention of the patient, as well as that of the physician. To it is owing the discharge from the ears, in which the secretion from the mucous membrane of the external ear takes on a specific purulent character, (otorrhœa<sup>1</sup>); again, the peculiar diseased secretion of the mucous membrane of the intestines which generates worms, (helminthiasis); lastly, the vitiated secretion from the mucous membrane in the female organ of generation (fluor albus), as well as irregularity of the menstruation. Since, then, as we have shown,

<sup>1</sup> Bennett and Haas have confirmed the same favourable results.



that the disposition to scrofula is subdued by the use of the Cod Liver Oil, it naturally follows that this derangement in the secretion of the mucous membranes, when it depends upon this diathesis, will be as certainly benefited as the scrofulous diathesis itself.

This is confirmed by the observations of Brefeld, Calama, Kopp, Schenk, as well as by my own. Brefeld<sup>1</sup> also asserts that he has witnessed the anthelmintic power of the Cod Liver Oil in children who suffered from rachitis. Calama<sup>2</sup> confirms this in his sixteenth, seventeenth, and twenty-fifth cases.

We, as well as Kopp, prescribed it with success in otorrhœa. Calama<sup>3</sup> cured a girl of twelve years of age of leucorrhœa with Cod Liver Oil. Schenk cured amenorrhœa with it. In the following chapter, in the first series of my observations, there is also a case of amenorrhœa, in which, although it had existed nearly eight months, the secretion was restored by the Cod Liver Oil, after it had been taken for the space of twenty-three days.

We sometimes observe that certain diseases of the nervous system, which have nothing in common with scrofula, are relieved by the Cod Liver Oil in scrofulous constitutions, where other remedies have been tried in vain. It cannot be denied, therefore, that in such cases a connection exists between this disease and the scrofulous diathesis, although it is difficult to explain it. Schroder von der Kolk treated a case of mania, connected with epilepsy, in a scrofulous habit, with Cod Liver Oil, with the effect of rendering the fits much less frequent. Osberghaus<sup>4</sup> relates a case of epilepsy treated successfully with Cod Liver Oil. Osius recommended the Cod Liver Oil, even in certain nervous diseases.

Brefeld<sup>5</sup> mentions a case in which a man had been deaf of

<sup>1</sup> a a O, p. 141.

<sup>2</sup> a a O, pp. 66, 68, 81.

<sup>3</sup> a a O, p. 80.

<sup>4</sup> Ruft's Magazin, Bd. 20; Heft 3.

<sup>5</sup> a a O, p. 51.



both ears for six months, and Calama<sup>1</sup> also makes mention of another who had been deaf of one ear for seven months; both were restored by the Cod Liver Oil. In the latter case the deafness was the consequence of swollen glands pressing on the tympanum; in the former case nothing external could be observed. Both patients, however, suffered from scrofula, and it was here plain that a connection existed between the deafness and the scrofulous diathesis.

Finally, the Cod Liver Oil was found to be efficacious in a few cases of the enlargement of the testicles, by Hahnekrot;<sup>2</sup> in tumour of the breast by Kopp;<sup>3</sup> in paralysis after parturition by Schupmann;<sup>4</sup> in pains of the back, from which the humpback suffers in changes of weather, by Brefeld;<sup>5</sup> in the various hæmorrhages by Richter;<sup>6</sup> and, lastly, by Brefeld in pains in the bones after the dispersion of syphilitic nodes and tumours which had existed for many years.<sup>7</sup>

[In order to be clearly understood, we cannot forbear to repeat here the facts which have been elicited in the preceding remarks, respecting the peculiar operation of the Cod Liver Oil on the system, when it is contra-indicated, of the method of prescribing it, the dose, and diet to be observed. The first apparent advantage resulting from the use of the Cod Liver Oil, is always an improvement in the chylopoetic and reproductive systems, a decided improvement in the nourishment of the body, as well as an increase of the biliary secretion. Klenke compares the operation of the gold-yellow oil to that of the bile. The Cod Liver Oil does not act directly in affording nourishment, as many erroneously suppose, but

<sup>1</sup> a a O, p. 81.

<sup>2</sup> Sanitätsbericht des königl. Med. Colleg. zu Munster, v. t. 1830.

<sup>3</sup> Denkwürdigkeiten, u. s. w.

<sup>4</sup> Hufeland's Journal, d. prakt. Heilunde. 1830, st. 4, p. 115.

<sup>5</sup> a a O, p. 56.

<sup>6</sup> Neue Untersuchungen in Betreff der erblichen Neigung zu tödtlichen, Blutungen, 1829.

<sup>7</sup> A A, p. 55.



only indirectly by the promotion of chylopoesis. Klenke's idea of increasing the dose of the Cod Liver Oil, in doubtful cases, to that extent, that the patient lives alone on it, is not to be approved of; oil alone does not afford nourishment. On the contrary, it would appear, from what we know of the influence of the Cod Liver Oil on the digestive organs, that the oil had best be given after a full meal. If this idea was a rational one, other oils and fat might, in a certain degree, be substituted for the Cod Liver Oil. The presence, however, of the constituent part of the bile, establishes the difference, and which, therefore, gives the preference in favour of Cod Liver Oil. In addition to these, the iodine contained in the Cod Liver Oil, must also be effective, which is proved not only from the fact of its presence causing the same unpleasant taste which always exists after taking iodine; but also from the detection of iodine in the urine of patients who have been under treatment with Cod Liver Oil, as mentioned by Haas. That, also, on which its healing properties depend in gout, rheumatism, and the exanthemata, particularly its power of increasing the secretion of the skin, so favourably spoken of by Haas, cannot be attributed alone to the fatty principle of the oil. The perspiration acquires, at times, after the use of the Cod Liver Oil, a fishy smell; in the other secretions, a smell of the Cod Liver Oil is observed, though not by all. Cod Liver Oil, according to the generally received opinion, increases existing inflammation, irritation, congestion, hæmorrhages &c., which is, however, not to be attributed entirely to the oil. Remarkable critical appearances, after the use of the Cod Liver Oil, are seldom noticed, although they may occasionally be remarked in the perspiration. In general, the Cod Liver Oil operates in a very gradual manner, and requires, therefore, a long perseverance in its use. It will, in general, be borne well, and sometimes will be taken in extraordinary quantities without inconvenience. Loss of appetite,



throwing up the medicine, &c., happens only at the commencement, in consequence of the disagreeable taste. By longer use, repugnance to the medicine is overcome, and appetite often returns. If the digestive organs are already disordered, particularly if in an irritable state, the Cod Liver Oil often causes pain, vomiting, diarrhœa, &c.; with respect to this last affection, some have regarded the Cod Liver Oil as having a constipating effect, others look upon it as an aperient. When the intestinal canal is quite healthy, it promotes the evacuations in proportion as it improves the appetite and the digestion; in chronic diarrhœa, on this account, it will always act favourably, whilst it decidedly increases diarrhœa arising from irritation. Hence these rules should be observed:—The Cod Liver Oil, which is by no means an indifferent remedy, should be given only when the diagnosis has established the existence of a disease in which its use is serviceable; when the patient is more of a torpid, inactive, rather than plethoric constitution; when neither disposition to congestion, inflammation, or local irritation of the intestines, indigestion, &c., is present; above all, it is necessary to give attention to the previous state of the intestinal canal, the removal of any accumulation by a purgative, combined, perhaps, at the same time, with a bitter and tonic remedy, a weak preparation of iron, &c. &c. The Cod Liver Oil, however, will always be of greater service when it can be borne without the assistance of these remedies; should indigestion, hæmorrhage, or diarrhœa come during the use of the oil, it should be suspended, in every case, for a considerable time. As we have to regulate the dose, it is necessary to direct in what manner it will be best borne; it should be increased from two tea-spoonfuls daily (in young children), to eight and more table-spoonfuls in adults. As to the time of taking it, it is mostly given in the morning fasting; but as the medicine is most nauseous at that



time, it may therefore not be so easily retained on the stomach.

How the repugnance to this remedy can be overcome, is explained at the end of this second section. At the same time, we must bear in mind, that aromatics (peppermint, &c.,) promote the eructation, and therefore are liable to recal the taste. A little broth, or a spoonful of crushed sugar (according to Brefeld), is best to take the taste from the mouth. All opinions agree as to the necessity of a restricted diet during the employment of the oil; some recommend particularly, animal and fat diet, others that it should be strictly farinaceous. As it is allowed that the principal action of the Cod Liver Oil is in the improvement of the chyle, it follows, as a matter of course, that the diet should correspond and consist of animal matter, with the addition of some substance of a decidedly nutritious nature. At all events, it must be understood, that one must be careful of prescribing an oil containing iodine. With regard to the external use of the Cod Liver Oil in abscess, exanthemata, diseases of the eyes, &c., the foregoing observations do not enable me to decide on its *modus operandi* in these cases. As long as it remains doubtful to what constituent part of the Cod Liver Oil it specifically owes its virtues, it is the duty of every one, where it is possible, to prescribe it, as pure and unmixed as it can be obtained. Of the other modes of prescribing it, the question has already been argued.]—*German Trans.*

### III.—*The Therapeutic Properties of the three kinds of Cod Liver Oil comparatively considered.*

From the historical review of the medicinal use of the Cod Liver Oil, it appears that the numerous observations which have been made respecting it from the year 1822 (now twenty years), have all tended to one object, that of especially making



known the efficacy of Cod Liver Oil as a remedial agent. For this reason, we find the different sorts of Cod Liver Oil indiscriminately sold in druggists' shops, the generality of physicians never noticing which sort they use.

Many prefer one particular sort to the others, and indeed successful results have occurred from the employment of either kind, or from accidental circumstances, and thus can it be alone explained why some attribute the greater efficacy to the dark, others to the light-coloured kinds.<sup>1</sup>

A comparative examination of the three kinds of Cod Liver Oil has consequently been long needed, and has been in vain looked for up to the present time. I will therefore endeavour to supply this blank in the history of Cod Liver Oil by the following researches.

It is not so much the object of these observations to demonstrate anew the virtue of Cod Liver Oil in rheumatism and scrofula, which no one any longer doubts, but rather, as has already been alluded to in the introduction, to mention the medicinal properties of the three kinds, which are as different in external appearance as they are in their chemical relations, and then to draw comparisons as to their therapeutic properties.

As, however, it is not possible to find cases which are similar in symptoms and progress, and at the same time patients of the same age, sex, temperament, constitution, &c., the

<sup>1</sup> The opinion has lately become more prevalent, that the brown and light brown oil, are preferable to the pale. It is not always because the pale oil appears to contain less powerful qualities, but far oftener owing to the frequent deceptions to which those who employ the pale oil are exposed. It is often the common South Sea Oil, or the seal oil artificially blanched. Meebold a a O, remarks that nearly all the white oil of commerce is blanched by chlorine, by which it is rendered not only less powerful, but also equally unpleasant to take. Bennett prefers the light brown, which is also the case with Meebold and V. Santen. Haas, and most of the modern authors, Osius and Klenke, are of opinion that the pale oil is altogether to be preferred, except however where the nutritive powers are to be assisted, then the brown oil is better. The brown is more anthelmintic.—*German Trans.*



results of individual cases cannot be compared, the general results, however, will be noted in the three classes.

To avoid repetition, I give the method of cure pursued equally in all.

First,—All other remedies besides the Cod Liver Oil must be proscribed, for, by the employment at the same time of other means, it is impossible to ascertain to which to attribute the cure.

Further, I conceived it my duty, from the commencement until the end, to give the oil with my own hand, particularly as it related to the comparison of the three kinds. I allowed, on this account, the scrofulous patients to come to me twice a day. Some of the scrofulous patients who suffered in the feet, and all those affected with rheumatism I visited myself for that purpose.

I exhorted the parents of the scrofulous children to give them neither black bread nor potatoes. As, however, these articles of diet—almost the only ones amongst the lower classes in my fatherland—were craved after by the scrofulous patients, it is not to be wondered at that the parents easily relaxed and neglected my directions. On the other hand, I recommended the use of white bread and some vegetables, as well as broth and meat. As this diet was too expensive for the labouring classes, I myself supplied it as far as I was able.

Lastly, I recommended the parents to keep their children clean and dry. This, however, was seldom attended to.

The dark and damp houses and unhealthy situations I was unable to remedy, besides other circumstances which, among the labouring classes, stand much in the way of the physician. Here and there a few scrofulous patients enjoyed a better situation.

The rheumatic patients were ordered a suitable diet and warm clothing.

I regulated the quantity of the oil so that at the com-



mencement I gave the younger patients half a tea-spoonful twice a day, and increased the dose gradually, so that at the end of the third week they took a tea-spoonful. The elder scrofulous and rheumatic patients took at the commencement a table-spoonful twice a day, whilst at the end of the three weeks it was given three times a day. In two cases of tinea capitis, and in the only one of herpes squamosus madidans, the Cod Liver Oil was externally prescribed.

As the operation of the medicines can only be observed after the lapse of some time, I have not, therefore, as in acute diseases, noted the daily changes, but have extended them to every fourteen days.<sup>1</sup>

<sup>1</sup> The author allowed the progress of the cures to be drawn up in classes, in the form of tables. As, however, in this manner the changes which took place in each case from its commencement, was thus separated from each other, it was not possible, as the author himself says, to draw comparisons between each individual case; and as the tabular form appears imperfect, a complete history of each case will be given: it is at the same time to be noticed, that all the patients who had continued the Cod Liver Oil for three months after the specified time of cure, and even later, have enjoyed perfect health.—*German Trans.*



## FIRST CLASS.

### CASES TREATED WITH THE BROWN COD LIVER OIL.

#### 1.—*Scrofulous Rachitis.*

JOHANNA VON DOMMELEN (3 years of age).—Parents had always been healthy, although both had been afflicted in their youth with scrofulous swellings in the neck. She had twelve sisters, seven of whom had died,—two of small-pox, five of difficult dentition. All the children had suffered from scrofulous enlargement of the cervical glands, and two from eruptions on the head.

The patient ran alone at two years and three months, daily became stronger, and could walk without assistance; three months since, however, the mother remarked that the child became weaker on its legs; the appetite was unaffected,—the child ate, as before, nothing but potatoes and black bread; she became weaker and weaker until she could neither stand or walk, and the belly became swollen and hard. The mother brought her to the hospital on the 25th of April, and placed her under my care.

The state of the child was this:—light hair, blue eyes, round face; the nose somewhat swollen and ulcerated, the upper lip not swollen; sound teeth; the glands of the neck enlarged, but not painful; the arms thin; the belly large and hard, ulcer on the organs of generation; the knees somewhat swollen, the shin bones slightly curved; the ankle joints enlarged; appetite good, digestion often disordered, acid eructations; sometimes vomiting of sour matter, irre-



gular motions, hard fæces, respiration normal, pulse slow; at one time wakeful, at others sleepy; the voice hoarse; inability of keeping the erect posture.

1st June.—The sores about the nose were healed, the voracious appetite was diminished; the sour vomiting was less frequent, the motions regular; the sleep more tranquil.

6th June.—The vomiting ceased; the sleep quiet, no drowsiness.

15th June.—The swollen glands in the neck are less hard, the belly softer.

1st July.—The glands are by one-half smaller, the belly soft and far less swollen, the sores on the genitals healed; the digestion natural; for some days the strength of the feet has increased; the patient attempted to stand.

15th July.—The swollen glands have disappeared; the belly soft, and not the least increased in size; the enlargement of the ankles is almost entirely removed. The patient stands steadily on her feet, and runs with the assistance of the mother.

1st August.—The general appearance is good: the arms and legs have become more fleshy; the reproductive functions are natural; the patient has to-day, for the first time, run without assistance.

15th August.—The appearance and the functions are natural; the patient runs as before. She has taken the Cod Liver Oil for three months and a half, and is considered perfectly cured. Up to this time she has remained quite healthy.

2.—*Scrofulous Swelling of the Subcutaneous Glands, with Amenorrhœa.*

CORNELIA VON ROSSUM (17 years of age).—Neither parents had ever suffered from scrofulous affections; the mother was sometimes subject to rheumatism. The patient was scrofulous



in her childhood. In her sixteenth year she first menstruated, which returned regularly every fourteen days; after six weeks it discontinued, and since that never returned again. One month after this the patient felt unwell. Two months after, a small swelling arose under the left ear; it was only painful during four days,—nevertheless, it increased daily in size. She entered the hospital in 1841, where the swelling was taken for paroditis, and she was recommended to keep it warm, and at the same time to rub in the mercurial ointment. The patient pursued this course until the 23rd April with little success, and on that day was given over to my charge.

She was of phlegmatic temperament; the swelling in the neighbourhood of the left parotid extended two inches backward, three inches and a half below, and one inch and a half forward. It was hard, and insensible to the touch. Besides this, there was an enlarged lymphatic gland on the same side, which could be separated from it under the skin. The whole of the left cheek was inflamed, but not hard; the lower part of the belly felt tumid and hard. The appetite bad, the digestion regular, motion once a day, the respiration and the pulse regular; menstruation had ceased; occasional cholicky pains, particularly in the lower bowels, combined with mal-aise and giddiness; sleep tranquil.

15th May.—Since the 10th of this month the cellular membrane in the neighbourhood of the swollen gland had become inflamed. For some days past she has suffered from frequent headaches and increased giddiness. Poultices were applied.

1st of June.—On the 18th ultimo, fluctuation was detected, and on the 20th the abscess was opened with a lancet, giving vent to a great quantity of yellow thick caseous matter, after which a slight discharge continued. Since the 23rd, the pain in the inflamed spot has ceased; the edges of the



wound are raised. On this day, the menstruation again returned; the cholicky pains, the mal-aise, and giddiness, are diminished.

15th June.—The swelling of the parotid is smaller by one half; the wound has contracted; the edges less raised; the caseous discharge diminished. Since the 4th of June, no more poultices were applied; the belly is softer; the appetite improved; the sleep more tranquil; the headache entirely removed.

1st July.—The tumour is much less; the wound nearly closed by granulation; the swollen lymphatic glands smaller and soft; the appetite reduced; the nausea is removed. On the 19th June the menstruation again returned; there is very seldom giddiness.

15th July.—The wound is cicatrised; the swollen lymphatic glands have almost disappeared; the surrounding swelling is entirely gone; the belly soft, and reduced in size; the digestion good; no giddiness or nausea.

1st August.—On the 21st July she again menstruated, and is regular in every respect; the patient has used the Cod Liver Oil for three months and is perfectly restored.

### 3.—*Scrofulous Swelling of the Subcutaneous Lymphatic Glands.*

ANTHONY GESINK.—Aged eight months; the mother suffered, as a girl, from abscess of the cervical glands, of which she still shows the cicatrix; the father was always healthy. A second child was rachitic, and died at two years old. Our patient was reared on its mother's milk from the first month; and was likewise fed on potatoes and black bread. Before it was two months old, the mother remarked that the glands under the chin, at the back of the neck, were swollen, as also the arms, hands, and face. The mother came on this account to the hospital, and placed the child under my care.



The head was larger than natural, eyes brown, the nose broad, the face puffy, the glands under the chin and back of the head swollen, the chest well formed, the belly tumid and hard. The child took the breast with great avidity, and at times other food, as we have before mentioned. Sour eructations, vomiting with pain in the lower bowels; the motions irregular, fæces smelt sour. The respiration and pulse normal, the sleep unquiet.

15th May.—The evacuations regular, but still of sour smell.

1st June.—Sleep somewhat more tranquil.

15th June.—The swollen lymphatic glands softer and more detached; the belly far less hard; the vomiting sour; eructations and pain in the bowels are diminished.

1st July.—The swelling of the lymphatic glands nearly gone; the belly less tumid and much softer, the evacuations regular; the sleep tranquil. Since the 18th of June the puffiness of the face, the arms, and hands were no more remarked.

15th July.—The swelling of the glands no longer exists; the belly normal, the evacuations regular.

The patient was cured in two months and a half, and has since been perfectly well.

4.—*Scrofulous Chronic Conjunctivitis and Corneitis, with consequent Blindness.*

JANE VON INGEN (15 years of age).—The father and mother have never been affected with scrofula, although all five brothers have suffered from it. The patient had had, until her fourteenth year, an eruption on the head, of which she had been cured by continued washing with soap and water. Six months afterwards, she went to bed perfectly well, and awoke unable to see out of the right eye; four weeks after this, the same thing happened to the other eye, and she



then sought advice. She was ordered the internal use of the Cod Liver Oil. Although it was not taken regularly, the improvement in the eyes was so great, that after a few days she was able to see her way alone. On the 16th of March she was bled, in consequence of violent throbbings in the head, and drowsiness. The throbbings, the drowsiness, and the headache gave way, but the wound in the vein suppurated, and the matter burrowed so deep, that it was feared that it would reach the joint. The Cod Liver Oil was again ordered; the patient herself acknowledged that she had altogether neglected its use. On the 1st of May she was placed under my observation, and her state was the following:—

Delicate constitution, cachectic habit, the edges of the lids swollen, and the vessels of the conjunctiva of the lids and ball of the eye very turgid; a plexus of vessels in each eye, running from the angle to the cornea, and there forming a ring; the cornea of both eyes obscured; a central pustule on the left cornea; on the left arm the above-named abscess. The appetite good, the digestion often disturbed; diarrhœa; respiration normal, the pulse slow, the secretion from the meibomian and lachrymal glands increased; slight pain in the eyes and in the arm. On closing the right eye, the patient cannot distinguish between light and darkness; with the right eye, objects are seen as in a mist. The sleep is quiet.

15th May.—The edges of the lids less swollen; the ulcer cleaner; the digestion better, the evacuation less frequent, the secretion of the meibomian glands not so great.

1st June.—Improved appearance, the vessels of the conjunctiva not so distended; less opacity of the cornea. The patient is enabled to distinguish objects better; the right eye can bear more light; the secretion of tears diminished; the ulcer not so deep, and more contracted.

15th June.—Far better appearance; the edges of the lids



no longer swollen; the plexus of vessels begin to disappear, particularly in the right eye; the secretion from the meibomian glands has nearly ceased; the digestion is normal; the ulcer, reduced to one-half, is granulating from the bottom.

1st July.—The general appearance still more improved; the plexus of vessels, the opacity of the cornea, and the pustule on it, daily diminishing. The patient distinguishes objects well: a few days since she came to me without a guide. There was a lesser degree of intolerance of light, as well as a diminished secretion of tears. The ulcer is cicatrising.

15th July.—The patient sees distinctly; digestion normal; the ulcer perfectly cicatrised.

1st August.—The general appearance very good; the opacity so diminished that the cornea in both eyes begins to shine; the pustule of the cornea is becoming every day less.

15th August.—Only a small spot on the cornea; no intolerance of light, and no increased secretion of tears.

1st September.—With the exception of a very small speck on the cornea of the left eye, there is nothing to be seen. The patient was cured within four months, and has since been perfectly well.

##### 5.—*Herpes Squamosus Madidans.*

EVERT SWEDENBERG (14 years of age).—Father and mother were scrofulous. The patient was supported entirely, for two years, on his mother's milk, during which he enjoyed perfect health, and never suffered from swollen glands. At two years old he was vaccinated, six months after which he was attacked with inflammation of the eyes, which continued a twelvemonth. The symptoms were these: the eye-lids were much swollen; purulent discharge, constant burning pain, intolerance of light, and secretion of acrid



tears. As the chronic inflammation and intolerance of light abated, the mother observed a speck on the cornea of the left eye.

Six months after the cure of the affection of the eye, the mother perceived, in the bend of the knee, a large red spot, consisting of many pustules, which burst, and poured out an acrid, serous fluid. These running together, after a time dried up, and fell off in scales, when pustules were again formed. In three months a similar eruption appeared in the bend of the right knee, spreading to the calf of the leg. This eruption remained in the same state. Different ointments, the last of which appeared to me to be the red precipitate, were in vain prescribed: nothing was given internally. With the exception of this affection, he was always well. On the 2nd of May, the child was brought to the hospital, and placed under my care, at which time its state was this:—A decided scrofulous habit; a slight pustule on the cornea of the left eye; the glands of the neck swollen; the eruption in the bend of the knee appeared to be of a scrofulous character; the digestion often disordered; sour eructations; constipation; respiration normal; the secretion of an acrid, serous fluid, from the surface of the eruption, was most abundant; the patient can scarcely walk, and that with great pain; the sleep is tranquil.

15th May.—The constipation is removed.

1st June.—The surface of the eruption is less red; in many places, dry and smooth—in others, still covered with broad crusts; digestion and the sour eructations better; the secretion from the eruption less; the sleep latterly more tranquil.

15th June.—The swollen glands in the neck have nearly disappeared; the eruption begins to dry up generally, although in some parts new pustules have arisen; four evacuations daily; sleeps better.



1st July.—The eruption on the right knee is altogether dried up; no humid spots are left; when the scabs drop off the skin is red, and rough to the touch. In the bend of the left knee the eruption proceeds equally favourably. The secretion is no longer acrid; evacuations two and three times a-day.

15th July.—The eruption on both knees is cured; the skin on the right knee has assumed its natural colour; the left is still red, and both are rough. The patient can walk easily; the swollen glands in the neck have almost disappeared; digestion good; evacuations twice daily; sleep quiet.

1st August.—The skin on the left knee is now healthy. For the space of one month no fresh pustule has formed; the digestion restored, and motions regular. In the space of three months, the patient has been cured, by the use of the Cod Liver Oil, of an eruption, from which she had suffered for ten years; since which she has been perfectly healthy.

#### 6.—*Chronic Rheumatism.*

HENRIETTA H—— (20 years of age).—Neither father or mother have ever suffered from rheumatic affections. In infancy, however, the mother was scrofulous. Out of thirteen children, three died of rachitis; the others had all suffered in their childhood from swollen glands in the neck, and eruptions on the head; which, however, were cured by the application of various ointments.

At the age of five years, our patient was free from disease, and was perfectly healthy until her seventeenth year. From this time she was seized with headache and lassitude. In her nineteenth year she first menstruated, and has ever since been regular. Shortly after the appearance of the menses, the first attack of rheumatism came on. The ankle swelled,



and increased daily with insupportable pain. The cause of the seizure was evident; for she was in the habit of standing at her work with naked feet, hot and perspiring, on a cold floor, in order to cool them.

On the application of leeches, the pain and swelling diminished, although there still existed slight pain. A short time afterwards, a second attack occurred from the same cause. By cupping and sudorifics the violent pain was relieved. A fresh attack was afterwards brought on by fatigue in dancing and exposure to cold, which however was checked by rest and warmth. Three weeks after, she suffered from another relapse in consequence of fatigue; there was now, however, not only pain in the feet, but she also complained of pains in the arms and back. On the 26th of April the father informed me of the state of his daughter, at the same time begging me to place her under treatment with Cod Liver Oil. She presented the following symptoms:—

Delicate constitution; sanguine choleric temperament; black hair and eyes; fair complexion; the hands swollen above the wrists, as well as the feet, which were swollen above the ankles. The hands and feet very painful, and hot, though not red; both feet perspiring greatly; pains in the back and side; scarcely able to move; the appetite diminished; the tongue clean; evacuations irregular; respiration and pulse normal; sleep quiet.

15th May.—The swelling of the hands and feet have disappeared; two natural motions daily; the pain in the feet and wrists less; that in the shoulders and side relieved; sleep tranquil.

1st June.—Continued improvement; the pain in the back gone, and less in the feet; the motions of the hands free, those of the feet still impeded; the heat of the skin in the hands natural; great perspiration of the feet, with an offensive smell; the appetite and sleep better.



15th July.—All pain and swelling removed ; the perspiration of the feet, as before, considerable ; all the functions natural. On the 10th, she was declared well ; consequently, the cure was effected, by means of the Cod Liver Oil, in the space of forty-one days. She was advised to wear woollen drawers and stockings, and she continued healthy.



## SECOND CLASS.

### CASES TREATED WITH THE LIGHT BROWN COD LIVER OIL.

#### 1.—*Scrofulous Rickets.*

MARIA VAN WYK.—Two years and five months old; the father has always been healthy; her mother, however, and nine brothers and sisters, have suffered from scrofula. The patient has been vaccinated; she has had none of the diseases incidental to childhood; she was suckled a year and a half; then had pap, and afterwards broth and potatoes. Before she was weaned, she could already stand, and in the second year she could get about with the assistance of surrounding objects. Later, however, her strength failed her, she was unable to stand, and the belly began to swell, the mother then brought her to the hospital, and placed her under my care.

The head is well formed and covered with hair, which is blond; the face full and round; the eyelids darker than the hair, the lashes long and brown; the alæ of the nose swollen, the complexion pale; the neck delicate, having many small moveable glands under the skin; arms and hands thin, the muscles flabby, the chest well formed, the belly swollen and hard; the thighs attenuated, the shin bones curved outwards, the vertebræ, particularly the last dorsal and first lumbar, inclining to curvature.

Appetite good (the child had eaten potatoes to the last); tongue covered with white fur, sour eructations; motions regular, soft, and brown. Respiration natural, pulse slow; voice rough, can scarcely stand or walk; stomach painful on pressure, sleep disturbed.



15th June.—The sour eructations less frequent.

1st July.—The belly neither so swollen or hard; the sleep more tranquil.

15th July.—General appearance better; glands less swollen; no craving for food, belly not so painful.

1st August.—The glandular swellings in the neck have disappeared. From the 23rd to the 26th July she suffered from diarrhœa, having five or six motions daily; she had continued the oil notwithstanding.

15th August.—The arms and legs more fleshy; general appearance much improved; three motions daily, appetite good.

1st Sept.—The belly soft, less swollen, and not so painful; the digestion in good order.

1st October.—The patient has attempted to stand; the strength in the feet increases.

15th October.—Since the 7th of this month the patient has been able to stand, and since the 13th she walks as she did before, holding on surrounding objects.

1st November.—The patient has become fat; strength increases daily; all the functions in a healthy state. The cure has been effected in five months and a half. She has been ever since healthy, can run, and the slight curvature of the vertebræ has disappeared.

## 2.—*Scrofulous Rachitis.*

PETRONELLA DE BRUNI.—Two years and a half old; father and mother scrofulous; out of four children who were still living, two were healthy; a boy, however, suffered for two years from otorhœa and swelled glands of the neck, and the mother remarked that our patient had fallen away during the past nine months. This child was nursed for one year, and then was fed on pap, black bread, and potatoes. In the thirteenth month the child began to run, and continued



doing so for a whole year, being quite healthy. She had been subject to no disease, though she suffered from dentition. Nine months since, however, she began to grow thin, the skin became yellow, the child could scarcely stand, there was no question about walking. On the 7th of May the following notes were taken:—

Large head, with scarce any hair, which was blond; eyes bright brown; the nose thick and swollen, as well as the upper lip; four decayed teeth; face pale, glands in the neck enlarged; arms thin and flabby, the skin wrinkled and hanging about her body; chest well formed; belly hard and swollen; the vertebræ of the spine soft and curved, particularly in the region of the three lower dorsal and two upper lumbar; the thighs thin and muscles flabby; the knee joint somewhat swollen. Appetite good, particularly for potatoes, black bread, and cheese. The digestion often disturbed; sour eructations, vomiting, irregular motions, cholicky pains; at one time constipation, at another diarrhœa. Respiration and pulse rapid; sleep disturbed.

1st June.—Four evacuations daily; fæces fetid and slimy.

15th June.—Cholicky pains less frequent.

1st July.—Less craving for food; vomiting not so frequent.

15th July.—The appearance improved; motions irregular; sleep not tranquil.

1st August.—Skin less wrinkled and dry; digestion better; vomiting and sour eructations less frequent; sleep still disturbed.

15th August.—The glands of the neck not so swollen, as is also the case with the belly; the general appearance improved; the evacuations regularly twice a day.

1st Sept.—The belly soft and not painful.

15th Sept.—The swelling of the glands is daily disappearing; the appetite for food, natural; the digestion good.



1st October.—Digestion healthy; neither the belly or glands are any longer swollen.

15th October.—The countenance improved; the strength increases; the patient attempts to stand.

1st November.—Since the 22nd October the child begins to run with the assistance of the mother.

15th November.—The child is quite fat; runs as before, although it is disposed to fall. The cure has been effected within six months. She has continued healthy.

### 3.—*Incipient Scrofulous Affection of the Ankle-joint.*

KATHERINE HENTING (9 years of age).—The father and mother were never scrofulous, though they suffered from rheumatism. The mother has had fourteen children, and of these, twelve died between the ages of six months and three years. From the accounts it appeared that the disease of which they had died (for almost all of them had been nursed only two months) was atrophica infantum. Of the two remaining children, the one (who is now six years old) at the age of one year and a half had an eruption on the head, which was cured in three months with red precipitate ointment, and washing with soap and water. She has since been healthy, with the exception of carious teeth, and an offensive smell from the mouth. The other child, our patient, was weakly and delicate until she was a year and a half old, since which the body had been better nourished. In the third year she was seized with a discharge from both ears, which soon ceased of itself; again came on, and was then more decided than at present. In 1834 she suffered from an eruption on the back part of the head, which was cured by mercurial ointment. In March 1839, and March 1840, it again recurred, but was healed in a short time by the same means. At the commencement of the year 1841 she suffered very much from cholic, at the same time she was subject to



fits of somnambulism. The eruption of the former year did not again return. In the month of May, 1841, she complained of pain in the right ankle-joint, which was swollen. For the last fourteen days the patient has scarcely been able to stand on the right foot, on which account the mother brought her to the hospital on the 16th May, and she then presented the following appearances :—

Brown hair and eyes ; well-formed face, rather freckled : the chest well formed ; the belly hard ; the joint of the right foot is swollen, particularly in the outer ankle. The ankle of this foot considerably larger, painful on motion, and the patient can scarcely stand upon it. The appetite good ; tongue clean ; sometimes sour eructations, spasms, and cholicky pains. The bowels are open once a day ; fæces hard ; respiration and pulse normal ; sleep disturbed ; fits of somnambulism.

1st July.—The belly less swollen ; sour eructations not so frequent.

15th July.—Belly softer ; digestion better ; no spasms.

1st August.—The cholicky pains less frequent.

15th.—The swelling of the right ankle joint has decreased ; digestion good ; the cholicky pains and spasms of the stomach appear to have subsided altogether.

1st September.—The swelling of the ankle is diminishing, as well as the pain on motion.

15th September.—The ankle is decidedly better ; standing on the foot gives scarcely any pain ; walking is still out of the question.

1st October.—The swelling has disappeared ; the ankle is, however, increased in size ; she can now stand on it better, and there is no more pain experienced on moving it.

15th October.—The diseased ankle is much reduced in size ; the patient is able to walk slowly without pain.

1st November.—The patient improves daily in walking.

15th November.—The inner ankle of the right foot is



thicker than the left ; the outer ankle is still somewhat more swollen ; but for a month there has been no visible diminution in the enlargement. The patient can stand and walk without difficulty. The belly is soft, and not large, the functions natural. The patient was restored in about six months ; she has remained healthy, and the affection of the ankle of the right foot is quite restored.

4.—*Scrofulous Conjunctivitis and Corneitis, (with an incipient Opacity, and a central Spot on the left Eye.)*

HENRY VAN HOORN (29 years of age).—A tailor ; parents, as far as he is aware of it, have never suffered from scrofula. Seven brothers and sisters have died, though he does not know of what diseases ; the only brother now living is scrofulous. The patient suffered until his fourteenth year from scrofulous eruption on the head, with swollen glands in the neighbourhood of, and under the chin. Cured of this, the glands in seven weeks began to swell, particularly in cold weather. In his twentieth year he became a soldier. Shortly afterwards, he suffered from ophthalmia, and was during three months in hospital. After six months he was again attacked with ophthalmia ; so that in the space of two years it occurred four times. In 1833, having left the military service, he began to exercise his trade ; from this time, he was never free from the affection of his eyes, by which the cornea of the left eye has become opaque. After he had been treated with every known antiscrofulous remedy, with the exception of Cod Liver Oil, he was placed under my care ; his state was the following :—

The scrofulous diathesis strongly marked ; lymphatic temperament. The right eye healthy ; the lids of the left eye red and tumid ; the lashes for the most part are gone ; the vessels of the conjunctiva much injected, plexus of vessels are seen running from the angle of the eye to the cornea, and



there forming a ring; the cornea is opaque with a pustule upon it, purulent secretion; increased flow of tears; intolerance of light; imperfect sight. Appetite good, evacuations irregular; respiration natural, pulse slow; disturbed sleep.

1st June.—The inflammation increased; great intolerance of light; constipation, for which, on the 29th of May, an infusion of senna and tamarinds was prescribed.

15th June.—Inflammation somewhat relieved; two motions daily.

15th July.—Inflammation much less; the purulent secretion, flow of tears, and intolerance of light decreased. Sleep more tranquil.

1st August.—In every respect better.

15th August.—The redness of the conjunctiva much less, and in the external angle almost gone, as well as the intolerance of light and secretion of tears.

1st September.—Since the 28th of August, after exposure, all the symptoms were again increased; the right eye, hitherto healthy, was sympathetically affected; burning pain in both eyes, particularly in the left. Application of cold water to both eyes.

15th September.—Since the 7th, the right eye is again restored; the left is also better; the opacity and the pustule on the cornea, however, are again increased; pain nearly gone; appetite is good; cold water applications discontinued.

1st October.—Inflammation becomes daily better.

15th October.—The inflammation has almost ceased; no unnatural secretion of tears.

1st November.—The redness of the conjunctiva decreases daily; it is not so, however, with the opacity and pustule of the cornea.

15th November.—The general appearance improved; the inflammation, and intolerance of light removed. Digestion normal.



On the 1st December.—With the exception of the opacity and speck on the cornea, quite healthy.

15th December.—The sight of the left eye is affected by the opacity and speck on the cornea, otherwise he is quite well. He has taken the Cod Liver Oil seven months; he has never since been subject to inflammation of the eyes.

5.—*Tinea Granulata.*

CORNELIUS VAN SCHOONHOVEN (1 year old).—Both parents were scrofulous in their youth. The patient has been nursed and fed with pap and broth; has not yet been vaccinated, and has not had any of the infantile diseases. Has always been healthy. About two months ago, an eruption appeared on the head. White vesicles formed, which burst and discharged an acrid, watery fluid, which hardened into scabs; these scabs being daily washed off with soap and water, there remained behind red spots; the disease soon again resuming the same course. The mother brought the child to the hospital on the 8th of May, when it was placed under my care.

The head of the child is unusually large; the hinder part being peculiarly formed, being more prominent on the right than on the left side; bald in some places, in others the hair scanty, and matted together with yellow crusts, extending over the whole head, particularly on the forehead, and which, separating slowly, expose shining red spots—on some of which are seen round pustules.

Large blue eyes; nose swollen; sores on the alæ of the nose, the face pale; the glands in the neck, and under the chin, swollen; the belly hard; joints healthy. The digestion often disordered; sour eructations, sometimes vomiting; respiration normal; pulse slow; sleep disturbed.

1st July.—The sores on the nose healed.

15th July.—The belly less swollen and hard; the digestion better; vomiting seldom occurring.



1st August.—The glands under the chin no more swollen ; the belly soft ; cholicky pains not so frequent.

15th August.—Within the last eight days the head has become much cleaner ; sleep tranquil.

1st September.—The head cleaner ; no fresh pustules ; digestion good ; sleep tranquil.

15th September.—The healing progresses slowly.

1st October.—The improvement is decided ; all the crusts have fallen off ; no new pustules have formed ; the new hair is growing ; no cholicky pains ; the digestion and sleep good.

15th October.—For the space of one month, no fresh pustules have formed ; the hair is growing profusely ; all the functions in order. The cure has been effected within five months.

#### 6.—*Chronic Rheumatism.*

CORNELIUS ARNAAT (38 years of age ; shipwright).—His father, from his fortieth year, suffered from rheumatism ; died in his seventieth year from Asiatic cholera ; the mother, eighty-one years of age, is still alive, and has always been healthy. He has two sisters, of whom one has been rheumatic for many years, and since her infancy has suffered severely from scrofula. Our patient enjoyed good health until he was twenty-nine, and then began to suffer severe pains in the left hip. From that time the pain never ceased, and generally once a year, particularly in the autumn, was so severe, that he was obliged to give up all work and lie in bed. According to his account the diaphoretic treatment had been adopted. The state of the weather of this spring, constant rain, accounted for his being suddenly seized on returning from his work with such acute pain, that he was not only obliged to keep his bed, but after some days he sought my advice.

On the 14th of May I found the patient lying in bed on



the right side ; he was of a pretty strong constitution and choleric temperament. Acute pain in the left hip ; there was nothing to be remarked externally ; the heat of the bed increased the pain ; he was scarce able to move ; no appetite, the tongue furred ; bowels acted once daily. Sleep disturbed ; respiration and pulse normal.

1st June.—Appetite better ; motions twice daily ; pain somewhat abated ; can move more easily.

15th June.—Sleep more tranquil. Yesterday for the first time he rose from his bed : still the pain is so acute that any movement is impossible.

July 1st.—Digestion good ; pain continues.

July 15th.—The patient can walk ; the pain is nearly gone ; the digestion is good.

August 1st.—The pain is removed ; unrestrained motion of the limb ; functions restored. Since the 23rd of July he has returned to his work. He was cured in two months and eight days.



### THIRD CLASS.

#### CASES TREATED WITH THE PALE COD LIVER OIL.

##### 1.—*Scrofulous Rachitis.*

WILHELMINA VON LUIN (One year ten months old).—The mother died of low fever, and, according to the account of the grandmother, was very subject to scrofula in her youth, so that she constantly required surgical assistance on account of tumours on her head and neck. The father was never scrofulous, but suffered from rheumatism. The patient was nursed for one year, when she was fed on broth and potatoes. Three months after this change of diet the belly became swollen and hard. The child, who at thirteen months could stand with assistance, has so completely lost her strength, that she can scarcely keep herself upright on the floor, and she can no longer use the hands with which she was in the habit of feeding herself; in consequence she was placed under my care.

On the 29th of May the following notes were taken:—The head not very large; profusion of blond hair; long brown lashes; dilated pupils; nose swollen; fat cheeks; ruddy complexion; enlarged glands under the chin; arms thin; chest well formed; belly large and hard; curved spine; thighs thin and muscles flabby; ankles swollen. Appetite voracious; digestion often disordered; sour eructations; sometimes vomiting and spasms; one motion daily; fæces slimy. Respiration hurried; pulse slow and weak; disturbed sleep.

1st July.—Complexion improved.



15th July.—The glands in the neighbourhood of the chin less swollen; vomiting and sour eructations the same.

1st August.—General appearance better; the belly not so large; vomiting and spasms less frequent.

15th August.—Extremities filling out; digestion good; sleep more tranquil.

1st September.—Digestion continues better; the face fuller.

15th September.—The swelling of the glands has disappeared; no spasms.

1st October.—The belly soft, reduced in size; pulse regular; digestion good; muscular power increased.

15th October.—The general appearance daily improves; the ankles no longer swollen.

1st November.—The frame well nourished; digestion restored; sleep tranquil; is enabled to stand with assistance.

15th November.—The patient is perfectly restored. The cure has occupied five months and a fortnight.

## 2.—*Scrofulous Atrophy of Children.*

JOHANNA FLAAT (1½ year old).—Father and mother scrofulous. She was one of two children, the son had always been healthy; the daughter was also healthy as long as she was nursed by the mother, her body being well nourished and well formed. After she was weaned she fell off, and the glands in the neck and groin swelled. The emaciation increased daily; the belly became harder and larger, and the strength was so diminished that she could not support herself, and was obliged to be carried. The mother now sought my advice.

On the 2nd of June the patient showed the following appearances:—Light hair; blue eyes, with long brown lashes; thick nose, face much reduced; the under part of the chin much developed; numerous glands on the neck, which were felt



moving under the skin; arms and thighs emaciated, the skin wrinkled, and the body reduced literally to skin and bone. The belly large and very hard. Appetite voracious; the child ate nothing but potatoes and black bread; sour eructations; motions twice and three times a day; the fæces liquid. The respiration and pulse accelerated; muscular power very much diminished; voice shrill; sleep disturbed.

15th July.—The general appearance improved; appetite less depraved.

1st August.—The respiration and pulse slower.

15th August.—The belly softer; fæces more consistent; sleep more tranquil.

1st September.—Glands less swollen; general appearance better; sour eructations not so frequent.

15th September.—Improving; voice stronger, and less shrill.

1st October.—Still improving; digestion good; pulse and respiration almost natural.

15th October.—Muscular power much increased.

1st November.—Daily improving; digestion healthy; evacuations twice daily; fæces soft; sleep tranquil.

15th November.—The swelling of the glands entirely gone; muscular power increasing daily; voice again natural.

1st December.—Healthy complexion; digestion normal. Since the 19th of November she has been able to stand with the assistance of her mother.

15th December.—Perfectly healthy appearance; functions natural; the muscular power so increased, that the patient can walk with the assistance of the mother. The cure has been effected in six months and a half. She has since continued healthy.



3.—*Scrofulous Rachitis.*

WILHELMINA ROLLMANS (6½ years old).—Both parents were scrofulous. The father died of a rheumatic affection; the mother has suffered from chronic inflammation of the eyelids for twenty years. Of three children, two died early; the third, our patient, when one year and a half old, was affected with an eruption on the head, which was readily cured with fresh butter. She only first began to run when three years old: and even from the first year she was thin, and complained of griping; the belly was large and hard. Before three months the cervical glands began to swell; increased daily; the skin inflamed, and scrofulous ulcers were formed.

On the 30th of May, when she was placed under my care, she presented the following appearance:—Blond hair; brown lashes; blue eyes; small, thin, pasty face; many of the cervical glands swollen, with three ulcers on the neck. The chest contracted; arms and legs very much attenuated; the shoulder-blades raised; the belly large and hard; the long bones slightly curved; the ankles swollen. Appetite good, even voracious; sometimes griped; irregular evacuations; any motion of the body attended with pain; excessive night sweats; no muscular power; sleep restless; occasionally slightly convulsed.

15th June.—The sleep more tranquil.

1st July.—The cervical glands, as well as the belly, less swollen; the gripings diminished; the voracious appetite less.

15th July.—General appearance improved; the ulcers on the neck are cicatrising; digestion better; the night sweats have decreased; muscular power greater.

1st August.—Improving daily; belly soft and reduced in size; evacuations regularly three times a-day; fæces soft, seldom any griping; ulcers nearly cicatrised.



15th August.—The swollen glands have altogether disappeared; the ulcers are cicatrised; size of ankles reduced; digestion good; night sweats have nearly ceased; the muscular power is increased; the sleep is no longer convulsed.

1st September.—The gripings have ceased; the muscular power improves; sleep tranquil.

15th September.—The countenance is full and healthy; belly natural in size; the swelling of the ankles much decreased; the functions are restored. The patient was cured in three months and a half.

#### 4.—*Scrofulous Caries.*

DIRK VENENDAAL (9 years of age).—Both parents were scrofulous. All six children are affected with swelling of the cervical glands, as well as those at the back of the head. One patient was cured of these swollen glands in his fourth year, and, although delicate, since that period had been healthy. In November, 1839, he was seized with an illness, the name of which he did not know; all he remembered was, that he had lost his appetite and his accustomed sleep; he was under treatment for it during nine months, and when restored he remained well for nine months; there, however, existed in his left knee a pain which soon became worse, and prevented his walking. Brought to the hospital, he was immediately cupped on the knee, which was repeated after three days; he then lost the pain. After eight days the scarified wounds suppurated, which at the commencement secreted a thin matter, after which they all healed, with the exception of two on the inner side of the knee; these increased daily, and became deeper, with raised edges, discharging a great quantity of thick yellow pus.

Dr. van der Steen, who saw the patient daily, discovered, after eight days, caries in the thigh bone, and treated him with anti-scrofulous remedies, and for a short period with Cod



Liver Oil. The patient not wishing to submit to the proposed amputation, was placed under my care.

On the 27th May he showed the following appearance:— A decided scrofulous habit; cachectic appearance; the legs, hands, and arms, very attenuated; the belly swollen. In the neighbourhood of the knee were the cicatrices of the former ulcers; in the inner and under part of the thigh there are two sinuses, which on the slightest pressure discharge a great quantity of thick, yellow, fetid matter. The probe passes easily between the muscles to the back part of the thigh. In the upper sinus I discovered caries of the bone. The feet were œdematous. The patient was unable to stand, but suffered no pain. Appetite small; digestion disordered; diarrhœa; the respiration towards the evening accelerated. Pulse slow, weak; hectic fever; sleep disturbed; weakness considerable.

15th June.—The evacuations less liquid.

1st July.—The discharge of pus diminished; sleep less disturbed.

15th July.—The belly soft and less swollen; appetite somewhat better.

1st August.—The complexion better; digestion good; evacuations three times daily; fœces soft.

15th August.—The ulcers are contracted; discharge continues, and is fetid. Caries is still felt by the probe.

1st September.—The general appearance much improved; hectic fever diminished.

15th September.—Strength perceptibly increased.

1st October.—The appearance improving; discharge has lessened.

15th October.—The hectic fever better; appetite good; evacuations twice daily; fœces soft. The spirits and the strength improve. A little wine ordered daily.

1st November.—The patient is getting daily better; the ulcers very much contracted; the discharge considerably less, as well as the fever; sleep tranquil.



15th November.—The upper sinus is granulating; the œdema of the legs has nearly disappeared; appetite and strength increased; evacuations daily; fæces soft.

1st December.—The complexion good; the general appearance decidedly better; appetite and digestion good; the strength so increased as to allow the patient to stand alone.

15th December.—The arms and legs have again become fleshy; the œdema has disappeared; the discharge very little. No caries is discovered by the probe.

1st January.—Discharge slight; the remaining sinus nearly healed; pulse natural; the patient walks with the help of a stick.

15th January.—The sinuses are closed; better appetite; good digestion; evacuations regular; appearance good; strength improves; the patient can walk better.

1st February.—The patient was perfectly cured in eight months.

#### 5.—*Tinea Favosa.*

JANSKE KLOET (14 years of age).—Nothing deserving notice requires to be mentioned with regard to the parents. The patient from the earliest years had suffered from an affection of the glands of the neck. In the sixth year she first became the subject of tinea; external and internal remedies were prescribed in vain. The hair was even removed without benefit.

27th May.—She came under my care; she is of phlegmatic temperament, of apparently good constitution, but of a decided scrofulous habit, suffering from tinea; appetite and digestion natural, as well as the pulse and respiration; excretions and secretions healthy; sleep tranquil.

15th August.—Head somewhat cleaner.

15th September.—The improvement of the head very evident.

1st October.—The head continues better; the eruption is not reproduced.



18th November.—The greater part of the head is free from disease.

15th December.—The head is quite clean; the hair is beginning to grow again; the cure was effected in six months and a half.

#### 6.—*Chronic Rheumatism.*

ELIZABETH DE MAU (aged 77).—She suffered in her youth from scrofula, and, since her thirtieth year, from rheumatic pains, which were so severe as often to confine her to bed; in the latter years the pains in the legs became worse. Diaphoretics and blisters were used with some success in the very acute attacks, but still they were unable to remove the pain entirely. In this year the attacks were oftener repeated, and on the 31st May her state was this:—The patient lay in bed, which she had not left for many days; strong frame of body, choleric temperament; frequent pains in both shoulders, and in the right hip, extending to the knee; pain much increased on motion; the arms moved with difficulty; impossibility of raising the right leg. Appetite good, digestion and respiration normal, pulse slow, skin cool, no sleep.

15th June.—Sleep better.

1st July.—Pains diminished.

15th July.—Since the 12th, pain severe, particularly in the right hip; the appetite somewhat impaired.

1st August.—Since the 19th July, the pains have abated; arms are moved better; since the 23rd the patient has risen from her bed; the digestion somewhat disturbed; four evacuations daily; fæces soft.

15th August.—The pain is diminished in both arms, which are moved easily; pain in the right hip less; appetite better; digestion good, two motions daily.

1st September.—The pain in the right hip is removed; the



motions of the limbs are now unrestrained; sleep tranquil; digestion good.

15th September.—No pain, the limbs are quite free; the functions of the body natural. The patient was cured in three months and a half.

*Inference drawn from the Comparison of its Medicinal Properties.*

When the results of these three classes of cases are compared together (for the individual cases cannot be compared for the reasons mentioned), we find that the Brown Cod Liver Oil is similar in one respect with the two lighter-coloured sorts; while, in other respects, it differs considerably.

The three kinds agree so far, that all the patients which were treated with the Cod Liver Oil were cured, there being, however, a marked difference with regard to the time in which the cures were accomplished, evidently showing that there is a decided superiority in the efficacy of one kind over the others. That this variation in the period of the cure is not unimportant, is satisfactorily proved by the following Table, which has been drawn up<sup>1</sup> for the purpose:—

TABLE.

I.—WITH BROWN COD LIVER OIL.

Rachitis . . . . .	in 3½ months
Intumescencia gland. lymph. subcutanearum . . . . .	„ 3¾ „
Intumescencia gland. lymph. subcutanearum . . . . .	„ 2½ „
Conjunctivitis et corneitis chronica cum cœcitate insecuta . . . . .	„ 4 „
Herpes squamosus madidans . . . . .	„ 3 „
Rheumatismus chronicus . . . . .	„ 1½ „

<sup>1</sup> In the original tables, besides the duration of the treatment, only the name of the patient was given, for which I have substituted the name of the disease, since it is more connected with the treatment, whereas the latter is altogether of no consequence. I have also, for the sake of brevity, retained the Latin appellation.—*German Trans.*



## II.—WITH LIGHT BROWN COD LIVER OIL.

Rachitis . . . . .	in 5½ months
Rachitis . . . . .	„ 6 „
Pædarthroace incipiens . . . . .	„ 6 „
Conjunctivitis et corneitis chronica . . . . .	„ 7 „
Tinea granulata . . . . .	„ 5 „
Rheumatismus chronicus . . . . .	„ 2½ „

## III.—WITH PALE COD LIVER OIL.

Rachitis . . . . .	in 5½ months
Atrophia infantum . . . . .	„ 6½ „
Rachitis . . . . .	„ 3½ „
Caries . . . . .	„ 8 „
Tinea favosa . . . . .	„ 6½ „
Rheumatismus chronicus . . . . .	„ 3½ „

From this it is evident that the cures with the brown Cod Liver Oil were in general effected in half the time than those with the two other sorts. This might be attributed to accidental circumstances, if only one patient had been treated with each kind; there were, however, in each class of cases, six patients indiscriminately taken, and, indeed, quite as chance brought them: for we placed under treatment the first six patients which came under our notice with the brown, the following six with the light brown, and the last six with the pale.

It follows, from these results, that, although all three kinds of Cod Liver Oil fulfil the same indications, still the brown effects this sooner, and we can, therefore, ascribe to it more powerful healing properties than to the two other kinds. This difference in its operation can only be attributed to some variation in their chemical relations. This, indeed, has been found to be the case in our chemical researches, and it may probably enable us to discover from what constituents the Cod Liver Oil peculiarly derives its therapeutic properties.



## CONCLUSION.

As my inquiries in this Treatise have been directed to a positive result, I could not allow the nature of the disease in which the Cod Liver Oil has been prescribed with success, nor the *modus operandi* on the system, to enter into the question, which would necessarily have led me into much speculation. I have reserved to myself, in a work expressly written for that purpose, the answer to both these questions, submitting them to the test of experience; I shall, therefore, only give here the results of my chemical and therapeutic researches.

That the Cod Liver Oil is composed of different substances has been sufficiently proved by chemical analysis. Neutral fat, biliary matter, iodine, phosphorus, all substances of acknowledged power, as well as butyric acid, gaduine, &c.; lastly, the many organic salts which are found therein.

The question naturally arises, to which of these different constituent parts of the Cod Liver Oil is its efficacy owing? Whether to the iodine, or the fat, or the phosphorus, or to the others. These questions are solved with great difficulty; for in all diseases in which the Cod Liver Oil is found to be efficacious, the physician has to fulfil many indications simultaneously, if he expects the perfect restoration of his patient. In general, the weakened digestion is to be corrected, the secretions must be restored, and the lymphatic system brought to a higher state of activity; besides which, and what seems to be the most important of all, the tone of the nervous system is to be improved. The slightest reflection will show that neither biliary matter, nor the fatty substance, nor the iodine, nor any one single constituent part of the Cod Liver Oil, is able, of itself, to fulfil these indications; consequently its power as a remedy is not to be ascribed exclusively to one only,



but to the united operation, if not of all, still of the greater part. It is not, as is the case with the quinine in the Peruvian bark, that there exists a peculiar active principle in the Cod Liver Oil, but as each individual constituent part fulfils a peculiar indication, it is possible that the operation of the whole is successful in the cure of these diseases.

Nevertheless, I do not think that all the constituent parts are equally powerful; on the contrary, some of them possess greater efficacy: and it is, in every case, those which fulfil the most important indication that are to be the most esteemed. I now come to the comparison of my observations.

The brown Cod Liver Oil has proved itself a most powerful remedy in rheumatism and scrofula. Now I have found, in my chemical analysis, a quantitative difference between this and the other sorts of Cod Liver Oil. The constituent parts, which exist in great proportions in the brown Cod Liver Oil, must, therefore, be considered as those which fulfil the most important indications. The neutral fat, the iodine, phosphorus, the inorganic salts, exist in the same proportions in the other kinds of oil, which are not supposed to be particularly efficacious in scrofula and rheumatism; it is, therefore, fair to assume that the brown Cod Liver Oil owes its greatest power to the biliary matter and butyric acid, which exist in it in much larger proportions than in the lighter-coloured oils.<sup>1</sup>

In conclusion, I have still to remark that the substance, unknown until now, which I first found in the product of the *Gadus* tribe, and called Gaduine, should, by no means, be considered as possessing that peculiar active principle; on the contrary, I am inclined to think that, on account of its perfect insolubility—in the form, at least, in which I found it—it is altogether inactive.

<sup>1</sup> Klencke also mentions the importance of the biliary matter, without even knowing of its existence in the Cod Liver Oil; for he declares the yellow Cod Liver Oil to be a substitute for bile. We cannot however agree with Klencke's opinion on the transformation of the oil into albumen.—*German Trans.*



## APPENDIX.

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It is not my intention to expatiate on a subject which has been so thoroughly investigated in the preceding pages, and to which it would seem nothing further could be added.

In appending a few of the most striking cases which have come under my treatment, I cannot, however, withhold my meed of praise in favour of a medicine with which an experience of many years has made me familiar, and has led me to regard as the most valuable we possess as an analeptic agent, independently of its other virtues, for which it also merits the highest consideration. But, as I consider that its success will depend mainly on the proper selection of the oil, I would direct attention particularly to this point, which has been much overlooked.

Dr. de Jongh has, by an elaborate analysis, brought to a positive conclusion the relative proportions of the different constituents in the three kinds of Cod Liver Oil; and has, moreover, obtained for himself the merit of discovering a new element, which was previously unknown to exist, and to which he has given the name of Gaduine. He has, however, been unable, with any degree of certainty, to attribute to any one in particular the active principle to which the Cod Liver Oil owes its therapeutic powers.

The solution of this question involves another, equally essential—How does it afford nourishment to the system? The answer to this we must leave to the future research of the chemist. But the author has, by his comparative observations,



placed beyond doubt the superior efficacy of the brown and light brown over the pale kinds in different diseases, which has been attested most by continental writers. Dr. de Jongh has done much to prove this, and to show the necessity of employing none but the real Bergen oil, which he considers the only genuine kind.

Since the publication of his treatise, Dr. de Jongh, not satisfied with the inquiries he had made in reference to the quality of this oil, and wishing to ascertain personally the cause of its frequent uncertain operation, so often noticed by the most scientific observers, and which, remaining unexplained, tended much to bring its value as a remedy into disrepute, determined on undertaking a voyage to Bergen, in order to trace out the cause, and, if possible, remove it.

He has given an account of it in a small pamphlet, which was published in the Dutch language, at the Hague, 1846.

He devoted two years to this object, which was attended with complete success; having ascertained, beyond doubt, by the aid of his chemical observations, that this uncertainty in the operation of the oil depended upon its being occasionally adulterated.

Anxious to remedy the evil, which, however, was beset with much difficulty, he obtained the assistance of the Baron von Wahrendorf, *Chargé d'Affaires* from Sweden and Norway at the Court of the Hague, as well as the Consul at Bergen, Monsieur du Prahl, and other respectable persons high in office. He has thus been enabled to ensure to the profession the means of procuring the most genuine and powerful oil, and to warrant it as such.

In conclusion, he says: "I wish to make as public as possible the results of my voyage; at the same time to state my conviction that only such Cod Liver Oil as can be obtained at the Loffoden Islands is of exclusively good quality. I have it sent to me by two of the first mercantile



houses at Bergen; and the Dutch Consul feeling much interested in the matter, has kindly offered to affix his seal to every cask shipped, to prevent adulteration; experience, moreover, having taught me how important it is to ascertain the genuine quality of the oil, I shall carefully test every cask I receive, previously to its being used.

“Those who may be desirous of obtaining genuine Dorse Liver Oil are requested to pay particular attention to my signature and seal, which will be attached to the corks of each bottle, with directions for its proper administration.<sup>1</sup>”

This opinion, founded on practical experience, not on mere speculative theory, should carry with it its due weight, and lead, if not to its adoption, at all events to further inquiry, on the importance of this distinction, which has not been sufficiently regarded by the English practitioner, and which, indeed, may have arisen partly from its being still imperfectly known, from the writings on the subject being extremely limited,<sup>2</sup> and in a great measure, perhaps, from the difficulty of obtaining it direct from Norway.

The best Bergen oil has been shown to be derived most exclusively from the livers of the Dorse (*Gadus callarius*),

<sup>1</sup> The price at which the genuine Bergen oil may be obtained at Rotterdam, or the Hague, or Copenhagen, is about 8s. the gallon. That stamped with Dr. de Jongh's signature obtains rather a higher price.

Since this was written I have met with an oil which I understand is procured from Newfoundland. From its appearance with regard to colour, transparency, taste, and smell, it approaches so nearly to that which I have been in the habit of employing as the real Bergen oil, that I have no doubt, if analysed, it will be found to contain the same chemical constituents. It may be procured of Francis Walton, 283, Wapping, at a price which brings it within the reach of the poorest individual, I believe 1s. 6d. the quart bottle.

<sup>2</sup> The only work in the English language, is Dr. W. Bennett's on the “*Oleum Jecoris Aselli*,” Edinburgh, 1841, which has already been noticed, and quotations made therefrom by the German Translator. I should not fail to mention the excellent article which appeared in the first number of the “*London Medical Journal*,” by Dr. C. J. B. Williams, to whom the profession is much indebted for the clear and able manner in which he has detailed his experience of the Cod Liver Oil in phthisis.



and coal-fish (*Gadus carbonarius*), which are caught only on the coast of the Loffoden Islands, and are not indigenous to our coasts, but are natives of regions many degrees colder; and, from which circumstance, may be supposed to yield a far richer oil.<sup>1</sup> This applies equally to the cod fish (*Gadus morrhua*), which, only on the banks of Newfoundland, and in equally cold temperatures, acquire a full size, and arrive at greater maturity.

The fish caught on the English coast, from which the oil used in England is obtained, is considered by some naturalists not to be healthy,<sup>2</sup> from the fact of its being out of its proper latitude, as well as being deprived of its natural food, which is the cuttle-fish, and only found in quantities on the banks of Newfoundland, &c.

Much also may depend on the mode of preparation adopted in England, which would appear to have in view the production of a white tasteless oil, irrespective of its chemical properties;<sup>3</sup> be it what it may, I am confident that, if analysed according to the method employed in this work, it will be found greatly deficient in many of the chemical properties which have been found in the Bergen oil, particularly in the biliary matter which imparts the colour to it, and to which it may owe its superior efficacy.

In the present state of our knowledge on the subject, and with these facts before us, I do not think we are justified in denying to the Bergen oil, and to the brown in particular, this superior efficacy, or in substituting an inferior article, merely on the supposition of its being more palatable. We thus peril the reputation of a valuable remedy, and favour a prejudice already too prevalent, which we should be careful

<sup>1</sup> The size and fatness of the liver are often alluded to as being necessary to produce a rich oil.

<sup>2</sup> Vide Pennant's "Natural History."

<sup>3</sup> A great facility is thus given to the introduction of an adulterated oil, which is the impure fish oil purified and blanched with chlorine.



how far we encouraged, that it is more nauseous, and impossible for the stomach to bear; this not being the case, an idea which can only have arisen, as I have before stated, from the genuine Bergen oil not being known.

I have been in the habit for years past of obtaining, through Mr. Adolphus Arnold, chemist of this island, the three different kinds of oil, direct from Rotterdam and Copenhagen; the brown, the light-brown, and the pale; such as I am assured are brought from Norway, and used in those countries, and I believe them to be genuine, and unadulterated, from the respectability of the parties who supply them. I find that, as far as their external characters are concerned, they differ little, except in colour, which varies from a pale yellow to a brown, such as is seen in brown sherry: the difference in taste and odour is scarcely perceptible; they are equally transparent; nor is there more rancidity in the brown than in the pale. There is an oil used by curriers, having more of the characters of the three other kinds, of a dark-brown colour, approaching to black, not transparent, of the consistence of treacle, smelling and tasting strongly; but it is not medicinal.

I have invariably prescribed the genuine transparent brown and light-brown Cod Liver Oil, and I have never experienced any difficulty in its being taken by adults, nor has it been more repugnant to the stomach than the other kinds; and it is surprising how soon this repugnance to it is overcome, and how little aversion is felt towards it, after it has been taken a short time; much will depend, however, on the proper time for administering it, which should be immediately after a meal; it then mixes with the food, is digested at the same time, and passes with it into the duodenum. Much of the after-taste is thus, in a great measure, avoided. With regard to children, the fact is as extraordinary, as it is undeniable, that they not only make no objection to it, but really ask for it at the



stated time, and feel disappointed if refused, and this almost invariably happens in every case.

It is in this class of little patients, as far as my experience leads me, that the value of Cod Liver Oil cannot be too highly estimated; it is in the diseases incidental to childhood, that mainly depend on the mal-assimilation of the food, where scrofula would be developed, (and where it was not, a train of symptoms nearly resembling it would be produced,) in the pale cachectic child, that the most confident reliance may be placed on its use, when the anxious practitioner has exhausted the whole range of alteratives and tonics—the many and varied preparations of iodine—that the Cod Liver Oil will come in and satisfy his most sanguine expectations. It may be prescribed with almost a certainty of success in these cases; where the powers of life are low, it affords nourishment to the body, when none other can be borne; restores the functions of digestion, and furnishes the frame with fat in a truly wonderful manner. Although it generally restrains the undue action of the bowels, the colour of which is manifestly improved during its use, being of that bright yellow, such as is seen in a healthy flow of bile, it will, in some constitutions, produce diarrhœa; when this is the case, astringents should be prescribed. That which is invariably used in Holland is the acorn coffee, which is prepared of the same strength as ordinary coffee, and given two or three times a day. One of the most marked improvements is its action on the skin, which, from being arid, burning, or cold, becomes warm and perspirable, and, with the feeling of warmth, assumes the glow of health; the secretion from the kidneys is also considerably increased. I have never seen any ill consequences result from its use; on the contrary, it has seldom failed when long persevered in, to afford relief, where a cure could not be effected.

But it is not in disease alone that Cod Liver Oil is pre-



scribed with very great benefit, it may be administered, as it is in Holland, (a plan which I have frequently recommended,) to the delicate and puny child, who, though not considered ill, is in that state of impaired health which would favour the development of disease to which it may be predisposed. The extraordinary effects will soon be visible after having taken it for a short period, in a return to health and strength, which was before unknown, and which will be accomplished by no remedy whatever, with which we are at present acquainted.

Its beneficial operation in phthisis, according to my experience, has been more apparent in the earlier stages of the disease, where extensive disorganisation has not yet taken place; where the existing tubercles have not as yet become softened; where no excavation exists: it will then be found capable of arresting the disease, and effecting such a marked change in the constitution, that if the precautionary measures so requisite in all phases of this formidable disease be duly observed, although the disposition may exist, the further development will be decidedly and effectually stayed. In the more advanced stages, although it will accomplish much in the amelioration of all the symptoms, and in retarding its progress, these decided results can hardly be expected from it. Further experience is wanting to show that it has the power of restoring the destructive work which has previously gone on to the production of the last stages, and which, if it were able to accomplish, it would, indeed, deserve the appellation of the "grand restorer of health."

I would say, as a general rule, that the Cod Liver Oil will be found serviceable in the scrofulous, rheumatic, and the gouty diatheses; and, consequently, all those diseases which may be traced to these causes will be benefited by its use.

To those patients acquainted with the use of the oil in these cases, it is unnecessary to urge their steadily persevering



in it; their own feelings, the evident benefit which they derive from it, prompting them to a constant recurrence to it, whenever the slightest attack of cold, and return of cough, remind them of its necessity: in fact, they become sensible that they cannot do without it.

To the inexperienced, I would recommend a steady and persevering continuance in its use, which alone can insure that permanent success with which it will, in most cases, undoubtedly be attended.

*Curvature of the Spine, with Paralysis of the Lower  
Extremities.*

MARY P——. —Aged 6, born of unhealthy parents, of scrofulous diathesis, and with enlarged abdomen, emaciated appearance, and swelling of the glands of the neck; had been affected since birth with curvature of the spine and paralysis of the lower extremities. In the lumbar region, the natural bend of the spine forward was increased so much beyond its proper axis, that the spinous processes could not be felt. The lower extremities, attenuated to the smallest size, hung powerless from the pelvis, which was thrown backwards. The whole osseous system was deformed; the sternum thrown forwards, the clavicle bent to right angles; the muscles of the back were sufficiently developed to support the erect posture when seated. The vital powers were much depressed; cold shrunken skin, tongue furred, bowels irregular. The secretions having been corrected with mercury and chalk, the use of the oil was commenced by one tablespoonful three times a day, nourishing diet, and tepid salt water baths three times a week. At the end of a month the general health was visibly improved, the power of motion was gradually restored to the extremities, and she began to crawl. At the end of three months she stood at the bedside, and at the expiration of six months she walked alone. She



continued improving under the use of the oil, until she was able to run about and enjoy the perfect use of her limbs. The spine remains still somewhat incurvated forwards.

D. G.—Aged 1 year and nine months, born of scrofulous parents, a rickety, strumous child; large head, fontanelles open and large, tumid belly, dark hair and eyes; the spine was distorted, the sternum and clavicles were thrown forwards, the bones of the frame soft and yielding. At this early age he was subject to periodical attacks of dyspnœa, resembling spasmodic asthma, occurring every fortnight, and ceasing after some hours' duration. The respiratory murmur in the intervals was normal, though the breathing was somewhat quicker than natural. Three former children of the same parents had been similarly affected, and had died young. A course of iodine and hydriodate of potash had been persevered in, for three months, without any visible alteration in the general health, or alleviation of the distressed breathing, nor had the infant acquired the least power over his limbs. The oil was prescribed, when he was a year old, in doses of a teaspoonful three times a-day, increasing it gradually to a dessert-spoonful. After the first month, the attacks of dyspnœa became less frequent; at the end of the third they had ceased, the general health rapidly improved, the limbs acquired strength, and he became a stout, robust child. He is now nine years old, and has enjoyed average good health since the above-named period.

#### *Phthisis.*

M. D. P.—Aged 35, of consumptive habit, florid complexion, nervous temperament; father still alive and healthy; mother had died at an advanced age of gastric disease; an only brother had fallen a victim to confirmed phthisis, and one sister is at present living of the same delicate appearance. Our patient had suffered for many years from pain in the



left side, dyspnœa, occasional cough, unattended by expectoration, which symptoms were readily aggravated by any exciting cause.

On the 10th of April, 1848, after exposure to cold and fatigue, having previously been much depressed by extreme mental suffering, she had an attack of her usual symptoms, attended with considerable hæmorrhage from the lungs; when I first saw her, she was not reduced in flesh, but there was complete incapacity to assume the horizontal posture, respiration was short and difficult, with a feeling of oppression; pain in the side much increased, cough frequent, accompanied with bloody sputa; skin hot, pulse 120, weak.

Chest, over the greater part, dull on percussion; respiratory murmur inaudible over the whole of the left side; on the right, respiration puerile and bronchial, with distinct mucocrepitant râle in the clavicular region. Digestive organs much disordered; constant sour eructations, loss of appetite, bowels irregular.

The more urgent symptoms were subdued by leeches, moderate antiphlogistic treatment, &c.; and, although the expectoration was occasionally tinged and rusty, there was no recurrence of active hæmorrhage. The dyspnœa, cough, and pain in the left side were relieved, but still existed, with acceleration of the pulse; she had become much emaciated; hectic flush was present, with night sweats.

A course of hydriodate of potash and iodine was followed by no decided results; she remained much the same, her symptoms, however, were somewhat alleviated, and her strength sufficiently restored to allow of her rising from her bed, and reclining on a couch during part of the day.

Having succeeded in overcoming a very great aversion to the Cod Liver Oil, she commenced taking it in August (notwithstanding her gastric symptoms), a tablespoonful twice a day. After she had taken it for three weeks, she



was so sensible of the benefit she derived from it, in the amelioration of all her symptoms, but particularly in the restoration of her strength, improved appetite, and the absence of the acid eructation, that she increased it to three times daily. Her improvement was rapid, and she was soon brought to that state of health which enabled her to get through the winter comparatively well, by continuing the oil, which she did, with only occasional intermissions, so that the spring found her capable of enjoying the air, and, in a short period, to return to her avocations, enjoying a better state of health than she had done for many years.

The left lung remains impervious to air; considerable change has taken place in the right, the respiratory sounds assuming a more healthy character.

*Incipient Tubercular Phthisis.*

D. M.—.—Aged 15, delicate complexion, fine clear skin, large blue eyes, dilated pupil; long eye-lashes; highly scrofulous appearance. Father died of consumption; one brother and three sisters living, all of phthisical tendency. She has always been subject to dyspnœa, particularly in ascending any height, with a feeling of pain and lassitude in the limbs; she was, however, never considered unhealthy, nor had she suffered from any serious illness.

On the 11th of January, 1846, after a violent exertion of running, her breath was so distressed that fainting was produced; from which, however, she soon recovered, and was able to walk home. From this time the pain and lassitude in the lower limbs were perceptibly increased, became gradually worse, and, after a few days, on attempting to rise in the morning, she found that she had lost all power over them. When I saw her, she exhibited her usual appearance, not reduced in flesh, but was perfectly paralysed from the pelvis downwards; sensation was perfect; no pain or pressure in



the course of the spinal marrow; pulse from 120 to 130; small and weak; heat of skin rather increased; perspiration hurried; cough, though slight, easily excited. She had menstruated, and had been regular since the age of fourteen. Chest was dull on percussion; respiration highly puerile; heart sounds audible over the whole præcordial region. The dry cough increased with the confinement, and after a short time became incessant, continuing day and night without any intermission. She became much emaciated and reduced to the last stage of exhaustion, having lost her appetite, and being unable to take any nourishment.

Every means failed to afford relief or subdue the cough, and the only one left, the propriety of trying change of air, was questionable, from her extreme debility. This, however, was accomplished in the month of June, by sending her across the sea to an adjacent island, but proved equally unsuccessful; she returned, still coughing, though her strength and appetite were somewhat improved. She was perfectly unable to move her limbs.

In the latter end of July, I prescribed the Cod Liver Oil, not in the expectation of its succeeding; for I considered her case beyond the reach of medicine; but to satisfy the friends that nothing had been left untried. A table-spoonful was given three times a day; and she had taken it but a short time ere she perceived a decided abatement in the cough; her inclination for food returned; she was stronger, and a visible improvement was manifest in her general appearance.

At the end of six weeks, her cough had entirely left her, and she had acquired some power over her limbs. She was put on crutches, from which time, being able to move about in the air, she went on gradually improving; before the autumn, she left off her support, and could walk short distances. She passed the winter without any recurrence of the symptoms; adopting the greatest precaution, and persevering



in the use of the oil, which she continued taking until the following September, without once leaving it off. During the following winter, from taking cold, she had a slight return of the cough, which was arrested by again resuming the oil for a short time. She is now restored to a better state of health than she enjoyed previous to her illness, and which she attributes entirely to the Cod Liver Oil.

*Scrofulous Caries of the Lower Maxilla.*

M. A.—10 years of age, about two years ago, was the subject of low fever; convalescing from which, the whole chain of cervical glands as well as the parotid inflamed and suppurated, producing numerous pustulous openings under the chin. The inflammation soon after extended to the mucous membrane of the mouth and gums, where an abscess formed, which, on being opened, discharged a fetid pus, which, leading to the detection of extensive caries of the lower maxilla, her health was much impaired; the functions of digestion disordered; powers of nutrition low; temperature of skin cold; bowels irregular; pulse weak.

February, 1849.—Her present appearance is that of an unhealthy scrofulous child, with the powers of life low; left side of the face considerably swollen; two pustulous ulcers on the cheek, and those under the chin fusing out a thin fetid pus, with no disposition to heal; inside the mouth, the whole of the alveolar processes on the left side of the lower jaw was in a state of caries, attended with an insupportable fœtor; some of the teeth loose; others had fallen out.<sup>1</sup> She had been a considerable time under treatment, without any progress being made towards recovery; nature making no effort whatever to throw off the necrosed bone.

A dessert-spoonful of the Cod Liver Oil was administered

<sup>1</sup> She was able to open her mouth, the motions of the jaw being little impeded considering the extent of the disease.



three times a day, using at the same time the nitric acid lotion for the mouth. After the lapse of a month her general health was evidently improving; the ulcer put on a more healthy appearance; the discharge lessened; the fœtor remained the same. During the second month the bone began to exfoliate, and before its termination the part of the ascending ramus of the inferior maxilla loosened and came away with the coronal process quite perfect; the separation had evidently taken place immediately below the articular process; the cavity soon filled up and quickly healed, which was the case also with the ulcers under the chin. A short time afterwards a considerable portion of the horizontal plate of the jaw, with the alveolar process, was again thrown off; healthy granulations sprung up, and the gum readily closed over it.

She has taken the Cod Liver Oil for nearly four months, and is quite restored to health. There is very little deformity, with the exception of the loss of her teeth and the marks of the cicatrices on the neck; the cheek little varying, somewhat swollen.

*Porriigo Scutulata.*

M. F.—12 years of age, of healthy appearance, although born of scrofulous parents, and having no tendency to these diseases, had suffered since her fourth year from porriigo, for which she had been subjected to various modes of treatment without any benefit resulting, and she had been declared incurable. Her state, when I first saw her, was the following:—The general appearance indicated that the state of health was good. No treatment had been adopted for some months, with the exception of shaving the head and keeping it clean by washing it with soap and water. The eruption occupied the whole of the hairy scalp, from the forehead to the occiput, the patches running into each other, leaving but few healthy spots here and there. The clusters of pustules were in different stages of maturation, some forming, others



pouring out a copious acrid discharge; many inflamed irritable parts remained after the removal of the scabs, which was effected by the washing, and which tended much to keep the disease in check. The hair, which had been kept constantly close by shaving, appeared to be of healthy growth.

The treatment was commenced by a table-spoonful of the brown Cod Liver Oil administered twice daily, which was gradually increased to thrice daily, with the continual application of the oil externally, and the occasional use of the nitrate of silver ointment. After three months no fresh pustules were formed, and the head altogether assumed a less irritable character. The pustules went on the same course in the diseased parts, the patches, however, becoming more defined. After ten months' perseverance, the ulcerated spots put on a healthy character, contracted, and healed.

The process of the cure was gradual, and required a twelve-month's perseverance in the use of the oil for its perfect accomplishment. She has never since suffered a relapse.

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Since the preceding pages were in the press, a case of no little interest, in reference to the subject, has occurred to me, which I would here mention as briefly as possible. In the autumn of last year, I was making a casual visit in the country, when my attention was directed by a mother to her child, a girl of three years of age, who, she told me, had been afflicted since her birth. She had never been able to use her legs as another child, nor had ever attempted to support the body on them.

The relaxed state of the ligaments of the ankle joint, and the yielding nature of the bones, as well as the extreme curvature of the bones of the leg, prevented her placing the sole to the ground, which, when supported, she rested entirely



on the outer side of the joint. Although fat, she was an extremely strumous child.

The intention of the parents was not to seek professional assistance. She was pointed out to me as an afflicted object, for whom nothing could be done. I combated this opinion and explained to them how much might be effected, at all events, to ameliorate her state. I was, however, unsuccessful; they would hear of no plan which would subject the child to pain or confinement. I recommended the oil, which they had never heard of, and they consented to try it. The circumstances of the case entirely escaped my memory. I never saw or thought of it again, until a few weeks ago, when the parents brought the child to me to thank me for the advice I had given them, on which they had immediately acted. A month was sufficient to convince them of the efficacy of the medicine; in two months she was able to run about, and was so active on her feet, that the mother's expression was, "I cannot afford to keep her in shoes." They then discontinued the oil. Considerable curvature of the tibia and fibula still exists, for which I have advised their again recommencing the oil, in order to correct, if possible, this deformity.

THE END.



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*Including the applications of Chemistry to Pharmacy, the Arts, and Manufactures.*

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AND

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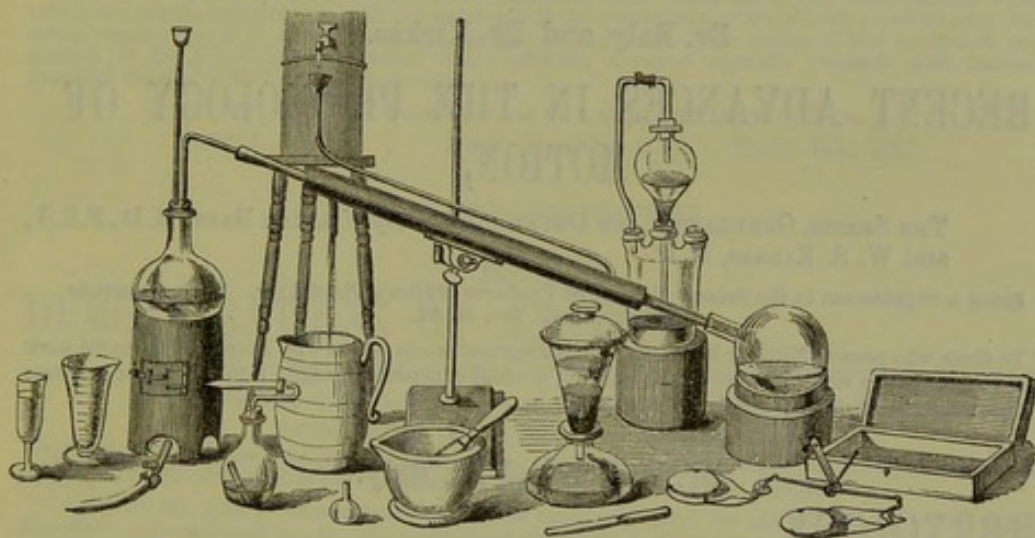
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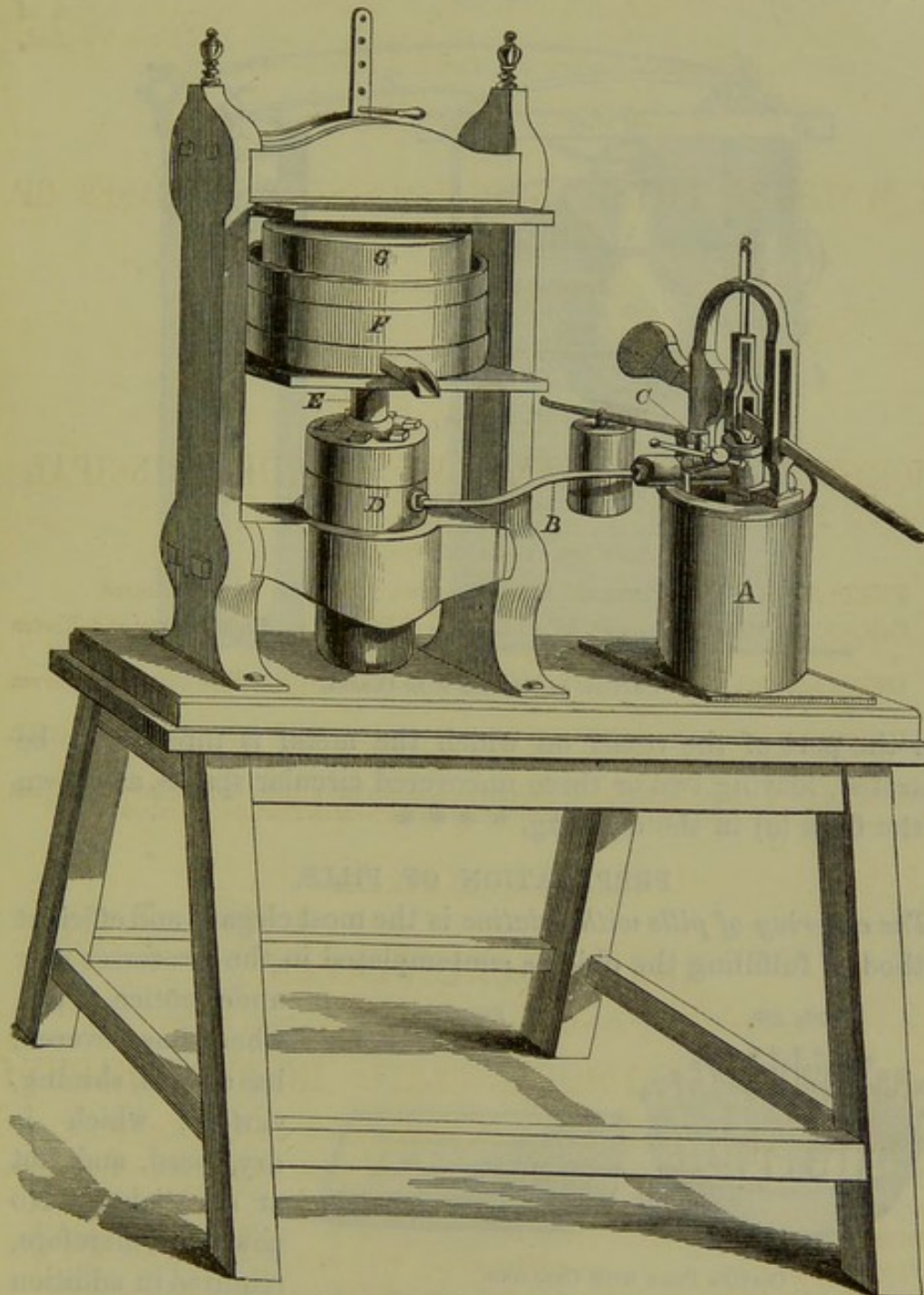
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Fig. 100.



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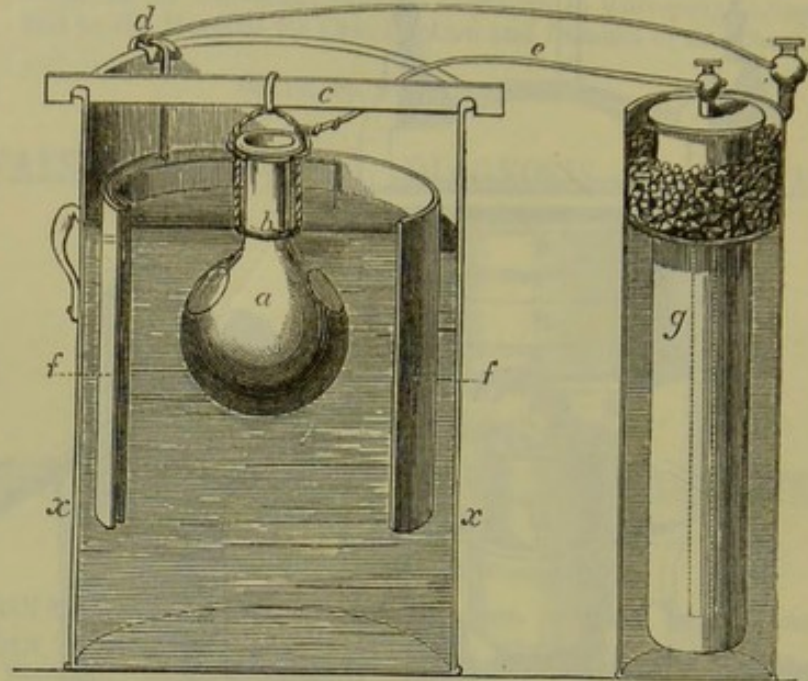
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Fig. 371.



COATING OF VESSELS WITH COPPER.

over the part of the vessel on which the metal is intended to be deposited, leaving two or three uncovered circular spaces, as shown on the flask (a) in the drawing. \* \* \* \*

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Fig. 386.

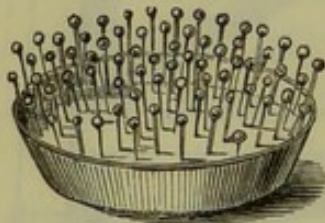
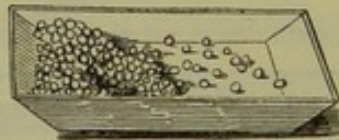


Fig. 387.



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