Erythroxylon Coca and Cocaine

by

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M.A. (Aberdeen) M.B. CM. (Edin) 1879

A Thesis for the degree of M.D.

1889.
It is not yet five years since one of the now most useful and extensively employed drugs, Cocaine, and its use as a local anaesthetic seriously and strenuously urged. The honor of those introducing Cocaine into practical therapeutics belongs to Dr. Carl Koller, who at a meeting of the Vienna Royal Imperial Society of Physicians, held on October the 17th, 1884, read a paper on the local anaesthetic effect of Cocaine especially as applied to the eye. The immense importance and great practical utility of such a drug was at once grasped by the profession and Cocaine sprang forthwith into most multifarious use. The substance itself, however, had been discovered very much earlier, for it was in the year 1859 that Kekulé, at Göttingen, first extracted the alkaloid from the leaves of the plant Erythroxylon Coca, while very soon after it was noted the fact that if Cocaine was taken into the mouth it produced a numbing effect on the
e mucous membrane of the tongue. For some reason or other, however, very little notice was then taken of Cocaine, and except for very occasional notices in the medical journals it sank into undeserved oblivion; and it was only after Herr Koller's paper alluded to, and a subsequent report of a meeting of the Ophthalmo-Ophthalmological Society, at which various members gave their experiences in the use of Cocaine, that the alkaloid rapidly took its place as a most valuable adjunct to the practitician's armamentarium.

Although, however, the discovery and, more especially, the therapeutic usage of Cocaine is a matter of quite recent history, we must go much further back along the tracks of time before we come to the first mention of the plant from the leaves of which that alkaloid was obtained. Among the Incas and Incas inhabiting the countries adjoining the eastern slopes of the great mountain range of South America, the Coca plant seems to have been known from time immemorial, and ever to have been held in most superstitions reverence. Its very name indicates the esteem
in which it was held that name, Coca, being apparently derived from the Indian word Khoka which means the plant.* Here I may digress a moment to say that I can find no special reason to support a spelling of the name, viz. Cacca, with of course Cacane, which I have found in several articles and letters on the subject, as for example in Sir Robert Christian's article upon the plant. Alternative spellings are usually unfortunate and always apt to mislead; and when the preponderance of evidence, etymological and otherwise is clearly in favor of one spelling, as I think it is in the case of Coca, that spelling should always be adopted. I shall, therefore, throughout my thesis always use the spelling Coca.

But to resume. Ethnoxylym Coca, is literally Ethnoxylym, the plant, so-called doubtless because it was, and even now is, the plant par excellence. The earliest account of it in literature that I have been able to find

* Compare the name given to the tea-plant of Paraguay, which is Yerba or the plant.
occurs in an old book written by a Doctor Bernardino de Seville. This book was published about 1565, and it was first translated by one Casibus Classicus in 1589, while in 1596 it was translated into English by John Frampton, merchant. The article in this book on Coca being short and succinct, yet very comprehensive and correct in its account of the plant and its use by the native Andeans, and having, moreover, a certain historical value as the first mention of the Coca plant in literature, I venture to quote it in full. Doctor Remondes writes: "I was desirous to see that herb so celebrated of the Incas, that has so many years past, which they call the Coca, which they sow and till with much care and diligence, because they use it for their pleasures, which we will speak of. The Coca is a plant of the height of a yard, little

*Joyful News out of the New-found Worlde, where in are declared the rare and singular virtues of divers Herbes, Trees, Plants, Oyle, and Stones with their Applications as well to the use of Physick as of Chirurgery, &c. The Three Books of Doctor Remondes of Seville, Englished by John Frampton, merchant. (London: 1596)
now a less, it comes to leaves like to Arrai

now somewhat greater, and in that leaf

there is marked another leaf of like form,

with a line very thin; they are soft, if a

color light green, they carry the seed in

clusters, and it comes to be red when

ripe, as is the seed of Arraiam when

it is ripe. And it is of the same great

ness, when the herb is seasoned that it

is to be gathered; it is known of the seed

that it is ripe when it is of some red

ness like to a blackish color, and the

herb being gathered is put into cans, and

many other things that they may dry,

that they may be kept and carried to

other parts. For that they carry them from

the high mountains to other places as

merchandise to be sold, they tarter and

change them for Pantoles, and cattle and

salt, and the things which run like

money amongst us. They plant the seed

in Almacoys, and from that they take them

up and set them in other places into

earth that is well labored or tilled,

and made convenient to set them in by

their lines and order, as we do set here

a garden of beans or of peas. The use

of it amongst the Indians is a thing

general for many things, for when they
"Travel by the way for need, and for content
to be in their houses; they use it
in this form, they take cockles or oysters
in their shells, and burn them and
grind them, and after they are burnt
they remain like dust, very small ground;
then they take of the leaves of the Coca
and chew them in their mouths, and so
they chew it they mingle it with some of
the powder made of the shells, in such
sort that they make it like a paste,
taking less of the powder than of the
herb, and of this paste they take certain
small bundles round, and lay them
to dry, and when they will use them they
take a little ball in their mouth, and
chew it, rolling it from one place to an-
other, procuring to conserve it all they
can, and that being done they take an-
other, biting it all the time they have
need, which is when they travel by the
way, and especially if it be by ways
where there is no meat, nor plenty of
water. For the use of these little balls
they say that they receive substance there-
by as though they had eat meat. At other
times they use them for their pleasure,
although they labor not by the way, and
These lines occur in "The Plant," Bhārti.
"They use the same Coca alone, chewing it and turning it in their mouths from one side to another until there is no virtue remaining in it, and they then take another. When they will make them selves drunk and be out of judgment, they mingle with the Coca the leaves of the Tobacco and chew them together, and go as they were out of their wits, as if they were drunk, which is a thing that both give them great contentment to be in that sort. Surely it is a thing of great consideration to see how desirous the Indians are to be deprived of their wits, and to be without understanding, seeing that they thus use the Coca with the Tobacco, and all to this end, that they would be without understanding, and have their wits taken in from them, as we said in the second part when we treated of the Tobacco.

The fame of the Coca plant must have widely spread and its wonderful properties soon have become known, for we find in the works of the poet Cowley, who flourished in the 17th century, the following lines:

"O our Vicarocha first his Coca seat, Sadow'd with leaves ofondrous nourishment,"
A translation of Dr. Wordsworth's account of China is to be found in the Pharmaceutical Journal for 1854 pp. 162, 263.
"Where juice sucked in and to the stomach
Long hunger and long labor can sustain;
From which our faint and weary bodies find
More succor, more they cheer the drooping mind,
Than can your Baccinos and your Cores joined.
Three leaves supply for six days, much afford,
The Quiritá with this provision stood,
Can pass the vast and cloudy Andes too."

Since the time of Cowley many
other writers have treated of the Coca
plant. Perhaps the fullest and best
account is that given by a Dr. Weddell
of Paris, who in 1853 published an
account of "Voyage dans le Nord de
Bolivie", while in Johnson's Chemistry
of Common Life, republished a few
years ago under the editorship of Dr.
Church, there is a very good popular ac-
count of Coca and its properties. There
are also works on the subject, some in
German and some in Italian. Of these
languages I am ignorant, and for my
knowledge of the works referred to I am
indebted to abstracts and references given
in English books and periodicals.

It is my intention and will be my
endeavor to consider the nature and action
of this wonderful Coca plant, and to illus-
trate and indicate its therapeutic uses.
for I think it might with advantage be rescued from the undiscovered oblivion into which it seems to have fallen, and put to practical use. And further, I hope to briefly discuss the action and uses of the alkaloid Cocaine, and the practical conclusions to be therefore deduced, as gathered from my own experience and from the literature of the subject.

The original habitat of the Coca plant is somewhat uncertain. Johnson, in the article on Coca in his Chemistry of Common Life, says that it is a native of the tropical valleys that occur on the eastern slopes of the Andes.* There is no doubt, further, that the Incas, when they conquered and overran Peru, found Coca in use among the native tribes, adopted its use and extended its cultivation.† Even to this day it is said still to be grown in Bolivia. We may, therefore, take it for granted that the original habitat of the Coca plant was in Peru and Bolivia on the eastern side of the Andes. A map in Johnson's work shows that the plant has been cultivated in the parts of

† In a short account of the Incas, see p. 115, Peru in Popular Encyclopedia (Blackie & Son).
South America, e.g., in Venezuela, in Brazil, and in the Argentine Republic, while in an article in the Lancet, Dec. 13th, 1884, p. 1063, it is stated that the Coca plant has been acclimatized in Ceylon.

The botanical characters of the Coca plant were, according to Weddell, first described by Clusius about the year 1605. Nearly one hundred and fifty years later, in 1749, it was again fully described by Antoine Laurent de Jussieu from specimens sent over by his brother from South America, and by him it was classed in the genus 

Bythoxylon, now the natural order Bythoxylaceae. Its full name Bythoxylon Coca was first given to it by Lamarck in his Encyclopédie Méthodique, Botanique, published in 1786, the name being derived, as I have already mentioned, from the Indian word Khoka.

In its wild state it attains a height of about three feet, little more or less, as Remondes says, but when cultivated it attains nearly double that size. In appearance it somewhat re-
for exact representation of the tree leaf I saw visible to my friend Mr. Johnson. It is an entire physiologic leaf of a tree (after surface of the simple veins) that I have had cut out. What is the purpose of all the blood supply of this leaf? And what is the function of all its organs? What is the function of all the organs of a leaf? It is a question of interest and important to answer. It is a question that cannot be answered without a thorough study. What is the purpose of the veins in the leaf? What is the function of the veins in the leaf? What is the purpose of the veins in the leaf? What is the function of the veins in the leaf?
resembles the English Black or Common Thorn. It is a thick, bushy shrub with a very abundant foliage. The leaves are very closely placed on the branches and are alternate in their arrangement. The leaves vary in shape and size somewhat, the largest being about two inches long, and in shape resembling an elongated ellipse or obovate boat; some leaves being much more obtuse at the extremity than others. The leaf has one distinct peculiarity, which I have merely represented in the diagram. On each side of the midrib there is a faint curved line, seen best on the under surface of the leaf, running from stem to apex, and giving the appearance of there being "marked annular leaf of like form." These lines are not true veins, but are caused by the folding of the leaf in the bud. In their fresh state the leaves are said to be of a bright green, dark on the upper surface, and a more delicate shade on the under surface. The dried leaves, of
which I have a specimen by me as I write, show the same difference in shade, but the upper surface color I would christen a kind of light sage green while the lower is of a very washed-out green shade. The carefully dried leaves are said to have the fragrant odor of tea, very as in the case of tea to a volatile odoriferous principle, and this is very noticeable in the specimens that I have obtained. Fresh leaves I have not been able to procure, so cannot speak as to their odor, but Professor Johnson in his work already quoted says that "when nearly dry the leaves emit an odor similar to that of new-mown hay, in which melilot or sweet-scented grass is contained." And he mentions also the curious fact that the anying Coca leaves produce in new-comers an affection resembling and analogous to hay-fever.

The flower is a small white drooping flower with a short stalk attached to the places on the branches from which the leaves have dropped. The fruit is

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*Johnson, op. cit. p. 359.*
a small red berry about the size of a large pea, elongated in shape, containing one seed, and when quite ripe, of a dark red color. The flowers and the fruit, however, do not possess as much interest for us as it is only the leaf that is used by the natives and which is employed medicinally, and from which the alkaloid Coca is extracted.

As I have above stated, the Coca plant is now very carefully cultivated and in some parts of Peru and Bolivia, especially in the province of Yungas, it forms an extensive and lucrative agricultural industry. It grows best up the mountain sides between two and five thousand feet above the sea level. If planted at higher altitudes it is apt to be nibbled in the bud by chilli pests, while if planted at lower levels the shrub is weakened by excessive heat, and the leaves lose their virtues. The seeds are planted regularly in May, usually in the month of November. The young plants are very carefully watched and tended till they have attained a height of about eighteen inches, which is generally about February of the second year after
after their being planted. The shrubs are now taken up and replanted very systematically in rows eighteen inches apart, the plants themselves being also eighteen inches from each other. They are arranged in terraces, pretty much as vine yards are planted in Tuscany in the Appenines. Between the rows of coca plants it is customary to plant maize to secure moisture and shade for the young plants. They require extreme attention and careful weeding, the latter process being performed with complete thoroughness every three months. The first crop of useful leaves is borne in about eighteen months, but it is generally three years till the bushes come into the full sign of life and full bearing powers. The plant is most prolific once it has attained its full stature, and in favorable localities and in well irrigated Céals, as the plantations are termed, as many as four crops of leaves will be brought forth in one year. Though the fresh leaves are what the Coca-chewers prefer to use and are of more virtue and power than the dried leaves, yet the latter form the Coca.
of commerce. The careful preparation of these dried leaves, therefore, so as to preserve as fully as possible the virtues of the fresh leaf, is evidently a matter of much moment. The successful gathering, the drying, and the preservation of the leaves is a most delicate and difficult process. If the leaves be at all broken or bruised, they lose their active properties, and hence their market value is much diminished. Such great care is necessary that, according to Dr. Brookeswell, who is fancy writing from Dr. Weddell's book, the women in some plantations are not allowed to pull the leaves off the branches, but must with their nails cut the stalks, so as to avoid bruising the leaves. The leaves are ultimately spread out in the court of the house and allowed to dry in the sun. If they are not very carefully dried, or are allowed to become damp and overheated they lose their proper fragrant odor and develop a very disagreeable smell. The yield of a local precast varies in different seasons, but in a good year, a fair
average crop will yield from eight to nine hundred pounds of dried leaves per acre. So valuable is the cultivation of the plant and so much is it valued, that it is calculated that the annual produce of the Cocos in South America amounts to over 30,000,000 pounds, yearly which, taking it at the market value in this country, represents the large sum of £2,000,000; while it is computed that upwards of 10,000,000 inhabitants of South America are habitual consumers of Coca leaves.

From the earliest of times, the Coca plant seems to have been held in great esteem, and it figured a large place in the legends and traditions of the Indians. In the early ages before the precious metals were in vogue, Coca was used as the medium of barter or money; and when gold and silver came to be used for money, Coca at once became the chief article of commerce of the countries where it grew. Religion and superstition also claim a tribute from Coca; and in all the great religious ceremonies of the people it was used by the priests either to throw upon the sacrifice or even as the sacrifice itself. The priests, too, chewed the leaves...
during the ceremonies, as it was feared that the Gods would not be propitiated. And to this day when an Indian “shuffles off this mortal coil” and starts on his journey towards “that bourn from which no Traveller ever returns”, it is the custom to put some Coca leaves in his mouth, so that at his journey’s end he may receive a cordial welcome into the realms of Paradise; and “when a Pinovicia Indian on a journey falls in with a necromancer, he with timid reverence, for “suits to it some Coca leaves as his pious “offering.”

And for the superstition ideas in connection with the Coca leaf growth, of the wonderful effects found to accrue from the chewing of the leaf, or how far these very superstitions, on the other hand, reacted and tended to increase the supposed effects of the narcotic, are questions which belong to the domain of metaphysics, and which may be left to the philosopher to discuss. Without doubt all travellers in the countries where the Coca plant flourishes and is in use,

*From Tschudi in his Œuvres on Brazilian.*

as quoted in Johnson (cit. p. 366.)
and all observers into the effects of Coca-chewing agree in attributing most wonderful results to its use. To the native Indian it seems to be almost as much a necessity of his life as his daily bread. Certain it is that in the indulgence of the habit of Coca-chewing he finds the supreme delight of his life, lifting him, as it does, into the brightest and blindest regions of fancy, and shutting out from his ken the worries and cares and pains of life, you even the very elemental disturbances of nature.

The native Indian never goes without all the paraphernalia requisite for his customary indulgence; the pipe, or chucopa as it is called, to carry the dried leaves, the little bottle to contain the unslaked lime or oyster-shell ashes or quinoa ashes to mix with the leaves and the small strip of wood into which to apply the ashes to the leaves. His usual method of enjoying his luxury is as follows. From the chucopa he takes a small quantity of leaves. These he moistens in his mouth and with the help of his tongue rolls up into a small ball, called an acullies. Then he moistens the slip...
of wood and dips it into the lime or ashes that he carries with him and then applies it to the cneullico, which he now proceeds to masticate. The object of the lime or ashes is to bring out the true taste and delicate flavor of the leaves, while it is also claimed that the lime increases the flow of saliva. Mr. Dowden, well in a footnote to the paper already quoted, says that he has found the first effect of intensifying the flavor is very marked, but that the flow of saliva is no greater than it would be in chewing any indifferent substance. The chewing process is continued as long as the ball of leaves gives out any juice, and when that is exhausted another ball is prepared in a similar manner and chewed as before. If chewed for pure enjoyment, as a means of intoxication, the fresh green leaves are usually employed. But if used to help to sustain prolonged exertion several balls are prepared as above described and kept ready for use. A third method of use is, as Monoddo tells us, to mix a small quantity of tobacco with the corn leaves as this is supposed...
to intensify the intoxicating effects. Authorities differ as to the management of the saliva; some, as for example D. Weddell, affirming that it is all swallowed, while others, among whom is Dr. Ischeide, assert that it is partly swallowed and partly rejected. The time occupied in the chewing varies from fifteen minutes to half an hour, and as a rule the Indian indulges in it three or four times a day. Johnson mentions in his book that so confirmed is the habit among the Indians and so apparently indispensable to him that he employs all labor and it to their advantage to allow their employees to have their regular times for indulgence in the habit, as the Indians will some leave work under any master who does not concede them this privilege. The habitual chewer is termed a Cooper, which is the native word for a chewer, because the drivers as a class are particularly addicted to the habit. To enjoy his pleasure to the full, the confirmed Cooper usually returns to some quiet, secluded spot, and making himself as comfortable as possible, lies down and gives

*Johnson, op. cit. p.357.*
himself wholly to the luxury of the narcotic effects of the leaf, indifferent to all that goes on around him, "needless of the thunder, storm which threatens to drown him where he lies, of the roar of approaching wild beasts, or of the smoky fire which creeps along the grass and is about to suffocate a srooch him in his lair."

In course of time the toqueros is said to become as completely a slave to the habit of coca-chewing as the drunkard becomes to the habit of dram-drinking. The continued and excessive indulgence in the habit gives rise to a train of evil symptoms not very unlike those following excessive indulgence in alcohol. Biliar attacks, accompanied always by great constipation, are very frequent; the appetite fails, dislike to all nourishment gradually gives way to an incoordinate desire for animal food, droopy enervant perhaps on liver disease ensues, and at last in a very long time death ends the scene. Von Treichl thus describes the result. The constant and continued habit of coca-chewing, he says, "gives a bad breath, pale lips and fingers, greenish and
"Stumpy teeth, and an ugly black mark at the angles of the mouth. The inconstant walk, the unsteady gait, his yellow skin, his dry and sunken eyes, encircled by a purple ring, his quivering lips, and his general apathy, all bear evidence of the harmful effects of the Coca juice when taken in excess."

Such are the evil effects of over-indulgence in the Coca leaf; but it would be illogical to argue from this that Coca has no beneficial effects and no proper use. Indeed such dire results of this habit of what for its sake I may term Cuperousia are only seen among the native Indians, but are seen chiefly among Europeans who have taken to the Vice somewhat late in life. And Ischudl gives it as his opinion that the moderate and judicious use of the Coca leaf may be not only productive of no evil results, but may even be conducive to health, stating in support of his opinion, what indeed is hardly credible, that many of the Indians, who begin chewing the leaf in boyhood, attain the marvellous age of

\[\text{I quote again from Johnson op. cit. p. 364.}\]
130 years, while even the most rapid conqueror lives to the age of fifty.

The one great and outstanding effect of coca-chewing which all writers and all accounts agree in attributing to the custom among the Indians at least is that of producing marvellous powers of endurance. Even those, who like the German traveller Pöppig, lay great stress on the beneful and debilitating effects of the coca leaf, bear testimony to this sustaining property of the plant. Pöppig mentions that the native miners will work for twelve hours at a stretch in the silver and quicksilver mines of Peru with only a small handful of maize and the chewing of coca leaves every three hours to sustain them; and further, that an Indian miner will, with coca as his sole sustenance, travel thirty miles in eight hours, carrying a load of a hundred weight. The proof of the sustaining effects of the coca leaf are too numerous and universal to be set aside as myths, in so far at least as regards its use by the native Indians. It will be enough for my purpose...

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Here is a good abstract of Pöppig's book Reise in Peru, Chili und im Amazon- in Sir W. J. Hooker's Companion to the Botanical Magazine 1835, p. 161.
if I relate cases given by Mr. Ischudia and Dr. F. H. Senners, who visited for some time in Lima, the capital of Peru.

Van Ischudia employed an Indian to de-convery heavy digging for him, which occupied altogether five days and nights. During all that time the Indian never tasted any food, and slept only two hours each night. While he was at work, every three hours or so he chewed about half an ounce of Coca leaves, while he was never without the little ball or aculelo in his mouth. Ischudia remarks that he was constantly beside the Indian and could therefore closely observe him. The digging work being finished, the Indian accompanied his master on a two days journey of sixty three miles, and though on foot, kept up with the mule on which Ischudia was riding, still sustained and strengthened only by the Coca leaves. And all this he did although he was, in the authority of the village priest of the village, sixty two years of age.

Dr. F. H. Senners, of Lima, whence the chief spot of Coca leaves comes, mentions that

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*see Johnson op. cit. p. 367.

Medical Times and Gazette, Vol. 22. 1871, pp. 407, 408.
mellows and mysterious effect of seeming to supply the place of food, of bestowing extreme powers of endurance, and of preventing feelings of fatigue. And at the same time unless it is indulged in to great excess it has apparently little or no injurious effects. One remarkable fact, which is wedded in his book mentioned, is that though enabling the Indians to do without food for a long time, Coca in no way impaired the appetite; for though they chewed the leaves all day long yet at night, when proper food was provided, their appetites were ravenous.

I now turn to inquire what effects the Coca leaf has on Europeans; and here, although individual experiences vary, yet the preponderance of opinion is in favor of the sustaining powers of the plant. The most systematic and complete observations that I have been able to find recorded are those by Dr. Mantegazza of Milan, Sir Robert Christison, and Mr. Drodswell of University College, London. Dr. Mantegazza’s prize essay on Coca appeared in 1859, published at Milan, while Sir Robert Christison’s and Mr. Drodswell’s experiments with Coca were both published in the spring of 1876, the former in the British
Medical Journal, the letter in the Lancet.

Dr. Mantegazza's experiments were most elaborate and extensive. He states that chewing a draught of Coca leaves increased the flow of saliva and produced a bitter, soon succeeded by a warm aromatic taste in the mouth. This bitter taste we now know to be due chiefly to the alkaloid, cocaine, the aromatic taste to the volatile essential oil, Hyoscyine. After a second and third dose he experienced the sensation of having had a comfortable meal, while there was, he states, an increase of thirst. After using the Coca some days he found on himself and on others who had been experimenting with him a circumcised erythema and a peculiar tingling sensation in the skin.

Taking an infusion of three draughts of the leaves increased the rate of the pulse and raised his temperature, and caused vertigo, headache, and noises in the ear. At the same time it produced a feeling of great strength and agility and impetus to action, while after a short period the intellectual faculties joined in this ep-
altation. The effect of four draehmus was
much the same only in a greater de-
gree, while the effect of eighteen draehmus,
which amount Mantegazza states he took
in one day, was to cause great delirium,
the pulse at the same time bounding up
to 134 beats per minute. The intoxication
eventually passed quite away, three
tours sound sleep following, after which
he was able to perform his daily duties
without any inconvenience, rather, I think,
better than usual. He took no food for
forty hours, but thereafter, the coca not-
withstanding, he was ready for his food,
and the stomach digested it well.
These experiments, St. Mantegazza frequently
repeated on himself, and his resulting
opinions as to the effects of Coca may be
summarized as follow: (1) It both stimu-
lates and calms the stomach, and pro-
duces digestion, though at the same time
causing slight constipation. (2) In large
doses it increases the animal heat, and
accelerates both the pulse and respiration.
(3) In a moderate dose, say about three
draehmus, it stimulates the nervous system,
so that it makes muscular action easier,
and renders the body more tolerant of fatigue.
(4) In very large doses it induces delirium
and hallucinations, but apparently without any subsequent nervous depression. He also says it is an excellent drink, and this opinion is rather contrary to that of most others, who say that it spoils the teeth, makes them green and stumpy.

Sir Robert Chisholm first began experimenting with Coca leaves in 1870. Having had a small quantity of leaves sent to him, he gave some to two students, who, for some time out of the habit of prolonged physical exercise, had taken a long walk and had returned home weary and fatigued and hungry. They took no food, but each drank an infusion of two drachms of Coca leaves. Hunger soon left them, and with it the sense of fatigue, and they again went out and walked for an hour or so with great ease and comfort, and on their return took an excellent meal. One of the students felt somewhat giddy on first going out after taking the Coca, but his were no bad effects were noticed. In 1875, Sir Robert got another supply of leaves and again gave them to some students for experiment. The results were varied some-

# cf. Von Feilcke's opinion, ibid. supra p. 21.
# British Medical Journal Vol. 1871 p. 527.
what. Out of the ten students who experimented with the leaves, two found no appreciable effects, while four experienced complete relief from all symptoms of fatigue. Hunger generally disappeared for a time, but eventually reappeared. Appetite was not impaired. Sir Robert Christian was of opinion that the second supply of leaves was not of such good quality as the first, and this may account for the varying experiences of the students. He next, in 1875, experimented in his own person, using the remnants of his first supply of leaves; and, in the address he justifying from, gave a graphic description of the ease and some agility with which, after chewing the leaves, he no longer a young man, got through long country walks and stiff mountainous excursions, while in the evenings he was quite free from all fatigue and dizziness and felt alert and ready for work. During the days he took the Coca his meals were breakfast before he started on his excursions and awaking apart after all his hours were over; and he stated that he felt throughout the day neither hunger nor thirst, but yet he always enjoyed a hearty meal in the evenings. He found,
and in this his experience agrees with that of
Mantegazza that the effect of the Coca was
not to decelerate the pulse, but rather to
correct it, and lessen the excitement of
the circulation. The results of Sir Robert
Christian's experiments of Coca may be
summarized as follows: (1) It removes fati-
gue and prevents it; (2) It suspends
hunger and thirst, yet appetite and di-
gestion are not thereby impaired. (3) It pre-
vents the dullness and droviness of the
mind that follows bodily fatigue. (4) It
reduces the effect of severe exercise in
accelerating the pulse. (5) It increases
the flow of saliva. (6) It probably lessens the
decretion of the urine solids.

Mr. Brodheswell, in the article already
tened to, gives a detailed ac-
count, with some instructive tables, of
the results of experiments on his own
person with the Coca leaf. Every pre-
caution was taken to make the experi-
ments as scientifically exact as possible,
and the drug was taken in various forms
and varying doses, at all hours of the
day and under different circumstances.

* vid. Supra p. 23.
The effects of the Coca on the pulse, the tem-
perature and the urine were all carefully
tabulated for comparison with observations
made when no Coca was taken. The results
Mr. Bowditch arrived at were almost
entirely negative. He says that in a month
nearly a pound of leaves was consumed
without producing any decided effects.
"It has not," he writes, "affected the
pupil nor the state of the skin; it has
caused neither dizziness nor sleepless-
ness; assuredly it has occasioned none
of those subjective effects so fearedly
described and ascribed to it by others." And he finishes his article by suggesting
that the beneficial and beautiful effect
described by travellers may be in large
measure the result of peculiar nervous
idiosyncracies.

From a very lengthy list of experiences
in the use of Coca leaves, that I have gath-
ered while wandering through the literature
of the subject, I shall quote briefly only
a very few more. I take the following
incidental reference to Coca from a book
of travels* in which the writer is describing
his ascent of the great Mexican mountain

Pocovatapeo. "I had procured a double handful of Cora leaves, the stay and stimulant of the Indians of the Peruvian Andes, and to these may be attributed the fact that I made the ascent without fatigue."

A correspondent, writing to the "Kame", from London, under the initials A. K., states that on going shooting one day he tried taking tincture of Cora — of which the strength is I believe 1 in 5 — in doses of one to two ounces. It had no appreciable effect in preventing the sense of fatigue, which was his object in taking it; but it had one remarkable result in that it transformed him from a bad shot into a good one, by preventing the nervousness and palpitation that always came on just as he was taking aim. On the same page of the same "Kame" is a letter from another correspondent stating that Cora has a great effect in preventing the breathlessness and discomfort due to rarefied air at high altitudes. Wm. Ischidi bears similar testimony. He gives his own experience of an infusion of the leaves taken when climbing and hunting on the mountains of the Puna.
14,000 feet above sea level, and states that he found no more difficulty in respiration than he would have had in equally severe situations on the coast. Writing in 1885, Surgeon-major Charles drew attention to the thirst-quenching properties of coca leaves, and claimed to be the first to observe this—a claim Lemaître finds unjustifiable, as Sir Robert Christian had previously made the same observation to-day noting if Sir Monardes who mentions this property of the leaf so far back as 1565. Dr. Charles tried the leaves on himself and three guides. They each took 7 1/2 grains during an ascent of Mount Blanc, and found it completely quenched the severe thirst often felt in very high altitudes or under a burning sun. He thinks the sustaining effects of coca leaves is much exaggerated, and yet somewhat inconsistently, it seems to me, to say that coca leaves are useful in helping women to endure prolonged labors without loss of nerve power. Dr. Waddell in his book states that on himself the action

* Medical Times and Gazette, Vol II 1885 p.165
* cf. supra pp. 6 and 31.
of the Coca leaves was to produce a slight excitement, which, he says, was not so well marked as that produced by alcohol, but more diffused and sustained. He concludes that Coca has, in moderate doses, no special action on the brain, but that its effect is spread over the whole nervous system, that it gives support without possessing any nutritive properties, and that it has no injurious results.

My own experience as to the results of chewing Coca leaves is very limited and correspondingly valueless. This is owing to the fact that, unless small quantities, thirty grains at most, the leaves give me a feeling of intense nausea, and I cannot continue the mastication so as to extract the full virtues from the leaves. I have tried several times but always with the same results. On two different occasions I have managed to chew thirty grains of leaves, but the effects were practically nil. Except for a slight feeling of nausea, and perhaps a mildly constipating effect. As, however, my natural tendency is in that latter direction and as it is difficult to eliminate all other con-
In the circumstances, I would not positively attribute the result to the Coca leaves, tho' it does agree with what Dr. Mantegazza's conclusion. The flow of saliva did not seem to me greater than it is during the mastication of any substance. The opinion that it is the process of chewing and not the Coca per se that causes the flow of saliva is borne out by the fact that I never experienced any increased salivation after taking the Extractum Coca Ligniwm of the British Pharmacopoeia. This extract, of which one drachm is equal to one drachm of the dried leaves, I have now tried on eight different occasions, and in doses ranging from two to six drachms. Taken in this form, I have never felt any nauseating effect from the Coca, while I am more inclined to ascribe to it the constipating effect before mentioned, which has followed too constantly after the doses of the Extract to be a mere accidental coincidence. The thirst-quenching property of the Coca has been invariably well marked in my case, and this effect I have found to outlast all others.

ef. Supra p. 28.
My appetite and powers of digestion, always excellent, have never been in the least impaired. Not even after the largest doses I took, did I at any time notice any perceptible alteration of the pulse or variation of temperature. In doses of two draçines or under, it produced no special result either in preventing or removing fatigue. In larger doses, from three to six draçines, it certainly removed to some extent the sense of fatigue, yet not, it seemed to me, to any greater extent than I have felt after taking a cup of good tea or coffee. It never prevented the sense of fatigue. When taken after hard work it produced after an hour or so a very pleasant condition rather hard to define or describe—a condition in which my head sensations were those of extreme satisfaction and well-being, and of complete indifference to outside affairs. It never gave me that feeling of alertness and activity which Dr. R. A. F. Christian says it produced in him. The only inconvenience, effect of Coca I noticed followed the taking of four draçines.

\* cf. Supra p. 30.
o more of the attack. Twenty minutes after taking that amount, it seemed to affect my head somewhat, not causing any disagreeableness or anything approaching delirium, even with the biggest does I took, but producing a sensation of my head being too full, with the faintest suggestion of throbbing. It was in no wise painful or distressing. I am at all times rather liable to suffer from headaches, and the sensation produced by the Coca was, so to speak, a potential, but not an actual, headache. This sensation lasted from two to three and a half hours, the length of time varying directly with the amount of Coca taken.

Such are my personal experiences with the effects of the Coca leaf. I have taken it in the morning before my day's work was begun, and I have taken it in the evening after my day's work was over. It has been tried during the ordinary routine work of a general practitioner's life, with only this limitation that I have selected days when I have counted on more work than usual, and have occasionally done my work on foot instead of in my trap. I may further state that in 1887 I took on
six occasions a wineglassful of Ambroisie
Coca wine at the evenings after work was dne,
and I found it act as a stimulant, fresh-
ening my energies, while it also lessend
my thrist. Since the effect of the pure Coca
extract has been so slight I am now in-
eclined to attribute the effect of the Coca
wine to the Burgundy with which it
is made up. Again, I have, during
the past two or three years, frequenty
used as a table water, or ordinary beverage,
Schweppes Coca water# - a pleasant acido
drink. From this I have observed no
special effect on myself, except that it
is more thirst-quenching than most be-
rages. A medical friend, however, Dr. Williams
of this town, who when spending an evening
with me, has frequenty joint me in
drunking his Coca water, tells me that
almost invariably after taking it he
has had sleepless nights. Because of
the force under which I have taken
Coca has it or produced the effect
on myself.

In the main my impressions of Coca
though not absolutely negative, are not

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This wine contains 3 1/2 dried leaves in 3 1/2 pint.

This water contains 9 grains of leaves in each small bottle.
nearly so productive of good results as that of others. And while there are too many testimonies to the sustaining virtues of the Coca leaf to be altogether put aside, yet I cannot but agree with Mr. Brownlee well that the very powerful effect recorded by some observers may be partly due to successive idiosyncrasies. Except to Mantegazza few have described the dreamy and religious effect as having been experienced by themselves. And though there is no doubt the native Indian does experience these effects, and spends his time when under the intoxication of Coca in realms of blissful fancy, yet it may be that these effects are intensified by the superstitions reverence which to him surrounds the plant. The concluding words of Dr. Doddrell's chapter on Coca are much to the point. He says: "It is essential not to forget the fact that with the Indian the habit we are encumbering has all the more force from the circumstance that it alone survives from bygone days; that to-day, as in the past, he attaches superstitions ideas to the Coca leaves, which much trouble in his imagination the greatness of the benefits he expects from them; and that he puts in this nourishment the sole
annunciation that in any way interrupts the
utit[or incomparable] moment of his existence.

The precise physiological action of
Coca is not easy to determine. It appar-
ently acts by contracting peripheral
blood vessels, and this would explain its
action in controlling the heart and in
preventing excessive tissue waste. In large
doses it is narcotic; yet to some extent stimu-
ulating the brain. It may be that it acts
mainly on the sympathetic nervous
parasympathetic system, just inhibiting or stimulating it and
then, if pushed too much, hastening it.

By its action in preventing tissue waste
Coca is an indigestible nutrient, but there
may be in the leaves some constituents
which are utilized in the body as for
and thus help to give Coca its mar-
vellous sustaining properties.

If there were a fraction of the power-
ful and stimulating effects attributed to
The use of Coca were true, then without
doubt the practical medicinal value
of the drug is worth great attention, more
than it has yet received. I propose
to shortly enumerate the cases to which
it has been put and the results of its
employment by different medical men.

Dr. Mantegazza, in his paper, already
quainted states that he has used it in eight or
nine varied cases, and always with satisfactory
results. The details of the cases I cannot
give; for I cannot read Italian, and no
abstract of the paper I have been given any
particulars of the cases. As the result of
his experience Dr. Mantegazza advises the
use of Coca in cases of Dyspepsia, Nostalgia,
the debility following Fevers, and in Hypochondria
and Hypochondriasis, and suggests that in
large doses it might be useful in Hypo-
phobia and Insanias. He also states that it
is a valuable aphrodisiac.

Knowing in mind the reputed effect
of Coca in lessening or altogether warding
off the breathlessness and discomfort
experienced in rarified air, it is not unusual
to find its use chronicled in cases of
Dyspnoea from different causes. In a
letter to the Lancet* Mr. Honos Lewis says
that smoked in a pipe is used as an
inhalation. Coca leaves have a benedicial
effect on Bronchial Spasms. He says he
has used it in cases of Asthma, the
Dyspnoea and Cough being much relieved,
and he gives the case of a gentleman.

* cf. supra p. 33, 34.
# Lancet Vol I 1876 p. 520
who formerly suffered sleepless nights from
the paroxysms of coughing, but who, having
mixed some Coca leaves with a small
quantity of tobacco, smoked a pipeful
of this mixture just before going to bed,
with the very satisfactory result of enjoy-
ing a full night's sleep. So also, in a
review of a work entitled "The Influence
of Climate on Disease," it is stated that
the author of the work, Dr. A. Bickerly,
having proved their value recommends
the use of Coca leaves as the best means
of relieving the sufferings of mountain
ascent.

Dr. S. MacBeane of Newcastle has
recorded the results of the use of Coca
in Typhoid and Typhus fevers. The first
case was one of Typhoid Fever, in which
the gave one dram of the Tincture
of Coca, which I take to be the old French prep-
ration containing one dram of leaves in four
drachms of tincture. The result was that
the amount of urine secreted was dimin-
ished and the delirium controlled, though
the effect on the temperature was not pro-
nounced. The patient did well, and was

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*British Medical Journal* Vol. I. 1871 (March 10th)
fully convalescent, but unfortunately caught cold and subsequently died from Pneumonia. The second case was one of Typhus Fever which was successfully treated with doses of one to three drachms of the tincture. Here also the delirium was controlled and the amount of urine excreted much diminished. The third case, a prolonged convalescence from Typhoid Fever, was also greatly benefited by the use of Coca. Mackean mentions two or three other cases without any details, merely saying that Coca was successfully used. He strongly recommends the use of Coca in cases of excessive tissue waste, because it has the power of checking the secretion of urine, and of lessening the tissue waste.

In France, Coca has, according to Bouchardat, proved of considerable therapeutic value, and has rendered most valuable service almost equal to Cinchona. He considers it a stimulant both to the muscular and nervous systems. And in Germany, where Coca seems to be much more used than in England, it has, according to Diedrich, proven in doses

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**ib. The Satellite (American Journal) Nov. 1888, p. 128
From five to twenty minims of the tincture, proved useful in dyspepsia, and chronic diarrhoea, while given in pill or as an extract, it bids fair, he says, to be of service in angina, chorea, and epilepsy.

To this kind courtesy of my friend Dr. Jones of this town, who has recently been using Coca in his practice, I am indebted for liberty to give the results of his experience. He has given it generally as a "pick-me-up" in cases where other tonics have failed or had very little effect, and the results, he says, have been satisfactory. A case of chronic diarrhoea, due to structure of the rectum, was much benefited by one dramme doses of the Vinum Coca (cortyn). The patient always experienced a feeling of well-being and renewal after taking the dose, which was administered every three hours; and Dr. Jones says he had some difficulty in preventing the patient taking too much.

A woman suffering from chronic uterine trouble was also much benefited by Coca. She took twenty minims of the tincture of Coca, and for about an hour after there was a slight feeling of intoxication, but
followed as in the other case by a sense of well-being. One man who took twenty
minim doses of the tincture complained of occu-
dinal "tightness of the head", but in "most cases," says Dr. Hearsey, "the exhilarating effect
of the drug has been admitted. In two cases,
noo seemed to aggravate the sleepless.
now the patient suffered from."

I have jottings of thirteen different
cases in which I have used Coca. In
all these cases I have employed the
Extraction Coca Liquid of the last pharma-
esia. I had previously and not infre-
quently advised Ambrochto Coca tincture in cases
where I deemed that a good restorative
would be useful. Of the thirteen cases,
five were suffering from Dysepsia, chiefly
atonic in character. I prescribed half to
one drachm doses of the Extract to be taken
about quarter of an hour before food. Two
of the patients derived little benefit at first,
but with the addition of five minim doses
of Tincture of Waeh Vonica, improvement soon
took place. The other three dysepsites did
well with the Coca, the pain after food al-
together disappearing after two days use
of the tincture. In two cases I have pre-
scribed drachm doses of the Extract merely
as a tonic, and the patients certainly be-
proved under this treatment; but how much of the improvement was due to Cora, and how much to Nature, I am not prepared to say. In 10 cases I have found some striking effects from the administration of Cora, than in those irritative conditions of the bowels, in which the chief symptom is a great desire for defecation almost immediately after a meal; the desire very always culminating in a loss of fluid. I have used it with complete success in four such cases. In the first of these I had previously tried several other remedies, when recollecting the constipating effect of Cora noticed by some observers and experienced by myself, I resolved to give it a trial. It acted extremely well; as after four or five days Cora given with or immediately after each meal, the diarrhoea ceased. In one of the cases I had to increase the dose to two draughts.

The other two cases in which Cora were cases of diarrhoea, occurring in the first case in a man, aged 69, with chronic double Pneumonia, in the second case in a young girl, aged 5½, with Malaria and Severe Bronchitis. In the former,
I gave two doses, one of two drachmas of the
3rd and one of three, with an interval of
three hours between each dose. The first dose
made no appreciable effect; but within three
quarters of an hour after the second dose the
silence of the delirium was much abated
and the patient's conversation became more
retarded. The pulse dropped from 118 beats
per minute to 96, and the temperature fell
from 103.2° (Fahrenheit) to 102.6°. Thus the fever
continued not aggravated, even though it
was not much lessened. These doses were
given in the forenoon, and next day the
more informed me that in the evening
the delirium returned; and so the patient
unfortunately died, rather suddenly, before
my visit. I had no opportunity of respecting
the Cosa. In the little girl's case I first
gave two doses, then thirty, then forty and
lastly a draught, at intervals of four
hours, but the results were entirely
negative. The little patient recovered.

In experimenting with any new
remedy, and in afterwards endeavoring
to fix its true value as a therapeutic Cosa.
agent, there is a tendency on the part
of the practitioner to occasionally let zeal
outtrace discretion, and to forget the logical
maxim that the post hoc is not
always or of necessity the proper one. There is, I am persuaded, a strong inclination amongst general practitioners at least, of whom I am one, to place too much reliance upon physic and to ascribe too much of whatever success may attend our efforts in our combat with disease. I remember once reading—when I do not recollect that the art of being a good physician was "to amuse the patient, while nature cured the disease"; and here is a big germ of truth in that definition. The vis naturae medicatrix does very much for our patients, as well as sometimes perhaps in spite of our drugs. Nevertheless, there do have their use and proper sphere, not least aiding nature to work a cure. So what extent then, under that class of cases, is Coca likely to prove of service? The outstanding property of Coca, which also made it famous and attracted traveller’s attention, that namely of enabling the consumers of the leaves to undergo great exertion without feeling fatigue, at once suggests that in any conditions of excessive wear and tear of great debility, it would be found beneficial. In cases of pyrexia, in convalescence after long and strenuous ailments, and in cases of mere general debility from
whatever cause the indication for a remedy like Coca, with its power of preventing tissue waste and its nervous and muscular tonic properties, seems clear. A correspondent in The Lancet so far back as 1872 wrote: \#4

"It is very possible that in Coca may be discovered a valuable aid in fevers and some nervous and wasting diseases, for sustaining the strength under conditions where ordinary food cannot be taken." And the experiences of Mantegazza and Maclean show that in such cases Coca is valuable.

There is one class of cases in which I think the muscular and nervous tonic properties of Coca might find great scope. I allude to a very common condition among business men. It is hard to give it a single name; for it is not so much a distinct disease, as a general want of tone throughout the system and marked by the nervous system, brought about by the worries of business and pressure of work, and is especially common in these days when the struggle for wealth, may even for competence, is so keen. Distress, cessation

\# Lanceet Vol. I. 1872 p. 746

from work is the best of all remedies; but one cannot always get patients to agree to this, and then, I think, Cocain will be found most useful. At any rate, it is certainly worthy of a thorough trial.

In certain forms of diarrhoea, when the diarrhoea is about the only symptom, there is a possible use for Cocain. It is not a specific that will cure all cases, nor is it of much use in severe cases; but in such cases as I have alluded to above, we have in Cocain a most safe and valuable remedy, with so far as I know, no after effects. It is in the treatment of such cases of what I may call Gastro-intestinal irritation that I am inclined to think Cocain will be therapeutically most constantly beneficial. In cases also of Atonic Dyspepsia, where there is inability to digest food, with accompanying discomfort and want of appetite and relish Cocain, if it be as Mentagazza claims, both stimulant and calmitant to the stomach, will prove valuable.

In these cases of functional disturbance of the heart, which are by no means rare in nervous women, there is another
I refer for the use of Quercus. It is true that Dr. Montagu agrees that it had a greatly exciting effect on the circulation in his case, but that was only after doses that I regarded as unusually and unnecessarily large, at least therapeutically. Against this experience we have that of Dr. Robert Christian and those who say that Quercus unambiguously controlled and calmed the pulse. I have a lady patient who suffers from such cardiac disturbance as I am alluding to. I have given her digitalis, strophanthus, senapinaria, and the cardiac remedies with fairly satisfactory results. Being on a visit to some friends in Berlin, she consulted Dr. Leyden of that city, who prescribed for her a pill containing two grains of strophanthus and half a grain of digitalis leaves, to be taken three times a day; and she has always maintained that she found more lasting benefit from these pills than from any of the drugs I have prescribed for her. In such cases, then, if functional cardiac trouble prevails, I would suggest a trial of Quercus, especially when the more common cardiac tonics have been used without much benefit.

* cf. Supra pp. 28 and 31.
At present I am not inclined to place much value on cocoa as a means of diminishing or preventing delirium. I have insufficient experience to give a settled opinion, but the effect of cocoa in causing sleeplessness, as it does in many instances, and its results in myself, make me somewhat sceptical as to its value in cerebral disorders.

Lastly, as regards the therapeutic value of cocoa, it has been suggested as a means of helping the victims of alcohol and opium to throw off the chains of their slavery. I do not, however, view with much favor its use here, and I doubt its good results. When we consider how apparent it is for over-indulgence to follow the medicinal use of the drug, we run a risk of merely substituting one form of intoxication for another. Thus, the results of what I have called cooperation do not seem so harmless and disastrous as those which follow the abuse of alcohol and opium; nevertheless, it were better, I think, to employ the and safer means of saving the intellect and the opium eater than a drug that runs the risk of still pandering to the passion for intoxication, even though that intoxication be
of a mild character.

Briefly stated, then, my conclusions as to the therapeutic value of Coca are these:

1. It is a good restorative or tonic stimulant to the muscular and nervous systems, and in all cases where such a remedy is indicated is worthy of extended trial.
2. Owing to its mildly constipating action, it will prove of value in the milder forms of diarrhoea, especially in that form where the regulation of food causes a desire for almost immediate defecation with an accompanying loss of body moisture.
3. It may, probably, will, be beneficial in certain forms of functional cardiac trouble usually found in nervous women.

Not much need be said as to the doses to be used. The Extract is the only official preparation, and is a very good one. If this, it is rare, if ever, necessary to prescribe a larger dose than two, at the outside, three doses. In the great majority of cases much smaller doses are sufficient; and I would strongly recommend it as the most and safest plan always to commence with a dose of thirty-minutes equivalent to thirty grains of the leaves, and gradually to increase it if necessary. The patient must
be carefully observed, and any tendency in this order part to take more of the remedy than has been prescribed, as was noticed by my friend for doing, very promptly checked and the dose diminished.

Coca has been much more extensively used abroad than in England, but I hope its use here will spread, for I consider it, used in suitable cases, a valuable and a safe remedy.

**Cocaine**

I now turn to the second part of the subject of this paper, viz. the alkaloid extracted from the Coca leaf, which has been called Cocaine. Although it is only a few years since Cocaine was brought into universal use, yet already the literature of the subject is so extensive and miscellaneous that any attempt even to notice, much less to discuss, that like alone would extend my paper beyond due limits. I shall therefore chiefly confine myself with recounting my own experience with the drug, its uses, its dangers, gusting from, or referring to other observers in support or elucidation of my statements.

Cocaine is not the only substance extracted from Coca leaves. At least four
Hyoscine, a volatile essential oil, which gives the apericin taste to the leaves, and which is said to have hydrate properties; (2) a body called Bora-wee; (3) a variety of tannin acid called Bora-tannic acid; and (4) Eggumine which can also be got from Boraic acid when the latter is treated with strong hydrochloric acid. With none of these, however, am I at present concerned.

As before stated, Boraic was first discovered by Nenner, then assistant to Wöhler, professor of Chemistry at Göttingen in 1857. It is only fair to state that some claim that Seucke was the first to isolate the alkaloid which he named ephydrine. Nenner's method of isolating the alkaloid was to macerate the leaves with alcohol strongly acidulated with sulphuric acid, and afterwards neutralized with lime. Then carbonate of soda was

* id. Lancet Vol. 1885 p. 909
* id. supra p. 1.
* id. "Cocaine and its use in Obstetrics and General Surgery" by Perl, Knepeck (of New York) p. 11. This was published in 1885. There is a smaller pamphlet on "Cocaine and Cocaine" by Mr. W. Mortensdale, published in London in 1886.
added and pure Cocaine precipitated, and
this was finally purified by crystallisation
from acetone. Cocaine is a compound sub-
stance, whose chemical formula as given
by Looze, in 1862 and was accepted generally
is C₇ H₁₇ NO₄. It has a bitter taste, no appreci-
able smell, and crystallises in monoclinic
prisms. It is very sparingly soluble (1 in 704)
in water, but readily soluble in alcohol,
ether, chloroform, benzine and oils. The
quantity of Cocaine for one box leaves
is proportionately very small, never more
than about 0.3 per cent. Cocaine combines
readily with acids to form salts, of which
the best known and most widely used
is the hydrochlorate. Other known salts
are the benzoate, the sulphate, the
tartrate, the oleate, the salicylate and
the citrate, and of these the first has
been especially recommended by Maa. Johann
as being free from the slight irritating
effect of the hydrochlorate, while the last is
said to be the best adapted for use in
dental surgery. The hydrochlorate occurs
in very fine needle-shaped crystals, so

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# vid. Lancet Vol II. 1884 p. 1064. cf. also the account
of the preparation of Cocaine in Mortlandale's book p. 53.
# quoted in Mortlandale op. cit. p. 55.
pure and minute sometimes as to make the salt appear to be a white amorphous powder. It has a bitterish taste and a slight acridish odour. It is soluble (1 in 4) in water and readily so in alcohol, but it is practically insoluble in oils. Throughout the rest of my thesis wherever I use the word Cocaine I must be understood to allude to the hydrochloric salt and not to the pure alkaloid unless it is otherwise expressly stated.

Very soon after he isolated the drug, Neumann discovered that it had a numbing effect when put on the tongue, and two years later Dr. Schöffer made the observation that, when administered to rabbits, it dilated the pupils. From time to time occasionally notices were taken of the new substance. Among these Dr. Köhler, Kussnatt made experimental enquiries into its properties, along with those of theine, caffeine, and theobromine, and showed that the alkaloid Cocaine exerted its influence in the sensory nerves and was analgesia. Yet however till the end of 1884, after Dr. Rolll had proved the analgesia the effect of the hydrochlorate of Cocaine when applied to the conjunctiva and published his discovery did the alkaloid attract
much attention. Then indeed, if one may
presume the substance, Cocaine "sought to
find itself famous"; and thenceforward ex-
periments were made on all hands to test
its anaesthetic and analgesic properties in
every branch of surgery, and even to find
fresh fields for its use in the domains
of medicine.

The physiological action of Cocaine
may be summed up by saying that it
acts on the sensory nerve fibres by para-
lyzing them, and on the sympathetic nerve
fibres by, in small doses, exciting, and in
large doses, paralyzing them. Dr. J. King,
conducted a series of experiments on dogs,
and the results of his experiments prove
that after a slight and very transient in-
terrupting effect, Cocaine paralyses the sensory
fibres, and if the administration be con-
tinued the motor nerves are also affected.
He further shows that it is a depressant
to the heart and respiration, a sufficiently
large dose paralyzing both at once. Brain
segment, as the realt of this surgeon, con-
siders that Cocaine acts through the medium
of the peripheral nerves on the nervous centers.

\* Lanceet Vol. I 1885 p 439
which react in producing an inhibition of sensibility. Some authorities also assert that it acts on unstriped muscular fibres, probably through irritation of the sympathetic nerves, causing their contraction. Its mydriatic action on the pupil is due to this same irritant action and not to any paralysis of the third nerve. That this is so is proved by these facts: that it is impossible to cause the maximum dilatation of the pupil by Cocaine; that what dilatation does occur can be at once overcome by ergotamine or pilocarpine, and by the stimulus of light; that the power of accommodation is never paralysed, indeed is very little affected; and that it enlarges the palpebral fissure probably by irritating the unstriped muscle in the eyelids, a result we do not get from the use of other mydriatics, which act by paralysing the third nerve. That Cocaine acts on the sympathetic, the same nerves is further proved by the constriction of the blood vessels that follow its use as evidenced by the pallor of the surfaces to which it is applied, and the diminished haemorrhage that takes place during operation on a Cocainised surface.

St. Bowd. in Thorpe Op. cit p. 62, also Mr. Jacob. Lancet Vol. II. 1855, p. 76
This too will account for the diminution of tension in the eyeball when Cocain is instilled on the conjunctiva. Such diminution I have myself experienced, and it is testified to by many observers. Dr. Lucien Allee, and Mr. Benson affirm that there is an increase of tension, but Mr. Desoiz says this is extremely transient, and is at once followed by a marked diminution of tension. It may be that the transient increase occurs just when mydriasis is just seen and before the Cocain has had time to affect contraction of the blood vessels. Certainly the majority of observers report a diminution in the tension of the eyeball following the use of Cocain; and perhaps if Dr. Allee and Mr. Benson had tested the tension somewhat later they might also have found there not T but T. Dr. Allee, Mr. S. St. Everick, report that Cocain is a general as well as a local anaesthetic; which agrees with Brown-Segard's observation that it acts through the nerve centres producing an inhibition of sensibility. Cocain may thus be called an anaesthetic, an analgesic.

† as Lancet Vol I 1888 p. 870.
and a haemostat. It is also said to be slightly antiseptic, a five per cent solution delaying putrefactive changes in meat. Never use a weak solution very soon becomes turbid from fungal growth, requiring some antiseptic, preferably mercuric chloride solution 1 in 5000, to keep it clean and antiseptic.

In testing the effect of Cocainc on myself I have used various strengths of solution. First of all I applied two drops of a two per cent solution in water to the conjunctiva of one eye. Within five minutes there was some impairment of sensibility, but no other symptom. In ten minutes anaesthesia was well established, but it never was complete, and within twenty minutes after the instillation of the drops, the conjunctiva had resumed its normal sensibility. There was slight dilatation of the pupil, which, however, readily reacted to light and there was absolutely no impairment of accommodation. Well within an hour after applying the solution, the eye seemed as improved as the other eye, quite normal again.

I next tried the effect of a five per cent watery solution of Cocainc. As before I instilled two drops into one of my eyes. In two minutes there was slight anaes-
The result of the conjunctiva was in five minutes the anæsthesia was much more marked, but I could still feel pinching up the membrane with forceps; in ten minutes there was complete anæsthesia of the conjunctiva and cornea. This lasted ten minutes, and then gradually subsided; and thirty minutes after first applying the cocaine the sensibility of the conjunctiva was normal. Well marked anæsthesia of the membrane came on in about seven minutes, and the palpebral fissure was perceptibly enlarged within ten minutes after the application. The effect on the pupil was as follows: in ten minutes it was well dilated; in fifteen it was still more so, and this was the maximum effect produced by cocaine, and was by no means so great as that produced by atropine. The dilatation lasted in all about three hours after which time there was no appreciable difference between the pupils of the operated eye and of the unoperated eye. When the dilatation was at its height, the pupil still reacted to the stimulus of light while the accommodation of the eye was affected only to the degree of removing the near point of vision one and a quarter inches further away than usual. Even this slight paucity of accommodation lasted only thirty minutes. Within four hours of
the application of the five per cent. solution. The crystallized eye was restored to its normal condition.

I also tried the effect of a five per cent. solution of the pure alkaloid in laudanum to which was added the conjunctiva and rubbed into the skin. In the former case, the results did not differ from those obtained after using the lacrimal solution, while in the latter case the results were nil. I also used a five per cent. and again a ten per cent. solution of the alkaloid in oil of cloves. On each occasion I rubbed it well into the skin of the forearm and of the temple, but on no other occasion was the slightest analgesia produced. A ten per cent. solution of the salt applied to the eye produced effects in all material points differing from the effects produced by weaker solutions except that they lasted a very short time longer.

Lastly I have twice injected Carine hypodermically in myself, using twice a five per cent. solution and once a ten per cent. solution. The results were at a like extent that, as in the eye, so in the skin, the effect of the stronger solution acts longer; it never was stronger. The pain of the injection is trifling, as also is a very transient sna-
action of prickling. At the three occasions I injec-
ted two, three, and five minimos respectively,
and the anaestheticic results were well marked.
The injection caused a tiny swelling under the
skin, and the centre of this swelling was the
centre of the anaesthetised area, which, eight
minutes after the injection, covered a cir-
cular area an inch and an eighth in diam-
eter. The anaesthesia remained at this maxi-
mum for 9 minutes, and then gradually and
concentrically disappeared, totally vanishing
in thirty minutes. Now the insensitive area
there was a certain pallor of the skin. That
the anaesthesia was complete and reached
below the skin I proved by pricking up the
anaesthetised area with as much subja-
cent tissue as possible, and running a sur-
fical needle through the bone without the
very least sensation of pain.
Some of the trials I made with
Cocamine have I ever experienced any gen-
eral symptoms or toxic effects. There was
no sense of general anaesthesis, such as
was found with ether following its use;
no did the Cocamine when injected into my
own affect my pupils. At any rate, if
there were any mydriasis produced, it was
so slight and so transient as to escape
observation.
The action of Cocaine on the various mucous membranes of the body has been demonstrated by innumerable observers, and the published results prove that in every case it has had a distinctly anaesthetic effect. I cannot stay to detail these experiments and observations, but shall content myself with briefly enumerating a few of them. That Cocaine, locally applied, paralyzes sensation in the pharynx and larynx has been pointed out by Dr. Pinner Jameson, and Dr. A. Decar*, its effect on the interior of the nostrils has been demonstrated by Mr. F. Brattin and Prof. Bruvors of New York; its effect on the nasal mucous membrane has been proved by D. F. Herschell and Prof. Motta of New York. In all these cases the results were good and the anaesthesia produced was most satisfactory. I give nine observations on the nasal mucous membrane, and on the skin of the external auditory meatus, which may be considered a pseudo-mucous membrane, the anaesthetic effect of Cocaine are not
so well remarked, but still are fairly satisfactory. Its effect on the former has been observed by Prof. Polk*, professor of Gynaecology in New York University, while its effect on the latter are illustrated by cases recorded by Mr. B. P. Hill and Mr. S. P. Field. Prof. Knefler* states as to the anaesthetic effect of cocaine in the lecture is not very satisfactory, but still he says it was anaesthetic, and a case recorded by Dr. Frankel* (Breslan) supports his view.

There is no room for doubting that Co. came here the power temporarily destroying the sensibility of all serous membranes to which it is applied; and though it is not in itself anaesthetic, when applied on the skin is very useful, yet when injected beneath the skin the effect is decided. Competent authorities also maintain that it is analgesic as well as anaesthetic, but I do not think its success as the former at all compares with its success as the latter. Be that as it may, it is no wonder that its marvellous physiological effect,

have led to a most extensive and varied therapeutic use of the drug. There is hardly a branch of surgical
practice in which cocaine has not been used and found successful. It has also been employed
with happy results in minor general surgery, while it has even intruded into the sphere of
institutional and private medicine. Indeed, it may be safely asserted that few, if any, drugs we
have found such extensive and varied use so soon after their introduction to practical
therapeutics. It has been used with success to produce local anaesthesia in
operations in the tongue, in the pharynx, in the nose, in the urethra, in the vagina in the rectum, and in
many minor surgical operations such as circumcision, removal of warts, and tapping and injecting
hydrocele. It has been used with happy results as a remedial agent in cases of
Whooping Cough, in Key's Fever, in enuresis, in the disarrangements of
Pregnancy, and as a cure for

1884, p. 975: Langet Vol. II 1884, p. 1167: Krall, p. 117/084:
British Medical Journal, Vol. 1, 1885, p. 227: Langet
the diprosomacine and the opium rubs. It has been used as a means of diagnosing in cases of swellings in the anterior nes, where its power of causing contractions in unstripped muscular fibres enables me to diagnose between true inflammatory swellings and those that are hyperplastic. And lastly and chiefly, Cocaine has been used as a local anaesthetic in eye surgery, and as a remedial agent in many eye diseases. In this direction lies my chief experience of the utility of Cocaine though I have also employed it for anaesthetic purposes in other branches of surgery, and have even occasionally administered it intravenously.

In Ophthalmological work I must Primal here have used Cocaine times of times, and with perfectly general and rare exceptions the results have always been satisfactory. I have used it anaesthetically in innumerable cases for the removal of foreign bodies, in cases of strabismony, in cases of kinking, etc.


# of St. Bowrath in Kinspot, 07, cit. p. 20.
for glaucoma and two for artificial pupil
in three cases of cataract extraction, and in
one case of neovascular for cataract. I have
invariably used my usual 5% solution,
but in the cases where this failed I tried
also a 10% and a 15% solution, but they acted
no better than the weaker solution. Two of
the cases in which the cocaine failed
to act presented no peculiar conditions, and
I therefore ascribe the failure purely to
the individual idiosyncrasies of the patients.
The remaining failures were, made up so
follows: five cases of foreign bodies, on which
had been in the eye a day or more,
one case of subacute glaucoma, and one
case of cataract where the eye was also
glaucomatous. Was the one thing I noticed
common to all these cases was that there
was great conjunctival congestion with
much lacrimation, and in not one
case was there any suggestion of excessive
lacrimation on the part of the patient.
The only reason I can suggest for the
failure of cocaine in these cases is that
the conjunctival condition of the conjunctiva,
aided by the upward flow of tears to quickly
washing away the solution, prevented the
absorption of the drug. My experience in
the cases of trichiony, where the cocaine
was in the whole successful, was that the actual cutting of the iris was felt even though it was not very painful. Similarly in the operation for Sprint, the only pain felt was that the sensation was not pain but the actual tearing. I have never used cocaine in a case of enucleation having considered it would not prove sufficient to desensitize the pain of cutting several tendons and the optic nerve, but having read an account by Dr. Turnbull of Philadelphia, that using a nerve blocking cocaine even to an enucleation, I shall certainly try the method on the first opportunity.

As a medicinal agent I have tried cocaine in 2% and in 5% solution in three cases of tracts, in three cases of glaucoma, and in five cases of Corneal Ulcer. I must confess my disappointment in the results, for except in two of the Corneal cases, where relief from pain was obtained from a drop of a 5% solution used every three hours, I do not consider the cases did as well as such cases usually do under Somnivon or Heparine. Taking these results along with my experience in the failure of cocaine.


Knappe, op. cit. p. 26
to produce anesthesia in eye where there was first conjunctival concussion, I am led to the conclusion that its action in an already inflamed eye is not very satisfactory. Lastly, in connection with eye work, I frequently use Cocaine when I wish to produce a more temporary myosis for photokinesis purposes, but in refraction cases I never use it because its paralyzing effect on accommodation is too trivial.

In minor surgery, I have used it in the following operations, opening abscesses, removing warts, removing anal polyps, and in an operation for fistula in ano. In all cases I used as usual a 5% solution. In the case of anal polyps I first painted the polyps and then allowed two or three minutes of the solution to trickle down the rectum. In the other cases I injected from two to five minutes of the solution at two or three places in the neighborhood of the proposed incision, while in the fistula in ano case I also applied the solution to the rectum. In all these cases Cocaine fully maintained its reputation as an anesthetic. My one experience of pain was when I cut through a Sunday Sinus I formed passing upwards from the original fistula.
In general my experience of Cocaine is not very great. I have painted the interior of my nostrils with a 6% solution to relieve congestion or a common cold in the head with good results. The stuffy feeling soon passing off, and respiration through the nose being much facilitated. I suffer little now much from Preventive Ache, and I have, I cannot say always, but certainly often, experienced much relief from the application of an ointment containing 5% of the above Cocaine. In London, having read giving accounts of the effects of the internal administration of Cocaine in sea sickness, I tried it on myself during a voyage to Norway last year, taking half a grain dose every half hour, but I found to collect that the results were neither soothing nor satisfactory. I have prescribed Cocaine occasionally in the vomiting of pregnancy, but so far the results are not encouraging; and, moreover, the only case of Cocaine poisoning that I have had to deal with occurred in one of three cases after taking one grain doses of the salt. Cocaine has in my hands proved the final in cases of painful dyspepsia, where the

pain comes on immediately after food. It acts best in conjunction with Bismuth, and helps and is helped by the Bismuth; for neither singly has at nearly such a good effect as the combination of the two. Such is my limited experience in the general therapeutic uses of Cocaine. Except in cases of painful gastric trouble I do not see much hope for the internal administration of the drug.

As is the case with most new remedies, especially promising and possibilities of Cocaine, it has been used with so great inanissibility and freedom that it is not surprising to find cases of poisoning by it reported. Happily few fatal cases are recorded, none as far as I know up to the end of last year. In many cases, however, toxic effects have been recorded, following, it is true, usually after large doses especially when given hypodermically, but in one case even after a very small dose.

This shows that there are individual idiosyncrasies in the susceptibility of patients to the drug, and as such idiosyncrasy is an unknown quantity when we first use a drug it becomes us to proceed very cautiously with such a powerful drug as Cocaine. Many cases of toxic constitutional effects, happily without fatal

*Footnote*

*vid. British Medical Journal Feb. 9th 1889 p 312.*
results have been recorded at different times; but the symptoms are as a rule much the same in each case. These symptoms are chiefly headache, vertigo, pallor, difficulty of respiration, cold clammy sweats, tinnitus, often hallucinations, and delirium. As a rule the pulse is not noticeably affected. In the case occurring in my own practice, the patient had already taken at intervals of three hours, two one-grain doses of Cocaine with no untoward results, but after the third dose, and within fifteen minutes, toxic symptoms were developed. There was great rapidity of respiration, with a feeling of suffocation, the extremities were very cold, the pupils somewhat dilated, the pulse not noticeably affected; the chief distress being as if every breath were to be the last. Oxygen was freely administered, and friction applied to the hands and arms and feet and legs. The patient soon dropped asleep, and after ten hours sound slumber, she awoke, and Cocaine poisoning proved well. Dr. Wood, senior house-surgeon at the Middlesex Infirmary, has kindly sent me his personal
experience of Cocaine poisoning. Having recently suffered severely from toothache dependent on two broken stumps, he resolved to get rid of the offending members. Taking with him a 20% solution of Cocaine he went to a dentist close to the Infirmary. A quantity of the solution equivalent to two pangs of the salt was injected into the gums around the stumps, and the result, he wrote thus describes, "The pain ceased almost at once, and the teeth were successfully extracted. I could feel the groan of the forceps, but no pain whatever. Very soon I felt a tingling in the feet and hands, and this was speedily followed by an increased rapidity, rapidly going way to increasing difficulty of respiration, ending finally in two gasps for breath, each of which seemed as if it must be the last. The window of the room was opened and brandy was given to me, which I could not at first swallow, but which once swallowed gave almost immediate relief. The respiration improved, but it still required a great effort to breathe. More brandy was administered, and I was able to walk with help into another room, and in three quarters of an hour went back to the Infirmary in a cab, not feeling equal to walking the necessary hundred yards or so. I went
"to bed, and for five or six hours still felt the
difficulty of breathing, though not so markedly,
while from time to time there was a return
of the tingling in the hands and feet. During
the whole time I was at the dentist I was
perfectly conscious, told him to open the win-
dow, and when I felt at the worst held out
my arm and told him (as I thought) to air
just as this. The dentist now tells me that he
could not make out what I was saying,
which accounts for his not injecting the
aeter, and that he opened the window because
my pupils were dilated, and my face pale and
covered with a cold sweat. I felt certain
also that I heard the dentist talking to
some one else in the room, but this he assures
me was a pure hallucination. During my
unpleasant experience among these thoughts
that passed through my mind, there came
the conviction that the cause of it all
was paralysis of the respiratory centre,
which would cause death; for I was fully
persuaded at the worst stage that this
was to be the end; and I pictured to
myself the last gasps of patients whom
I have seen dying from injury of the
spinal column.

Though happily most cases of cocaine
poisoning terminate in recovery, still,
as I have said, fatal results have occurred. I have found recorded three fatal cases. The first of these was recorded by Dr. J. C. Sins, of Philadelphia. One drachm of a 20% solution of cocaine (equivalent to 12 grains of the salt) was injected into a man’s uterus. Almost at once toxic symptoms supervened: silly speech, twitchings of the facial muscles, staring eyes, with dilatation of the pupils, frothing at the mouth, congestion of the face, and difficulty of respiration. These ended in epileptiform convulsions coming in frequently at very short intervals, with general muscular spasms. The respiratory function first failed, and then the heart was only secondarily affected, its action becoming slow and irregular. The breathing got worse and worse, the face and body became cyanosed, and in twenty minutes death ensued in spite of all efforts to restore the patient. The other two fatal cases were recorded in one number of the British Medical Journal this year. The patient, in both cases being women, in the first about three and a half grains of cocaine were injected hypodermically to produce

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* * The Medical News (American) July 21st 1888, p. 71
* * British Medical Journal Feb 16th 1889, under Italian reproduction
anesthesia in an operation for mammary Cancer. Immediately spasm from convulsions came on and lasted fifteen minutes. Artificial respiration produced a short temporary improvement, but the convulsions returned in five minutes, and twenty minutes after the injection the patient died. In the second case twenty two and a half grains of Cocaine were accidentally administered internally. In fifteen minutes delirium and hallucinations came on, and rapidly increased. The face became pale, the pupils dilated, the lips cyanotic, the pulse imperceptible, and in a short time death followed. A post-mortem examination—the first recorded in a case of Cocaine poisoning—was made, and Dr. Montalbt found congestion of the brain and spinal cord with their meninges. There was a thin layer of bloody fluid on the surface of the brain, while the dura mater had space was full of serum. Sections of the brain showed innumerable minute bleeding points, so that the cut surfaces appeared of a uniform red color, and all the internal organs were engorged. Dr. Montalbt says that the post-mortem appearances show that the poison acts by vasomotor paralysis causing an engorge ment of the vascular system. Some authors
two consider that the actual cause of death is the failure of respiration due to paralys
of the respiring centrie, or perhaps to tetanus of the respiring muscles.

The smallest fatal dose was three and a half grains, and the largest twenty two and a half. As, however, on several occasions more than five grains, once as much as fifteen and a half grains, have been given without a fatal, though rarely without a toxic effect, while, on the other hand, slight toxic effects have followed such a small dose as half a grain, it is impossible to fix the fatal or even a toxic dose. It may, however, be laid down as a rule, that we enter the region of risk if we use, especially hypodermically, more than one grain of cocaine.

In cocaine poisoning probably the best remedy to adopt is the inhalation of Amyl Nitrite, which will speedily counteract the effect of cocaine on the terminal blood vessels. If the patient is able to swallow the free exhibition of Brandy also gives very good results, while friction of the chest and also gives relief. After the first acute symptoms have passed off,

**Year Book of Treatment. 1886, p. 291.
# Krapf, op. cit. p. 47.
complete recovery is aided by giving strong coffee, or perhaps better still by administering caffeine in the form of the caffeine citrate. I have now considered the physiological effects, the anesthetic and therapeutic use of cocaine, and I have indicated its dangers in giving rise to toxic and even fatal effects. I desire now, in concluding my thesis, shortly to state my opinion about the drug and its usefulness. At once let me say that in cocaine either as the pure alkaloid, or, and especially, as the hydrochlorate salt, we have a most valuable and useful addition to the surgeon's armamentarium. To the physician I do not think it will prove so useful, for I do not attach much value to it as an internal remedy, except in cases of painful jaundice, tumour, or, for example, in jaundice ulcers. Its local application to produce anaesthesia and pain as an anaodyne, applied to mucous membranes or injected hypodermically, I could say it is without a rival. Whenever local anaesthesia is required, whether for a brief period, or for a longer time in cases where it is deemed advisable to use a general anaesthetic, then cocaine finds its chief and most successful use. The very last virtue of cocaine I have seen is
in a recent journal, where an account is given of its successful use to produce an
esthesia in an operation for strangulated hernia in a patient to whom it was con-
sidered inadmissible to give either chloroform
oether. Cocaine has a great advantage
over poisoning by oether or other spray, as a
local anaesthetic, because its effects go
deeper in the tissues, last longer, and do not
interfere with dissection. My experience with
Cocaine as a remedial agent in disease
of the eye is not encouraging, but other sur-
gons have reported favorably of the use
of the drug, and possibly I should have
opportunities of using it may give me a better opinion of it. Certainly it sometimes acts
well as an anaodyne. But I value it not as a local anaesthetic; indeed I
consider it the anaesthetic par excellence,
as it is universal in its application,
and almost uniformly successful in its
results.

I am strongly of opinion that it
is rarely, if ever, advisable to use a
solution stronger than 5%. I have never
found any greater benefits from strong
solutions, while the 5% solution has suc-
ceeded where weaker ones failed, and at
the same time no unpleasant effects have

*British Medical Journal April 13th 1889. p. 834
ever followed its use. Thus there is no
obvious to be gained in using either a weak
or stronger solution, and it is I think
of great advantage always to use one uni-
form strength. In no case, not even when
removing tissue from a man’s head,
have I had to inject more than sixteen
drops of my 5% solution, that is equivalent
to three quarters of a grain of Cocaine; and
I cannot avoid thinking that the use of
stronger solutions with larger doses of the salt
is somewhat reckless, rash, and certainly risky.
If it is desired to administer Cocaine
internally, I would advise beginning
always with half a grain and increasing
the dose gradually, and very cautiously.

In conclusion let me give what
I believe to be the circumstances and
conditions that limit the use of Cocaine.
We meet with individual idiosyncrasies
in patients. There are persons whose con-
junctivæ, and I dare say the mucous mem-
branes are absolutely unaffected by Cocaine,
and in such cases, obviously, we must
employ general anaesthetics. Again my
experience tells me that in eyes that
are glancomatous or much inflamed, Cocaine
fails to produce anaesthesia, even as it usually
fails to relieve existing pain. And lastly, the
are some children, boy, and some of men and women who are so nervous and volatile that although you may prove to them the insensibility of the part to be operated on after local anesthesia, yet it is hopeless to try to operate without general anesthesia. Still, in all cases, where local anesthesia is desired and where it is inadvisable or impossible to produce general anesthesia, then I believe we have no other substance that can compare with cocaine and be so successfully used. Emphatically for such a purpose, "it holds the field."

Huddersfield
April 1889

Lt. W. L. Compal
M.B. C.M.(Bir) 1879