A Thesis on Aleum Ricinæ, with
original observations, and
Experiments into its Chemistry, etc.

By J. B. Wright.

In connexion with this Thesis there
is a box, full of many specimens, in
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Finis
Introduction.

It must ever be with some amount of diffidence & trepidation, that the embryo M.D. launches his thesis into the stormy waters of medical discussion & scientific criticism, hoping that it may not be broken into pieces by the one, or altogether swamped by the other; to avoid these misfortunes, *Hic labor hoc opus est.*

It was my desire to have written entirely on some original subject, but to do so I find that however great may be the desire or aim, it is in the power of but few medical students, from the want of sufficient accommodation instruments & above all a library for those who are away from their alma mater when composing their thesis. for it is only by using the library that one is able to know what have been the results of former experiments etc. & I not having this advantage, now find on revising my thesis I should have been saved
much time, trouble, thinking, & experiment
had I been able to have access to our noble library when contemplating the basis of this thesis, the subject of which is chiefly the chemistry, modes of administering, etc. the Oleum Ricini, one of the most useful aperients, our Materia Medica contains. I know that there have been several before me who have made some investigations into this subject, but as their researches have not been either satisfactory or conclusive, & the experiments of some contradictory & opposite to those of others I thought it was a fair field for further inquiry & that its chemistry, etc. has not received so much attention as its properties as a mild but certain cathartic gently entitle it too; & if it was not for its greasy, unpleasant taste, or if this could be completely disguised by art, I have no doubt it be the almost universal domestic purgative & would be a great boon to many a frail & nervous, sensitive daughter of afflatus as well as to those who enjoy robust
health, who require a mild but certain
agreeable laxative; & in these days
of Homeopathy, with their minute
globules of sugar, & tasteless tinctures;
& quacks with their numberless
active or
preparations, & however inactive the
drugs they contain they for the most
part have this advantage that they
are either pleasing to the eye or agreeable
to the taste. I think it behoves the
notables of legitimate Medicine to
bestir themselves that they may retain
their proud preeminence, not only from
their skill in giving the right drugs in
the right cases but also by making those
drugs pleasant & palatable as well as efficient.

& of all medicines an agreeable
safe, mild, but efficacious aperient
is what is most wanted, & such
I think we may possess in
preparations of the oil, or seeds
of the Ricinus Communis
the drug, which is the subject
of the following essay, & I shall
commence with its General History.
As to its History.

The castor oil plant has been known from very ancient times. Herodotus mentions the castor oil plant calling it "Tiliacypion" & the oil he termed "kieki" (vide Integre et al. Page 74. Hippocrates refers to it in his work entitled De Natura Rerum (Page 573 ed. 4.2.2), but he orders the root & not the seeds to be used. Dioscorides calls it kiki or krodon (vide his work lib. IV cap. 164). It appears to have been generally termed krodon by the Greeks; & by the Romans, Ricinus, from the resemblance of its seeds to the "tick" of the insect, which infest dogs. Above all, Pliny speaks of both the tree & oil under the same name: "ccc" & he adds, it grows abundantly in Egypt, where it is also known by the names = Castor, Terebinth, Sesaminum & Ricinus. Strabo calls it kiki but does not restrict this name to the oil as Herodotus does, but also applies it to the plant. Calabri, Christie, is also a common name, for the plant, & castor-berry oil is the name generally given to the oil, at the present time, in Egypt.
Caulfield found some castor oil seeds in some Egyptian sarcophagi supposed to have been at least 4000 years old. vide Dict. Univ. de Grat. Med. t. vi.

In India the oil is said to have been in common use from time immemorial to the present day. Some suppose the castor oil plant is that which is mentioned in the Bible, translated as gourd, in the Book of Jonah ch. iv. 6. Whether this supposition is correct or not, still remains a matter of doubt, but the pious fathers St. Jerome and St. Augustine, appear to have considered it a matter worth disputing about, as to what was the particular plant, in the passage referred to, & from words they proceeded. We are told to floras. vide Nat. History of the Bible by Harris.

II. The Botany of the Castor Oil Plant.

According to Lindley the General Characters of the Plant are: flowers monocious. Calyx 3 or 4 parted valvate. Petals none. Filaments numerous unequally polyadelphous. Cells of the anther distinct below the apex of the filament. Style short, stigma three deeply.
bipartite oblong coloured feathery; ovary globose three celled with areoles in each.

Fruit generally prickly capsular trilocous

Trees shrubs or herbaceous plants sometime becoming arborescent. Leaves alternate, palmate, peltate, with glands at the apex of the petiole;

Flowers in terminal panicles, the lower male, the upper female, all articulated with their peduncles, sometimes augmented by biglandular bracts.

Spec. Chace: Leaves peltate, palmate, the lobes lanceolate serrated. Stem herbaceous, fusiform.

Stigma three, bifid at the apex. Capsules covered with spines.

The stems of plants growing in this country are round, greenish or reddish brown, + Persimil furry, + brachied. Leaves long round petiolar, eight or ten lobed. A large scutelliform gland on the petiole, near its junction with the lamina. Filaments capillary branched. Stigma reddish. Capsules supported on stalks which are sometimes longer than the capsules themselves.

The Ricinus communis belongs to the natural family of the Euphorbiaceae. It is Lindean.
class & order *Monocotyledon*. There are 5 varieties of distinct species enumerated by Messrs. Bremekers distinguished chiefly by the colour & fascinose condition of the stem viz:

4. *Ricinus Jervisii* (Willd.) cultivated in Bengal & is arborescent (Hamilton).
5. *Ricinus Jervisii* (Willd.) Herbeaceous cultivated in Bengal (Hamilton).

But latest authorities agree that these pseudo species are but varieties of the one species the *Ricinus Communis* modified to a marked degree by the amount of cultivation & the heat of the climate in which it may be growing vide e.g. in the northern & middle countries of Europe it is a herbaceous annual from three to eight feet high. In Spain & Sicily it becomes a small tree toward 20 feet in height (Cluverius Ray); in India it sometimes attains the elevation of 30 feet & lives many years (Roxburgh).
It grows very fast, (in Europe during the months of July & August) throws up a long spike of green flowers succeeded by quickly ripening capsules, each containing three seeds. Description of Castor Seeds or Semina Ricini or Semina Castor-Utica Majoris. They are oval, somewhat compressed, about 4 lines long & 3½ lines thick; externally they are grey & beautifully marbled with reddish brown or blackish lines & spots. The seed consists of a thin ligneous but the husk, a delicate, white, silky, investing membrane & a thick fleshy olaginous nucleus, enclosing a large, dicotyledonous leafy embryo. The husk which constitutes 24 per cent of the seed, is composed chiefly of ligneous fibre with a little gum resin, & extractive matter. The nucleus which amounts to 67 per cent of the seed when dry, contains 42 per cent of fixed oil & about 20 of albumen, & it is supposed to contain a peculiar acid & fungative principle as Bieshe states it is powerful after expression of the oil but this statement I do not find corroborated by
hardly any other writer on the subject.
+none I believe have yet proved that the mass
left after expression of the has a purgative
action, but it is stated it will cause nausea
or vomiting. The only analysis of the seeds
yet published, is that of Geiger & is as follows:

\[
\text{a. Seed Coats} \begin{cases} \text{Brown Gum} & 191 \text{g} \\ \text{Ligninous Fibre} & 158 \text{g} \end{cases} \\
\text{Fatty Oil} & 18 \text{g} \\
\text{Gum} & 21 \text{g} \\
\text{Casein (albumen)} & 0.55 \text{g} \\
\text{Ligninous fibre with starch} & 2000 \text{g} \\
\text{(hardened albumen)} & \end{cases}
\]

\[
\text{b. Nucleus of the Seeds} \begin{cases} \text{Casein (albumen)} & 0.55 \text{g} \end{cases} \\
\text{Loss (moisture)} & 7.09 \%
\]

\[
\text{Caster Oil Seeds} \begin{cases} \text{Loss (moisture)} & 7.09 \% \end{cases} \\
\text{1st Variety} & \]

There are two varieties of the seeds, the large and the small.
1st The large variety was preferred in London when the
oil was prepared in that city to a greater extent than now.
2nd The small variety of Caster Seeds are used in
the East Indies for preparing the oil; the
larger seeds are chiefly used for preparing
and oil for burning under the name
of 'lamplight oil and is said to be an inferior
kind of the oil.
Modes of Preparation of the Oil.

According to Herodotus & Pliny the ancient method of extracting the oil was by putting the seeds in water over a fire & skimming the oil off the surface, & such is the method even now adopted in Egypt. Pliny also states that another mode in which the oil was got, was by sprinkling the seeds with salt & then pressing them, what was the use of the salt I do not know, unless it was for preventing the albumen & mucilage from decomposing & this would be under necessary as of course by this method a good deal of both would be mixed with the oil. The press is still used in Egypt, but almost entirely for that oil alone, that is wanted for burning in lamps.

The modern ways of preparing the oil are three in number viz.

1. In India it is most frequently obtained by first steeping the seeds for one night in cold water then boiling them for two hours, then boiling them in the sun & afterwards bruising or pounding them,
the seeds thus prepared are thrown into water + boiled till the whole of the oil is extracted, & as it rises to the surface it is skimmed off; & this is how most of the oil of commerce is prepared as it comes chiefly from the East Indies. But Pereira states that in Calcutta the oil is thus prepared. The fruit is shelled by women, the seeds are crushed between rollers + then placed in hempfem cloths + pressed in the ordinary screw or by hydraulic press. The oil thus procured is afterwards heated with water in a tin boiler until the water boils, by which the mucilage or albumen is separated as a scum. The oil is then strained through flannel & put into carriisters.

In Jamaica + the West Indies the oil is obtained by a different process; the seeds not being steeped or boiled previous to bruising, but the seeds are at once bruised, & boiled with water in an iron pot, the liquid kept constantly stirred. The oil which separates rises at the top, mixed with a white froth, + is skimmed off.
The skimmings, when heated in a small iron pot & strained through a cloth. When cold, it is put in jars or bottles for use, vide Wright on Med. Plants of Jamaica in Lond. Medic. Journal vol VIII. III. In America, the cleansed seeds are gently heated in a shallow iron reservoir to render the oil liquid, for easy expression; then compressed in a powerful screw press, by which a whitish oily liquid is obtained, which is boiled with water in clean iron boilers, the impurities skimmed off as they rise to the surface. The water dissolves the mucilage & starch. The heat coagulates the albumen, which forms a whitish layer between the oil & the water. The clear oil is now removed & boiled with a small portion of water until aqueous vapours cease to rise. By this process an acid volatile matter is got rid of. The oil is put into barrels & in this way is sent in to the market. Good seeds yield about 25 per cent. of oil vide United States Dispens.
“Cold Drawn Cotton Oil” was a name formerly given to that oil which was obtained by simple expression of the bruised seeds without previously heating them, but in this case the oil had to be subjected to 200 degrees Fahr. in order to free it from the albumen, starch, mucilage, or else it would soon turn rancid, but oil so prepared has no advantages over that carefully prepared by boiling the bruised seeds; and now the term “cold drawn cotton oil” is applied chiefly to the best kinds of the East Indian Oil.

The oil most used in this country is the East Indian, as it is lighter in colour and purer than the West Indian, it does not deposit a white substance if kept at 32 degrees Fahr. as the American oil does, this white deposit is supposed to be due to the oil being adulterated with olive oil, but others suppose it is Margaritine which has been congealed by the cold, this I believe to be an assumption that does not admit of proof if it is really
Margarine, but it is singular that it should occur to such a great extent in American oil; I so rarely find it to such a small extent in the East Indian variety; in fact it has been stated that it never occurs in the East Indian oil. But any further remarks on this subject, I will defer till I come to the discussion of the fatty acids of castor oil, or the adulterations of the oil.
The Chemistry of the Oil

with original investigations & experiments.

The chemistry of castor oil has not I think been sufficiently enquired into, nor its composition clearly demonstrated & the opinions of those chemists who have experimented on this subject are very dissimilar; thus Bunyan & Duncan believed it to be composed of three fatty acids, but more recent analysts state that they believe it is composed of one fatty principle.

I hope to be able to demonstrate failures in the experiments & conclusions of both parties.

My original intention on choosing this essay subject (which I was led to do by the remarks Professor Christison made when lecturing on this drug, as he recommended us to make investigations into its active principle; I following out this suggestion my design) at first was, as I then thought, both simple, easy & feasible, viz. to get the fatty acid acids test their aperient properties & also that
of the glycerine with which I found them combined, + to analyse the one in which I found the one in which I found the aperient property to reside + try to extract from it the active principle of the oil; such was my design but in endeavouring to carry it into execution I have found insurmountable difficulties which I had not before anticipated, but having commenced the subject I determined to go through with it to the best of my ability.

I intend dividing my remarks on this subject under the following heads:

I. The general & Physical characters of the oil.
II. The action of reagents on the oil.
III. The Fatty Acids obtainable from Al. Ricini.
IV. The Glycerine obtainable from Al. Ricini.
V. Remarks on the active Principle contained in the oil.
VI. Remarks on the adulterations & tests of the Oil.
VII. The actions + uses of Al. Ricini.
VIII. The modes of administering Al. Ricini.
IX. A general summary + concluding remark.
The general physical characters of the oil.

The appearance of the oil is that of a clear, limpid, but thickish fluid, with a very pale yellow colour, with a slight greenish tinge, and a peculiar nauseous odour, and a mawkish oily taste, which is very permanent.

The last Indian variety of the oil is that above described and I have not been able to get an authentic specimen of the other varieties except the American.

The specific gravity of oil is according to Bassusere 0.969 at 55° F.

When cooled down to zero it is said to congeal into a transparent yellow mass. By exposure to the air it becomes thick and rancid, and finally congeals without becoming opaque, and hence it is called a drying oil.

If heated above 500° F. it begins to decompose.

The ultimate composition of the oil has been made the subject of experiment by two chemists viz.
Saussure + Ure + the analysis is as follows viz.  

<table>
<thead>
<tr>
<th></th>
<th>Saussure</th>
<th>Ure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>74.178</td>
<td>74.00</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>11.034</td>
<td>10.29</td>
</tr>
<tr>
<td>Oxygen</td>
<td>14.788</td>
<td>15.71</td>
</tr>
<tr>
<td>Castor Oil</td>
<td>100.000</td>
<td>100.000</td>
</tr>
</tbody>
</table>

The chief difference in these analyses are Saussure makes nearly 1/100th part more Hydrogen than Ure + Ure makes a difference of 1/100th part more oxygen than Saussure.
The action of various drugs and reagents on Oil Ricini.

1. Water of Oleum Ricini be poured on it; water it floats on the top of it, and remains clear and transparent, but if they be shaken or boiled together and allowed to stand for a few days, the oil becomes opaque and of a yellowish-white colour, but if it be boiled (the water it had absorbed is driven off) it becomes again clear and transparent and remains so on cooling. The water with which it is mixed becomes of a slightly white colour, and has an oily taste, probably due to a small quantity of the oil dissolving in the water, but certainly not due to any active principle of the oil dissolving in the water, for water that had been boiled with an ounce and a half of the oil, and digested with it for several weeks had when taken not the slightest purgative or nauseating effect.

2. With other oils, Oil Ricini is readily soluble in all the ordinary varieties of oil, excepting Sini and mesy.
With Alcohol. Oil: Ricini is soluble in it all proportions, whether hot, or cold, & With Alcohol & Oil: Oliva, when Oil: Ricini is mixed with them in equal proportions & agitated, all the three mix, & are homogeneous, clear & transparent fluid is formed; then I tried varying the proportions of each—putting in excess of the alcohol or excess of either of the oils, but still all mixed & the fluid remains clear & transparent, in the cold & also on boiling, & continued so after standing several days. But the presence of the olive oil could be readily detected by the smell.

I may state here that Oil: Oliva, & Alcohol, when mixed alone, are quite inadmissible when heated, as well as when cold. Alcohol Oil: Lini & Oil: Ricini, then when mixed together form a single clear, transparent fluid, both in the cold, or if boiled, Oil: Lini & Alcohol alone on mixing are at first cloudy but on standing it becomes quite clear & transparent.
Alcohol, Al: Ricini, + Al: Amygdalae, if the twentieth part of Al: Amygd: be added to equal parts of the other two, it renders them slightly turbid, but this disappears on boiling. If the following proportions are used viz. Alcohol 3%, Al: Ricini 2%, Al: Amygd: on mixing it becomes cloudy, but is rendered clear off by boiling but is again opaque & cloudy on cooling. Al: Amygd: + Alcohol by themselves are not at all miscible either when heated or shaken together in the cold, two strata are quickly formed, the alcohol above & the oil below.

Alcohol, Al: Ricini, + Adolphe, these when mixed in any proportion + boiled become quite clear, forming one transparent liquid, but on cooling, it become white & opaque, this varying in degree, according to the proportion of Lord, employed in the experiment. Lord is insoluble in Alcohol + if boiled together they form a cloudy fluid which on cooling separates into two strata; best
below + alcohol above.
Alcohol, Al. Ricini, & neat's foot oil, in the proportions of Alcohol 3/, Al. Ricini 1/6, neat's foot oil 1/6 when shaken together in the cold it is white, & opaque, but on boiling it becomes clear, & transparent, but on cooling it is again white, & opaque. (the same phenomena of other preparations) neat's foot oil when mixed alone with alcohol, is quite insoluble though boiled together.

Al. Morbacea when boiled with Al. Ricini & alcohol is a clear, & transparent fluid, is formed, which on cooling becomes cloudy, but on standing two transparent strata are formed that above consisting of alcohol + Al. Ricini, + that below of Al. Morbacea.

What I have tried to show in the above experiments is 1. That Al. Ricini renders other oils more soluble in Alcohol + 2. That the Edinburgh Pharmacopea test for the purity of Al Ricini, is open to fallacy.
since a quarter or even half of the oil might consist of Ol. Oleara, yet not be detected by this test.

I may further add that all the above as well as the following experiments with Oil + Spirits of Wine, I have repeated over and over again to assure myself of their accuracy.


They do not mix so as to form one clear fluid in the cold, but only on addition of heat do cooling become cloudy again + on standing, separate into two layers, one of spirit with a little of the oil in solution above, the other consisting chiefly of soy oil with some of the spirit in solution. The above was the invariable result of experiments with many specimens of the oil, + where the proportions of one or the other were changed + varied,

The following are the details of one or two of these experiments.

Equal parts of Spt. Oinar Rect. + Ol. Ricini
being shaken together they are at first quite cloudy but on standing, the liquid clears, & two strata are formed one chiefly of spirit above, occupying about 1/4 of the entire volume, the remaining 3/4 being formed of Alholic oil with spirit in solution. On boiling, the two layers unite & form one fluid, it is cloudy at first, but on continuing to boil, it becomes clear, less fluid, & transparent, but on cooling, it again becomes white & cloudy, which after standing 2 or 3 hours clears, & two layers are formed, one above, consisting for the most part of spirit, in the proportion of 1/6 of the whole, the remaining 5/6 consisting chiefly of Alholic oil with spirit in solution. This fact is easily demonstrated by drawing off the layer of spirit & evaporating it, a residuum of oil about 1/56 of the bulk of the spirit evaporated is left, & when the oily layer, is heated it gives off fumes of spirits of wine, as proved by their distinct odour, & burning with the characteristic reddish blue flame.
When the following proportions are used: 3/16 H. Ricini 1/3 Vol. Spirit 3/13 on shaking together it becomes cloudy but is clear, transparent on boiling, but is cloudy again on cooling, & on separating standing, separates into two layers, one above of spirit, & that below oil with a little spirit in solution, it becomes cloudy again on shaking.

On using the thick & cloudy American or Australian oil, the same phenomena were noticed, thus on mixing & boiling 1/3 of the cloudy H. Ricini with 2/3 of Vol. Spirit 3/13 it becomes clear, transparent, but on cooling it becomes white, opaque, & cloudy, but on standing a few days it is again clear, transparent, but has separated into two layers, one above chiefly Spirit 1/4, the other chiefly H. Ricini 3/4 below, & if shaken it becomes white, & cloudy, & it remains so if even 4 times its volume of Vol. Spirit 3/13 is added, but it rapidly clears on boiling.


1st When H. Olive oil is added to H. Ricini & Vol. Spirit.
in the following proportions, 2 1/2 Dr. Cimic Rakt 6 1/8 Dr. Ricini 3 1/4 Dr. Olive 2 1/2; on shaking togeth 2. Dr. Linx, Dr. Ricini, and 2 1/2 Dr. Cimic Rakt.

When mixed in about equal proportions a cloudy fluid is formed which rapidly becomes clear and transparent on boiling, but on cooling it is cloudy again.
ultimately it clears + separates into two strata, one above of spirit + that below chiefly of oil.

3. On mixing equal parts of OI. Amygdala, with OI. Ricini + Spt. Vin. Rect. it becomes white, + opaque, + continues so on boiling, + on cooling, but if allowed to stand for some hours it becomes clear + separates into two layers, the one above as usual consisting chiefly of spirit + that below of oil, but I find that if only about a 1/2 part of OI. Amygdala be mixed with a mixture of equal parts of OI. Ricini + Spt. Vin. Rect. that though cloudy in the cold, on boiling it becomes clear + transparent, but if OI. Amygdala be then added guttatory it will soon render the mixture white, + turbid, + will continue so on boiling.

on shaking together, it is white, cloudy, and opaque, but on boiling it becomes quite clear and transparent, but on cooling it is again cloudy, and remains so on standing for it divides into two layers, one above of spirit which though at first cloudy, finally becomes clear, the lower or oily part remains pneumonia yellowish white, and opaque, even though great excess of spirit be added; but as before stated it speedily becomes clear on boiling.

5. Neat’s Foot oil Mixes readily with Spirit, on the addition of double their volume of hot water, and shaking it is white, opaque, and cloudy, but on boiling it speedily becomes a clear, transparent fluid, which on cooling is again white and cloudy, but after standing a day or two, separates into two layers, an upper or clear layer of spirit chiefly, and a lower layer of oil, some part of which is clear, but the lower part
consists of a flaky white deposit, which is insoluble in Apf. Dini Rect. though a great excess be added.

6. Benzonic Acid, it has been stated has the property of rendering other oils more soluble in Oleum Ricini + Apf. Dini, Rectificatus, but I find as the result of many experiments, that it is doubtful if it possesses this property at all, or if it does it is only to a very limited extent.

5 1/2. Spec. Otheris Sulphurici et Oleum Ricini

In the proportion of Vl:Ricini 1/3 + Other: Sulpur: 2/3 it forms a clear transparent liquid. When equal parts are shaken together, it readily mixed but the fluid has a slightly milky tinge but this quickly passes off on the addition of heat. The same is the result if the oil is added in quantities excess. If the ether is added in excess the fluid is clear + transparent even in the cold + continues so on boiling + on cooling it does not separate into strata.
If Oleum Amygdala Dulcis, Oleum Olive, Oleum Linum or Arumbge, i.e. if any one of the above be added to a solution of Oleum Ricini dissolved in Ether, the fluid is rendered whitish or has a milky appearance, but the fluid becomes clear & transparent again on the application of heat, or the addition of a great excess of ether in the cold.

They are miscible & form a clear & transparent fluid when mixed in any proportions, in the cold as well as when heated, & the fluid remains clear on the addition of Oleum Olive Oleum Amygdala Dulcis or melted apricin-etc. in any proportion.

7. Turpentine & Oleum Ricini.
They are miscible in all proportions clear both before & during boiling & also on cooling but after standing for a few days it becomes slightly cloudy.
Paraffin or Paraffin oil?
+ deposits a whitish sediment which readily redissolves on boiling.

\section*{3 Paraffin + Oleum Ricini.}

On mixing equal parts of the above together they become white & opaque but on boiling it clears to a perfectly transparent fluid is the result, but it becomes cloudy again on standing, on cooling, & it separates into a clear part above, & a cloudy one below, & similar results are obtained if the proportions of the Paraffin & Oleum are varied.

\section*{4 Kaptha + Oleum Ricini.}

When equal parts are shaken together they are invisible, but white & cloudy, on standing a night or two, it becomes clear above, & below, but is white & misty in the centre, but on boiling all becomes clear & transparent, & on cooling it again separates into two layers one above chiefly of Kaptha, with a little oil in solution, the rest
consisting chiefly of oil, with a little maphtha in solution, is below, it forms about 7/8 of the whole fluid.

10 The mineral acids = Acidi Sulphurici fort. Acidi Nitrici fort. + Acidi Hydrochlorici fort. when added to the oil in the cold had no visible perceptible effect upon it. (side-remarks on distillation of the oil)

11 Chlorine, Iodine, Hydrogen, Sulphur, Hydrogen, when passed through the oil for some time had no manifest effect upon the oil, nor did they appear to be absorbed. The above and other experiments were tried for the purpose, if possible, of forming a combination with, or to precipitate the active principle of the oil if such a thing existed.

12 The buds "Estro Oil" Palmine. I object to the term Palmine, for it seems to imply that it was an analogue of the "Palmitine" or fatty acid + base
It contains no morphin whatsoever —
The author is quite ignorant of
the research made on this
subject. Sulphurous acid forms
Palmite as well as NO4. Palmite
is the Palmate of Mycerium. This
Palmie-acid is common with the Chief
Acid of Crown. D.L.
found chiefly in Palm Oil, which of course contains no nitrogen, while on the other hand this so-called "Palmine" does not exist naturally in Castor Oil but is an artificial nitrogenous compound, of Hypnotious Acid with the fatty principles of R. Ricini, and I therefore think it would be more correct to call it by some such name as "Fittoricin" or "Fitricine.

It is prepared by passing Hypnotious Acid through R. Ricini, and the success of the experiment does not depend so much on the purity of the Hypnotious Acid as on having a good stream of the gas passed through the oil. The best and simplest means of accomplishing this end, is by mixing some starch and strong fuming Nitric Acid together in a full size test tube with a close fitting cork, in which a glass tube has been carefully fitted. It has at first to be heated over a lamp, until the fumes have begun to be given
off in a full stream, the lamp can then be immersed with the flames should be kept passing through the oil for an hour, or an hour and a half, depending much upon the amount of oil that it is intended to charge with the gas, and on the size of the stream of gas employed.

The oil gradually becomes of a deep amber colour; after standing for from 12 to 24 hours, it becomes quite solid; but the degree of solidity varies with the amount of hydrochloric acid, gas that has been passed through the oil, for the greater the amount of gas transmitted, the fonder the oil afterwards becomes.

Palmarine or biturcine on standing several weeks a yellowish looking, powderlike, body settles on the sides of the glass vessel in which it was kept, but it was not at the sides only, that this substance was deposited, but also in the resinae interior of the stem of biturcine, it is I believe the analogue of the deposit which is got by boiling
down glycerine as will be hereafter described. Glycerine readily becomes fluid on the application of heat but becomes solid again on cooling. It is readily soluble in ether & Pure Alcohol a clear yellow fluid being formed. On adding Npt. Vin. Rect. it dissolves in it slowly in the cold but quickly on heating, & this on being allowed to cool congests, but is of a darker colour & clearer. Than Glycerine & where at first equal parts of it & the Vin. Rect. artificially have been used, then after boiling & cooling was to cause it to congest, about 1/3 part of the whole consists of the Vin. Rect. with a little oil in rotation this floats or I should rather say forms a strata above the congested mass below. the latter, when heated, gives off fumes of Spirit & in this way all the Spirit may be driven off & the pure Glycerine of its ordinary colour & consistence may again be obtained, thus showing that no new compound had been formed.
Our Palomino is quite white.
Saponification of Oleum Ricini.

In saponifying the oil, my great object was to find out a soap from which I could most readily get the fatty acids in a state of the greatest purity, and as there was no book to tell me which to choose, it was a thing to be tested by actual experiment. I therefore made soaps of Oleum Ricini with Lime, Magnesia, Potash, Soda, and Lead. The Lime soap I found to answer best, as from it specimens of the fatty acids could be obtained most free from the contamination of extraneous bodies.

The Lime soap, I have tried boiling the oil with various proportions of lime, but find the great secret for getting the soap to form quickly is to have excess of lime always present. Thus a 3 1/2% of carefully powdered slaked lime should be added for every ounce of the oil used, and about half an ounce of water to the ounce of oil, i.e. to begin with, for water is to be added freely as
it is boiled away, for the sake of preventing the Glycerine from decomposing, or the mixture from boiling too fast. It requires to be kept well boiling for about 2 or 3 hours by which time the soap is fully formed; at first the mixture bubbles & froths up very much but as it becomes more viscous, it boils less wildly & finally a soap is found which on exposure to cold almost immediately firm & hard, & may be poured into any mould the shape of which it speedily takes. as it contracts on cooling it is readily removable from any mould it may have been run into.

The soap is of a greyish colour & is very hard & brittle, it is not soluble in or miscible with water, neither is it at all greasy to the touch. The water in which it has been boiled has a sweetish taste & when boiled down yields Glycerin
Magnesian Soap.
This is best formed by boiling a
fraction of Calcined Magnesia, to the
ounce of Olive Oil, if at first
I added water but soon found this
was useless, as no amalgamation
of the oil with the magnesia took
place till all the water had boiled
off, after slow boiling for two hours
the oil & magnesia unite & form
a 'white opaque looking mixture
(which might I think constitute
one form, for the administration
of the drug, & for children it might
be mixed with flour & made into
digestible cakes, but I will refer
more fully to this subject when
writing of the "Modes of Administra-
tion of Castor Oil".) If the heat be now
raised & the mixture boiled fast
for a full hour, it gradually darken,
in colour, & at the same time became
less opaque, if still further heated
& then poured out, it will form
a hard vitreous like body with a very
peculiar taste & smell. (Extract a tough stick (of wood) in strong vinegar.)

I repeated these experiments several times, as I hoped from the soap, that
got the finest specimens of Glycerine as Magnesia is insoluble in water, but
to my chagrin I found the water always boiled away before the
soap was formed, & if more water was added the mixture spluttered
about till all the water had been again expelled. I tried also to get
the glycerine from the soap by digesting it in water, but this was
useless as it appears the magnesia soap is insoluble in water.


This is formed by boiling caustic soda Na₂O with all the acetic acid. The proportions
I used was one drachm of soda to
an ounce of the oil, & thus after
boiling for an hour & a half yields
a hard & brittle soap but it is
readily soluble in water.

3. Potash Soap.

Here I used the proportions of two
drachms of Bi & Potassa to an ounce of Ricin & a soap was formed after boiling for an hour or two; it was of the same brown colour as the soda soap but was less firm & hard. It is readily soluble in hot or cold water.

5. Lead Soap: This is obtained by boiling Lixtharge with Bi. Ricin for fully 3 hours. The proportions I used were a 3 of lixtharge to the ounce of oil, & it requires more prolonged & vigorous boiling than for the formation of any other of the varieties of castor oil soap. & it requires also constant watching & stirring & the frequent addition of water, to avoid prevent its bubbling & running over; but finally when the soap is formed, it consists of a firm white substance but not hard & brown. It quickly blackens if exposed to the fumes of sulphuric acid. The water in which the lead soap has been formed contains Glycerine.
which may be got from it by passing No. 8. through it, then filtering and boiling it down to a proper consistence. Lead soap is insoluble in water.

15 **Distillation of Oleum Ricini.**

The results obtained by distilling the oil vary somewhat from those recorded in Pereira's *Materia Medica* as the results of two experiments, but the results obtained are differently stated in the two last editions of his work. *This in the edition for 1842 it is thus stated, in that for 1855 thus.*

<table>
<thead>
<tr>
<th>Distilled Liquid</th>
<th>33.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Water</td>
<td></td>
</tr>
<tr>
<td>(b) Acetic Acid</td>
<td></td>
</tr>
<tr>
<td>(c) Volatile Oil</td>
<td></td>
</tr>
<tr>
<td>(d) Fatty acids: Ricinio, Thiodie, Margantelie, Fatty Acids</td>
<td></td>
</tr>
</tbody>
</table>

2. Solid Residuum 63.0 Ricinio + Thiodie

3. Loss (Inflammable gas) 3.5 Anantarthal

<table>
<thead>
<tr>
<th>Total</th>
<th>100.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Loss Inflammable</td>
<td>5.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total</th>
<th>100.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Distilled Liquid</td>
<td>33.5</td>
</tr>
<tr>
<td>2. Solid Residuum</td>
<td>63.0</td>
</tr>
<tr>
<td>3. Loss Inflammable</td>
<td>5.5</td>
</tr>
</tbody>
</table>
The volatile oil is described as being mixed with acetic acid, & of a peculiar acid odour & taste, tarred & coloured by long exposure to a temperature of 23°F, it becomes crystalline. It is insoluble in solutions of Potash though soluble in alcohol & ether. This volatile oil in the latter edition is termed "acroleine".

2. Fatty acids, those in states are soluble in alcohol, & ether, & aqueous solutions of Potash. The Potassic is said to be crystalline at ordinary temperatures.

3. The Helioide is stated to be a yellow coloured fluid at 32°F. But at many degrees below it, it becomes crystalline.

3. The Oenanthynie is said to be a limpid colourless aromatic fluid & is an oxide of Oenanth.

3. The Solid Resin is described as: Pale yellow in colour, elastic gelatinous odourless tasteless combustible solid, insoluble in alcohol ether & the oils (fixed or volatile).
The following are the results I have obtained from 3 experiments.

1. The oil, after boiling quietly for some time, ebullition becomes more violent, (especially if a drop or two of water happens to be in the retort) then the oil becomes somewhat darker in colour, then

2. Whitish-yellow fumes are given off, which on condensing in a receiver form two strata, one above consisting of a volatile oily body which for the sake of distinguishing it may be called Margaricine. The lower strata is formed of a white limpid body & may as it has already been done, may be called “Acroleine.”

The fumes gradually are given off in less quantity, & at length some come over, & the oil that is being distilled froths up & the retort is filled with what on cooling becomes a yellow elastic or gelatiniform body. & The following are the proportion percent in & outside of these bodies calculated from 3 experiments.

<table>
<thead>
<tr>
<th>Distilled liquid</th>
<th>40</th>
<th>Consisting of Margaricine 35% &amp; Acroleine 5% in ent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residuum</td>
<td>60</td>
<td>Total</td>
</tr>
</tbody>
</table>
The receiver should now be removed & a fresh one put in its place. The gelatinous residuum should now be again heated, at first no fumes are given off, but in the course of a few minutes, fumes of an orange colour are seen to come off, which on condensing form a liquid of a brownish yellow colour. Mixed with it is a strata of a pure white colour. This accumulates below but forms a small proportion to the brown liquid above. These fumes are given off till the residuum in the retort consists only of a black carbonaceous mass.

The following are proportions calculated from experiments:

1. Distilled liquid 90
2. Solid Residuum 10

Consisting of:
(a) Brown liquid 80
(b) Acroleine 10

Chiefly carbon 100
The following is the percentage composition of the oil from my experiments:

1. Distilled liquid till gelatiniform residuum is formed = 40
   (a) Alkaline menstruum
   (b) Acroleine

2. Distilled liquid from gelatiniform residuum = 54
   (a) Brown liquid
   (b) Acroleine

3. Carboniferous residuum = 6

Total = 100

I would not state more fully all that I have to say about these bodies that distilled over.

1st. As to the acroleine it is a colourless transparent fluid with a slightly milky tinge. It has a very acid and pungent taste and odour and the fumes of it are very irritating to the nose and cause laceration. On introducing it to the action of cold, by means of a freezing mixture (composed of 2 parts of snow and one of salt) it becomes a
white crystalline body, which on close inspection appeared to be composed of plates of fibres crossing each other in every direction. At ordinary temperatures it is a mobile, limpid fluid. It burns readily with a bright molten flame. It gives a slightly acid reaction on the application of litmus paper. On keeping it becomes more acid this is due I suppose to the formation of acetic acid, which is said to resemble acetic acid, hence I think it probable the acetic acid found by Persica in his experiments was this acid formed by the oxidation of the acroleine. Acroleine on keeping undergoes partial decomposition & a white flocculent body called Bisacryle is formed. It is so called in acroleine from the distillation of olive oil & similar changes I have noticed in the acroleine got by distilling castor oil. In formulas chemotherapy it is stated that when brought in contact with the alkalis acroleine suffers violent
Is this not simply theoretical?
decomposition a gaseous body being produced. But I failed to get any gaseous body on the addition of Liquor Potassa to acroleine, but on the contrary it seemed quite soluble in Lig. Potassa, white diluted, or undiluted. Acroleine is probably formed by the decomposition of glycerine during distillation.

2. Margarine. I have called it by this name because I believe it to be the analogue of the Mangan-ricinic acid hereafter to be described. It is a volatile, perfectly clear, transparent fluid, with a slight yellow tint; it has a strong peculiar sort of aromatic odour. It burns readily with a bright smoky flame. It is slightly soluble in ether, alcohol, + spirits of wine, + to a very slight extent in water also. On the addition of Lig. Potassa, it becomes cloudy, + separates into two layers, the upper one of an opaque yellow colour, + the lower whitish + opaque. It remains quite limpid + fluid when exposed to a cold about 3°.
It is very india-rubber like & elastie, it has but little smell & is tasteless. It burns with a bright smoky flame. It is insoluble in Alcohol, Ether, Spirits of Wine, Turpentine, Paraffin, & oils of all sorts, & is but very slightly soluble in Sir. Potassa.

A Stereine & Steroricinine, got by distilling the above mentioned resinecrine. It consists of a yellowish brown fluid which is clear & transparent at ordinary temperatures but below 20 degrees it becomes turbid & deposits a buff coloured sediment, but if the cold be means of freezing mixtures be brought down to zero or a few degrees above it the whole mass becomes solid, an opaque buff coloured solid. It has a pungent acid taste, a penetrating pungent & slightly aromatic smell. It burns readily with a smoky flame. It is but slightly soluble in ether, alcohol, Spirits of Wine. On the application of Sir Potassa it becomes
white + opaque + on standing separates
into two strata, one above, yellow, +
cloudy, another below, white, + opaque,
resembling cream.

Distillation of Oleum Ricini with
Acidineum Vitriicum.

Dr. Bosius states that on distilling castor
oil with nitric acid, a volatile fatty
acid - Ananthylic is formed & it is
described as being a colorless oily fluid
with an aromatic odour + burning taste,
& is said to be slightly soluble in water;
& will not solidify even at a low temperature
& cannot be redistilled without de-
composing. Messrs. Dragee + Constable
state that on passing a galvanic
current through it, an hydro-carbon
is formed containing equal parts
of carbon + hydrogen, & also an oily
substance is produced having the
following composition C12 H13. The
radical of the alcohol of Capric Acid
which has the following formula =
C12 H13 O HO. (vide Fournes Chemistry)
Distillation of Oleum Ricini
with Liquef Potash.

Monsr. Bonis states, that on distilling castor oil with hydrated potash, he obtained the alcohol of the caprylic series which on oxydisation forms caprylic acid. The Sebacate of Potash is left in the retort; the following he states to be their composition:

\[
\begin{align*}
\text{C}_{36} \text{H}_{55} \text{O} & \text{.4 O} + 2 \text{K(OH)} = 2 \text{K(OH)} \text{C}_{20} \text{H}_{46} \text{O} + \text{C}_{16} \text{H}_{32} \text{O} + \text{2H} \\
\text{Castor Oil} & \text{. Hydrated Potash. Sebacate of Potash. Caprylic Alcohol.}
\end{align*}
\]

On adding Acidi sulphiuricui fort. to Oleum Ricini, & heating in a retort, I found the oil rapidly was changed to became of a greenish black colour, & then became of a very prunyent & penetrating odour, given off, & on condensing a brownish fluid was produced, but what name to apply to the fluid I am at a loss to determine.

The next experiments with the oil that I would notice are the
The Effect of Cold on Oleum Ricini.

On the East Indian variety of the oil I find a low temperature has but little effect, thus on plunging, a test tube containing some of this sort of oil, into a freezing mixture to lower its temperature to zero or a few degrees above, it, it becomes thick attaining nearly to the consistence of jelly, but at the same was perfectly clear and transparent, though exposed to the above degree of cold for more than an hour, though exposed to a cold below freezing point for several days and nights.

23. The Australian or American, varieties of oil when exposed to a temperature at or about 32°F. or below it, minute white specks appear in the oil, which gradually sink to the bottom of the vessel in which the oil may be contained to form a whitish deposit. The question naturally arises 'What is the deposit?' It has
been called Margaricine, or Margarine, by different writers, on the subject, and some believe it to be due to adulteration with lamp oil etc.

On boiling this deposit it becomes quite clear and transparent and is of a rather more yellow colour than the ordinary specimens of the oil, it soon becomes cloudy again on exposure to a low temperature. It is soluble in alcohol, ether, nitric acid, etc., just as castor oil is.

On taking some of the deposit, after the clear oil above had been carefully poured off, and boiling it with powdered lime, a fine lime soap was produced which on boiling with acid sulphate: filtrat: a fatty body was obtained which after throwing on water so as to dissolve out any sulphuric acid with which it might be mixed, that was skimmed off, and it consisted of an opaque fatty body of a brown colour.
less firm consistence than the ordinary ricinic fatty acids, on the
addition of Spirits of Wine & boiling it dissolved in it & on being allowed
to cool & stand for a day or two a deposit took place but was somewhat
less than when Spirits of Wine is added to the ordinary fatty acids.

I think it may be doubted whether it is due to adulteration.
1. Because it occurs so uniformly in all specimens of American oil & it is said also occasionally to occur in other varieties of the oil.  
2. It appears to me doubtful whether they would find it so much cheaper as to render it worth their while to adulterate the oil with ether Olive Oil or the Oleum of Lin. etc.  
3. It seems to me improbable that it is due to bad oil, as it deposits if exposed for some time to a temperature about 32° Fahr, but
Plein of lard is said to concretize only at the much lower temperature of 20 degrees Fahrenheit.

If the deposit was due to olive oil, I think, that in some cases at any rate it would be detectable by its smell and color. It deposit is more in small flaky particles than castor oil. Again the deposit is more soluble in spirits of wine than a deposit of olive oil would be.

Therefore I am inclined to believe the deposit does consist chiefly of Margarine. The reason, why it deposit is rarely in some varieties of the oil and so generally in others, is I believe to be found in the fact that there is a difference in the mode of preparation of the oil; but the exact cause of the deposit is at present uncertain and therefore the exact nature of the deposit must still remain to a certain degree doubtful. I may also add that the minute white specks
of which the white soft deposit consists, presented in one specimen of the oil, examined microscopically, the appearance of crystals somewhat of this shape but I have not examined a sufficient number of specimens to be able to say whether this is a common occurrence or only an accidental phenomenon.

III The Fatty Acids found in Oleum Ricinii.

The opinions of chemists seem to have oscillated between these two views: some hold that it is composed of 3 fatty acids, while others state that they believe it is composed of only one fatty principle.

Leavie & Russey assert that it is composed of 3 fatty acids, viz. the Ricinie, the Elaidie, and the Margarite, but I have not been able to find out that they ever stated there was a mode of manipulating, or that they actually separated, and demonstrated the three
fatty acids above mentioned. Pereira mentions the above named acids but states that they have been but imperfectly separated.

Other chemists have asserted that they believed it was composed of a single fatty principle, because the oil is so completely soluble in alcohol & ether; this is certainly a very simple view to take of the matter but I hope to be able to demonstrate that this is not the real true state of the case.

I believe that castor oil is composed of only two fatty acids. I will now proceed to state how they may be best obtained.

The fatty acids can be obtained from the Lime, Soda, or Potash Soaps.

1. They can be extracted from the Soda, & Potash soaps by adding acid Sulph. Dilut. & applying heat will hasten the process, the acids will float on the
Top of the water may be skimmed off, they should then be thrown on the surface of some lime water, and allowed to remain in contact with it for several hours so as to free them from any sulphuric acid etc., but it was not easy to get them pure, in this way, as they were always infallibly contaminated by a greater or less amount of the sulphates of soda or potash.

2. I also tried to get the fatty acids from the lead soap, but in this case I also found it impossible to get them in a pure state free from lead. I added sulphuric acid to the lead soap, so in this way sulphate of lead was formed, and the fatty acids set free, but then I found it quite impossible to separate the sulphate of lead from the fatty acids, for both were insoluble in water. Therefore the best simplest way of getting the fatty acids, is to decompose the lime soap, with sulphuric acid.
The fatty acids may be readily obtained from the lime soap by the following mode of manipulating; the soap having been broken in small pieces is to be boiled, in a mixture composed of half water and half acetic sulphuric acid, for about an hour, more water or acid being added from time to time to supply the loss of that which has boiled away. To prevent the fatty body that is being liberated from changing or decomposing. In this way the lime soap is decomposed, and the insoluble sulphate of lime sinks to the bottom; a yellowish or amber coloured fatty body floats on the surface, which is to be skimmed off and thrown into a vessel containing distilled water; allowed to remain in contact with the water for several hours, so that any sulphuric acid that is mixed with the fatty acids, may be dissolved out, the fatty body is then
again to be skimmed off the surface of the distilled water, then to be gently reheated to drive off any water that may be mixed with it and on cooling forms what I propose to call “Ricinie Acid” it is of grayish white colour varying a little in colour tinct, according to the specimen of oil on the purity of the linseed employed and also on the amount of boiling it may have been subjected to, it is of the consistence of land at ordinary temperatures but if exposed to a temperature below freezing point, it becomes firm and hard; on boiling it becomes fluid and on cooling slowly returns to its former consistence; it has an acid reaction and a peculiar greasy and somewhat nauseous acid taste.

It is separable by Alcohol, Ether, Spirits of Wine etc into parts and as they both become solid on standing I would call the one “Margaricinic acid” and the other “Steronicinic Acid” and “Margaricinic Acid” and “Steronicinic Acid”
The following are the means which I have found successful in separating them.

1. On mixing together equal parts of Ricinice Acid & Alcohol, I found they were invisible though the liquid was turbid, & continued so, though excess of the Anhydrous Alcohol was added, & even on boiling, it did not become quite clear, & on being allowed to stand for a few days, it deposits a sediment, which can be readily separated, either by carefully pouring off the supernatent liquid, or what is better drawing it cautiously off by means of a pipette, it is then to be heated to drive off the alcohol & when this has been done the remainder is what I propose to term "Stearoricinic Acid" it on cooling becomes solid, it is of a greyish color & has an acid reaction & a peculiar没有 acid taste, which is very persistent.
If the supernatant fluid, be now heated to drive off the alcohol, a fluid of an amber colour is left, it continues fluid for many days but in the course of several weeks it becomes slightly turbid and deposits a sediment, which at first has a nodular appearance (i.e., it deposits in the form of distinct nodules). On seeing this, I concluded I had to do with two fatty acids, and therefore separated the fluid part from the solid, and supposed that in the fluid thus separated I had a third fatty acid which I might call the "Elaisticinic" but much to my vexation I found that on keeping the supposed Elaisticinic acid for a few weeks longer, it also became entirely solid and exactly resembled the "Margaretinic acid"; hence I supposed it was identical with it and was therefore inclined to believe there are only two fatty acids in Castor Oil viz. The "Margaretinic" and the "Stearonicinic".
2. With Spirits of Wine the fatty acids are separable just in the same way as when anhydrous alcohol is used, and it was from noticing this effect produced on specimens of "Margaric acid" that I have come to the conclusion that they consist of but two fatty principles.

3.Ether dissolves Ricinie acid but on standing for a few days deposits the stearoric acid, and the Margaric acid can be separated in the same way as when Alcohol is used.

4. Chloroform, Vaphe, Turpentine, and Paraffin, in all of these, the fatty acids are soluble but they all give a deposit of the Steronic acid on keeping.

On the application of cold by means of freezing mixtures to the Margaric acid, if in the fluid state, it becomes entirely solid.
remains so at the ordinary temperature or unless it be raised to 90 or 100° Fahrenheit.

The Margaricinic acid is lighter in colour than the Steroricinic & has not quite so nauseous a taste.

**Palmic acid or Nitricinic Acid.**

This is obtained by slowly boiling Palmic with lime, & thus obtaining a hard soap & if this soap be now boiled with dilute sulphuric acid, the insoluble sulphate of lime falls to the bottom of the vessel & the oily Palmic acid floats on the top of the water, & can easily be skimmed off, & washed free of sulphuric acid by throwing it on water, & then again collecting it & heating it to drive off any water that may be mixed with it; when thus prepared it is of a brownish yellow colour of a pretty firm consistence, having a peculiar greasy taste & a slight odour.
of Hyposmotic acid.
When anhydrous alcohol, or Spirits of wine are boiled with its Palmitic Acid a reddish brown solution is formed which on cooling & being allowed to stand some days deposits a brown sediment which is the analogue of the Sterorcinic Acid which is deposited from the Ricinic Acid when treated in a similar manner.

When Hyposmotic acid is passed through Ricinic acid it becomes of a dark mahogany colour, on keeping, a species of fermentation takes place & the fatty acid swells & becomes lighter in colour. It has a strong smell of Hyposmotic Acid. On boiling with Spirits of Wine it forms a reddish brown solution & like the "palmitic acid" deposits on standing a brownish sediment.
The Glycerine obtained from Oleum Ricini.

It is best obtained by boiling down the water in which the lime soak has been formed, but before doing this as the water contains some of the lime in solution it is necessary to pass some carbonic acid through it, so as to precipitate it in the form of a carbonate but this is to be done with caution, remembering that the bicarbonate of lime is soluble in water, hence if too much carbonic acid be passed through the liquid it will just as bad as if none had been passed, but supposing the carbonate has been duly produced it is next to be separated from the fluid by filtering and the glycerine water thus prepared is then to be boiled down to a proper consistency and on doing so it gives off a smell closely resembling burning rubber. On further boiling the liquid a white
or grayish powder is deposited at the bottom of the vessel. The Glycerine on simply keeping in a bottle also deposits this whitish powder, which has not much taste, but I think it has a faintly sweetish taste. For boiling down Glycerine after all the watery part has been driven off in steam this powdery substance is left, Possibly it is a body allied to Murrite but I have not been able to come to anything conclusive on this matter. Glycerine burns readily leaving a carboniferous residue.

2. Glycerine may also be got from the water in which the "Lead Soap" has been has been made, but as the glycerine water contains lead, it is necessary to precipitate it by passing a stream of Sulphured Hydrogen through it and afterwards filtering the liquid and then boiling it down.
to a proper consistence thus the glycerine yielded by 3 to 4 ounces of oil, amounted when thus boiled down to about 3 l. This was a fluid of an amber colour and very peculiar taste of sugar and salt, what the saltish taint is due to I do not know unless it was caused by some change affected taking place in the glycerine from the passage of the sulphuric acid hydrogen through, for I found the same result on repeating the experiment several times. The best glycerine like that from the lime soap deposit on boiling or standing, a deposit of a greyish white colour this plainly shows that the deposit is not due to any deposit of lime, which is an objection that might be stated with regard to the deposit in the glycerine from the lime soap.

3. On saponifying palm oil, if the.
been carried on be subjected to a stream of carbonic acid to precipitate the lime, & then filtered, a clear amber coloured liquid is obtained, & on boiling it down it deposits a yellowish sediment in considerable quantity, it has a singular pungent salt, or slightly acid, taste & not at all the sweet taste of Glycerine. It consists I presume of a hyponitryl of Glycerine.
V. Remarks on the Active Principle contained in Oleum Ricini.

Many observers have made practical experiments, to determine in what particular part of the seeds of castor oil the active principle was contained, but few indeed are there who have made (or at any rate printed) practical investigations into the active principle of the oil. But as most probably the active principle of the one is identical with that of the other I will first make a few remarks on.

The "active principle" of the seeds.

Sondermann has suggested, but not demonstrated, the existence of a fixed acid principle of a venimous nature. Then there has been a singular variety of statements as to the exact nature of the seed in which this acid principle resides. Thus: Terboch states that in the fresh seeds the innermost covering of the seed contains the active principle, if this be the case it is singular that th
same cost when dry should contain any active or acid principle.

2. Boutron-Chalard & Henry just believe the active or acid principle is situated entirely in the albumen of the seed and that, that of the embryo is scarcely more active than that of the nucleus.

3. Susnere & some others have asserted that it resided exclusively in the embryo.

4. Henry & Boutron state, as can be easily believed, the husk & peripheral membrane, (as they have neither taste or smell) are inert.

From experiments on the dry seeds I find the smaller varieties of the seed are generally in better condition than the larger varieties, & that the naked seed has when chewed an oily acid, & slightly bitter, & very persistent taste, & the embryo has a rather more bitter & acid but has oily taste than the rest of the seed.

To try the effect of the seeds, I took
seven of the shelled seeds one night at bedtime, the next day experienced a considerable amount of nausea, but did not vomit, but the feeling of sickness soon passed off after taking some coffee, it had but a slightly aperient action causing but one loose & free evacuation.

I can hardly credit those stories of about a single nut causing violent vomiting & purging for an entire day, in a man, as recorded by Burgiers, or that a woman's life was endangered by eating 3 seeds as stated by Landzone, in their & other cases where one or two seeds have been said to cause such disastrous effects, I think it may naturally be supposed, that the seeds were really those of crotor oil which resemble the the crotor oil seeds very closely in outward appearance & therefore might readily mistaken for them.
2. As to the active principle of the oil.

Gribnout states that a feeling of dryness of the eyes and throat was experienced from exposing himself to the vapour arising from a vessel in which the bruised seeds were boiling. I have twice repeated this experiment with seeds that were in good condition but did not experience any dryness of the eyes or throat, but if the water be allowed to run short, it thus allow of the decomposition of the oil, then an acrid, prurient, volatile body, is given off, which causes irritation of the nose and lacrimation.

2. Planché obtained an odorous principle by distilling a mixture of water and castor oil, and this I can readily believe for both the volatile bodies produced by the distillation of the oil viz. what I have named and described as "Mercenine," "Inorganine," are both, though very slightly soluble in water, capable of imparting to the water a peculiar odour and taste, the truth of this I have tried.
myself of by mixing them with water + then filtering.

3. The activity of the oil has been supposed to be due to an acid resin, but this acid resin has never yet been separated either from the seeds or the oil. Sohavein by a complicated process obtained a soft resinous oil which as Parreira observes "was evidently a complex product," therefore it was not the active principle.

I have attempted to get the active principle, 1° By acting on the oil & 2° By acting on the fatty acids, with Water Alcohol Ether Chlorofom Heat & Cold etc. & the conclusions I have come are 1° That the active principle does not reside in the Glycerine, for I took at one dose all the Glycerine obtained from rather more than an ounce + a half of castor oil, but it had not the least effect either as a purgative or an emetic.

2° I believe that the active principle
of the oil resides in the Fatty Acids or 52° that if the fatty acids are not the active principle of the oil themselves, the active & acid principle is indissolubly connected with them, so as to render it impossible to separate it at any rate, by the ordinary chemical processes.

I found on taking a few grains of the fatty acids a considerable amount of nausea was produced, & a persistent disagreeable oily acid taste was left in my mouth, had I taken a larger dose I fear but little doubt vomiting would have occurred & possibly purging also. When the oil has become nauseis it has been often enough noticed to cause nausea or vomiting, possibly this is due to a portion of the Glycerin decomposing & thus leaving the fatty acids with which it was incorporated free, & thus allowing of the acid taste of the acids to be susceptible, & thus nauseating tendency to come into action.
Remarks on the adulterations & tests for the purity of Oleum Ricini

1. As to the Adulterations of the Oil

1st. It is sometimes adulterated with Croton oil, & sold in gelatine capsules & sold as 'Concentrated Castor Oil'; this is of course a very dangerous fraud, for if these capsules are incautiously given to children or pregnant females the consequences might be very serious & proofs of this have already occurred.

2nd. Castor oil has been said to be adulterated with a variety of the fixed oils of Oleum of Sand, Olive Oil, etc. but the oil is at present so cheap has to render it scarcely worth while to adulterate it, & therefore it is generally pure.

2. The tests for the purity of the oil. They are as enunciated in the British Pharmacopeia 1st. That it is entirely insoluble in equal volume of alcohol, & therefore that one volume of oil is soluble
in two volumes of Spirits of Wine. But the same tests would hold true though the castor oil contained a third of its volume of Ol: Oliva, Ol: Linii, Oleum of Lard? etc. (I have not been able to get a specimen of oleum of lard to test its solubility with castor oil + Alcohol + Spirits of Wine, but the solubility of the other two oils I have often tried.) I would notice further that though Ol: Linii is soluble in two parts of Spirits of Wine yet on standing some of the spirit separates & forms a distinct strata above the more oily layer below for a more minute account of this vide Page 23 + 24.

But though easy to find flaws in the present official tests for its purity, it is a difficult matter to suggest more perfect ones. But I think the smell, taste, colour, + effects of the oil, are the means by which we may best judge of its purity.
The action & uses of Oleum Ricini

1st. Its actions. In most of the lower animals it acts as a mild purgative & cathartic. (Pariera)

But Dr. Youatt states it is both an uncertain & dangerous remedy in the horse.

2. Its effects on man. When injected into the veins it causes griping & purges, it also causes a nauseous taste in the mouth (vide Dr. Hale in Begin Traité de Thérapétigue. p 114) from the above experiment Pariera concludes the oil has a specific action on the mucous membrane of the alimentary canal. When swallowed in doses of from 6 drams to 2 ounces it is a speedy safe & certain purgative.

Prof. Chisholm states that it produces thin feculent, but not watery stools & seldom causes more griping or sickness than might be expected by an equal amount of any other fixed oil; & it is useful when
It is desirable to move the bowels without causing local irritation or general disturbance.

Dr. Gullen states: "it has this particular advantage: that it operates sooner after its exhibition than any other purgative I know of, as it commonly operates within two or three hours. It seldom gives any griping, and its operation is generally moderate, one, two, or three stools only."

Some believe it is a nervine tonic and acts especially on the genito-urinary system, and will cause menstruation in some women.

2. Uses of the oil. Some of its uses have been mentioned incidentally above, and of course it would be useless for me to enumerate all the diseases in which castor oil has been given, for there is hardly one in which it has not been given. It is given whenever a mild aperient is required, or after surgical operations. After distention, or any inflammation,
In diseases of genito-urinary organs, in Epilepsy, in Habitual Constipation, Dr. Cullen observed that if doses of castor oil be frequently repeated the dose might be diminished so that a person who required half an ounce or more at first will require only two drachms subsequently.

In Cholera, it has been strongly recommended by Dr. Johnson of King's College, but from the report of the "Treatment of Cholera Committee" of the London Board of Health, it appears that the treatment of Cholera by castor oil is not successful thus 2,749 cases were treated in the stage of collapse &

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Deaths per cent</th>
</tr>
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<tbody>
<tr>
<td>1  Colonel + Opium</td>
<td>59.2</td>
</tr>
<tr>
<td>2  Colonel (in large doses)</td>
<td>60.9</td>
</tr>
<tr>
<td>3  Salines</td>
<td>62.9</td>
</tr>
<tr>
<td>4  Chalk + Opium</td>
<td>63.2</td>
</tr>
<tr>
<td>5  Colonel (in small doses)</td>
<td>73.9</td>
</tr>
<tr>
<td>6  Castor Oil</td>
<td>71.6</td>
</tr>
<tr>
<td>7  Sulphuric Acid</td>
<td>78.9</td>
</tr>
</tbody>
</table>
The Modes of Administration of Oleum Ricini.

It is administered by the mouth or by the nose.

1° The best modes in which it can be given by the mouth.

I have tried a great many experiments to ascertain by what means its oily and nauseous taste could be best covered.

The following are the formulas which I think best attain this object.

1° Rx. Pell: Fragonartha: $\overset{\text{P}}{X}$

Sacchari Alb: $\overset{\text{C}}{X}$

Ol. Ricini 3 vi & 3 viii $\overset{\text{P}}{X}$ be

et adda lenti Ag Rose (concent) ad $\overset{\text{B}}{\text{B}}$ f. humid. This makes an agreeable & pleasant draught but it required to be prepared with great care or the water will not mix with the other ingredients. The Ag. Rose I used was three times of the ordinary strength. If well prepared it forms a thin mixture of the consistence of cream & the taste of the oil is no modified as to be scarcely noticed. (Vide Specimen.)
2 Ap. Pulv. Tragacanthi 6 xxv
Sacchari alb. 6 xx
Pulv. Zingiberis 6 xx. Prima est adde
Ol. Ricini 3 vi. 3 viii
Ol. Caryophyllaci 3", very et addeLets Ag. Puriss. aæ 31/2 f, haust
In this draught the taste of the oil is pretty well concealed, but the flavour
of it is not so likely to suit ladies as the former draught. In this draught
also great care is to be taken to add the water to the oil very slowly. The mixture
of Oil of Cloves, & the ginger, tend to prevent the oil causing nausea or griping as well
as help to conceal the taste. (vide Specimen)
3 2 Ap. Pulveris Zingiberis 6 xx
Pulveris Tragacanthi 6 xxv
Ol. Ricini 3 vii. 3 viii. Then
et adde Sweat. Gent. Co. 31
Ag. Puriss. vel Aq. Rheti. Rf. aæ 3 1/2
Here a bitter has been introduced & it not
only is very useful in hiding the nauseous
taste of the oil, but bitters we know increase
the activity of purgatives. (vide Specimen)
The following formula conceals the taste of the oil, but is only applicable in certain cases as it contains brandy.

By Pulv. Acacia 3½
Sacchari Alb 3½
Hortus Ven. Gall. 3½
Al Ricini 3½ to 3½
Ag 1/2 3½ / 3 / 4

This requires to be well shaken, before being taken, as it separates into two layers on standing.

5th Carter Oil mixes readily with the yolk of eggs & it has this advantage that the mixture thus formed will readily mix with water & does not require the same amount of long & careful stirring that mixtures made with Pulv. Fragonia: et. Doege sie.

By Ditelli. Aci. unum

Ether: Chlor: M xx

Tinct. Emt. Co. M XL

Alci Ricini: 3½ vol 3½
Ag 1/2 3½ / 3 / 4

Unless Chloric Ether, Tinct of Gentian or some aromatic water be added the taste of the
Oil is still plainly perceptible.

An emmenagogue + aperient mixture may readily be made.

By Vitellii. Ste. %

Per. 3

Turp. 2

P. Ricini. 3 ij. vel 3 ij.

Ag

Add vitt f. Spirit.

To the above savine, lemon extracto etc can be added at the option of the physician.

The albumen of the egg readily forms an emulsion with P. Ricini and will mix with water when shaken, but on standing it separates into two strata, but on shaking & mixing with a few grains of salt it makes a most tolerable vehicle for the administration of the oil.

2. Big Potassa has been recommended but I don't think it hides the taste of the oil so well as the mixture made with Pulv. Fragacanthi, but amongst the best of preparations of this sort is the one recommended by Prof. Christian, it consists of the following ingredient.
As an anthelmintic, (particularly useful when patient is suffering from the Ascaris lumbricoides) the following mixture of Turpentine and Oil. By Apt Terentianus

Re. Olei Terentianus 3 1

Olei Ricini 3 VI. f. Haurt.

To be taken on a morning fasting.

For pain in the bowels, attended with slight diarrhoea, Castor oil and Aperient are often used by some physicians thus.

Re. Olei Ricini 3 VI. f. Haurt.

Suit olie 3 MXX vel xx f. Haurt.

The ordinary modes of taking castor oil are very numerous, some prefer taking it in milk, others in coffee, some in gin + others again will take it floating on the top of water, but in all these methods, the chief thing to be attended...
to is to swallow the whole at one gulp.
But the way, I think that is more agreeable
than any of the above, is to add one or
two drops of Oleum Carophylli, or Oleum
Pirmento, + a little Drop of Tinctura
Gentianae Co. + then to the dose of the
oil to be taken + then to take the
whole floating on the top of some
Ag. Rosa.
Caron oil readily mixes with Magnesia,
but then it will not mix with water,
but with magnesia alone, it forms too
thick + gelatinous a mass to be
swallowed readily, therefore the
thought occurred to me that it might
by mixing with flour be made into
cakes which might be used as medicine
more particularly in the case of children.
Therefore proceeded to try what might
be accomplished by this means + made
6 cakes or rather biscuits composed of
Magnes Carb. 3 gr. Al. Ricini 3 gr. + to
mix them thoroughly. I boiled them with
a little water, and afterwards mixed the compound, with sugar 3 sp. Liquor Ziziphus's 3 sp. and after mixing it I divided them into six cakes which were then carefully baked, to show that they were not very nauseous. I may state, that by mistake these cakes were set on the table and were freely partaken of by my father, mother, and sister, and were pronounced to be very good till I told them of what the cakes consisted; then they all refused to eat any more of them, and tried to fancy they were not so good as they had previously stated them to be. This fact shows that this mode of administering castor oil is one which might be had recourse to when the patient refuses to take it in any other way. As to the efficiency of this mode of administering the oil I may mention that I took two of the above mentioned cakes at bedtime and the next day I had two loose and free
Eviscerations I did not experience any pain or griping nor yet any sickness or nausea. I therefore think this is a sufficiently feasible mode of giving castor oil to make a trial of it in nurseries warrantable. I therefore have thought it advisable to include specimens of these cakes in the box which accompanies this thesis, but as the cakes were made last October I fear they will not be quite so eatable as when first made. They are composed of

\[ \begin{align*}
\text{Magnesia} & \quad 3\frac{1}{2} \\
\text{C. Ricini} & \quad 3\frac{1}{11} \\
\text{Sugar} & \quad 3\frac{1}{7} \\
\text{Flour} & \quad 3\frac{1}{9}
\end{align*} \]

made into six cakes. Lastly it occurred to me that as the seeds of castor oil are taken abroad as ordinary purgatives, that they might be used as purgatives in this country & the question then was in what way would they be most
palatable? & it struck me they would be most readily taken if boiled with sugar so as to make a sweetmeat of them & thus I accordingly tried, having first shelled the seeds the propoxy
I used were as follows of the Castor Oil
Seeds $\frac{3}{4}$ lb. of powdered loaf sugar $\frac{3}{4}$ lb.
I have a specimen of this sort by me which I intended to have sent in with my other specimens but as it by keeping soon gets soft & liquid
I have since thought it would be useless to do so. As to the dose of this
preparation I believe for a man it from 6 to 10 seeds, I took $8$ & they only produced a mild purgative
d action (causing me loose motion)

2 Castor Oil may be administered
per rectum in the form of enema
I have not experimented into this
matter. but I find writers have
recommended castor oil enema
in many forms of constipation &
+ flatulent distension of the colon & the following is a formula recommended by Dr. Witt. Rx. Acli. Ricini. 3v. Potassa Cub. cxxv.
Saponis. 3l. Azur. ferreutis, octium

tert. spirit. d'ace & wine & petris

In distension of the intestines the following has been recommended

Rx. Confectionis Ruta. 3l
Acli. Ricini. 3l
Tinctura Batman. 3v.
Decocto Avenae 3v. pl. Wine

The castor oil is sometimes ordered to be mixed with turpentine & in other cases with castor oil to increase its potency.

Castor when rubbed on the skin does not irritate it & I have seen a mixture of Collodion & Castor all applied to the face to prevent setting scars being formed by small pox & in one case it seemed to answer pretty well but I have not seen it often used.
A Brief Summary and Conclusions of the Thesis.

In the above pages I have attempted:

1st To give a general description of the castor oil plant, and the modes of preparation of the oil.

2nd I have stated the results of my experiments into the chemistry of the oil and have shown that it is probably composed of two fatty acids, the Stearoric, the Margaroric, and I have abstained from calling them either Elaidic or Margaritic. 1st Because this would render them liable to be confounded with the fatty acids of Olive Oil. 2nd Because these terms have been applied alike to the fatty bodies got by saponification, and also to the volatile oily bodies got by distillation. 3rd For these reasons I have thought it well so far to change their names.
are produced analogous though not identical with the \( \alpha \) acids &
glycerine obtained by saponification.

I have therefore termed them
steaericine, margaricine, &c.,
the latter being the analogue of
the glycerine obtained by saponification.

4. I have tried to show the great
probability that the active principle
of the oil, if not of the seeds, is indisputably connected with, the
fatty acids.

5. I have shown that the British
Pharmacopœia tests for the purity
of the oil are faulty.

6. Several new modes of administering
Castor oil have been suggested.

I should have liked to have had
more time for revising & thinking
over some of the contents of this
paper, for as I have been so constantly
remaking the same experiments.
to assure myself of their accuracy,
& I have delayed the writing of
of the latter part of this paper till
at length I have had to do it somewhat
more hurriedly than I expected
+ I should like to have rewritten
a great part of it but find now
I have no time. + Therefore
must leave it as it is, to your
merciful consideration + try to
console myself with the thought that
however imperfect this thesis may
be, it is not a mere compilation
of other men's words, + thoughts, +
that it might not be so, was my
chief reason for fixing on the
Chemistry of castor oil
etc.
as the subject of this thesis.

Finis.