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SPECIAL ARTICLE

Coca Leaf and Cocaine Addiction—Some Historical Notes

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ABSTRACT

Coca-leaf habituation has affected millions of Andean natives for over 400 years. In the last half-century it has also involved millions more Malayans. Coca leaf, from which cocaine and extracts for some commercial carbonated soft drinks are obtained, remains relatively unknown by the medical and allied professions elsewhere. A review of the original medical, historical and other pertinent literature of the last 350 years illustrates the origins of the use of coca leaf, its spread, the isolation of cocaine and its first uses, as well as some of the euphoric and other effects of both substances.

SOMMAIRE

Depuis plus de 400 ans, l'accoutumance à la feuille de coca a touché des millions d'habitants des Andes, auxquels sont venus s'ajouter, pendant la dernière moitié du siècle, quelques millions de Malais. La feuille de coca, dont on tire la cocaïne et des extraits servant à la préparation de certaines boissons gazeuses du commerce, est relativement inconnue à la profession médicale et les professions connexes. La revue de la littérature médicale et historique et d'autres documents originaux pertinents depuis 350 ans, permet de jeter quelque lumière sur l'emploi de la feuille de coca, sa diffusion, l'isolement de la cocaïne, ses premières applications ainsi que sur certains effets, euphoriques et autres, des deux substances.

"The dreadful Andes placed 'twixt Winter's Store
Of Winds, Rain, Snow, and that more humble Earth,
That gives the small, but valiant, Coca birth."
—COWLEY[14]

MESCALINE, lysergic acid diethylamide (LSD 25), marijuana, heroin and other drugs are currently very prominent and topical subjects of discussion in legal, popular and medical journals and magazines.[26, 28, 29] Most people are somewhat familiar with the histories of those drugs, as well as of opium, alcohol, tobacco, morphine, caffeine and tranquillizers, and know something about their addictions, habituation or effects.

The coca leaf and, to a lesser degree, cocaine remain relatively unknown by the medical and allied professions, even though cocaine is extracted from the leaf. The general public, moreover, is not aware that it comes into frequent, even daily contact with coca, in the alkaloid-free ingredients of some carbonated soft drinks.

More important, millions of South Americans and Malayans use coca habitually for its remarkably euphoric effects.

When Columbus landed in this hemisphere, the Incaic Empire, composed of the Quechuan, Aymara, and other tribe-nations, had been growing the coca leaf and using it for centuries. In fact, the history of the plant is almost the history of the peoples who first grew it. (The word "coca" is derived from the Aymara "khoka", which simply means "the tree". Unfortunately, coca is so similar phonetically to cacao (cocoa), the chocolate nut, and to kola, that it is often confused with them, even by contemporary medical experts,[27] although coca does not resemble the other two in any way.)

Coca, a relatively inconspicuous greenish-brown shrub, is found in the wild state abundantly in the Western South American countries of Colombia, Peru, Bolivia, and Ecuador; other indigenous species grow in Australia, India and Africa. It is grown commercially in South America, as well as in Malaysia, where it was originally imported.[24]

As can be inferred from its simple meaning of "the tree", coca played a vital role in the culture and economy of the Incaic nation, which at its height embraced over 10 million people in what is now Peru, Bolivia, Ecuador, and parts of Chile and Colombia.[1] An understanding of the importance of coca to these millions requires an appreciation of some facets of the Inca culture. Socially the Incaic Empire was divided into three distinct classes. The Incas, composed of the ruling family and related aristocrats, were topmost. Next came the Curacas, or provincial nobility, comprising the officials and chieftains of subjugated nations and tribes. The Purics, or commoners, made up the largest class of nearly 10 millions. The social, religious and political rights of each group differed markedly. Among these was the right to the use of the coca

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leaf. According to Mortimer,[15] "The Inca was not only the head of the temporal power, but because of his divine origin the representative of the spiritual light as well. All of the religious feasts were appointed by him, and once a year he entered the most sacred place in the Temple of the Sun, stripped of his magnificence as a token of humility, to give thanks and crave for continuous protection." Among the highest rewards the Inca could give was the right to chew the coca leaf, which was prized far above the richest presents of silver or gold. "Special sacrifices of coca . . .", adds Mortimer, ". . . were made at these times and, in fact, it was considered essential that supplicants should only approach the altars with coca in their mouths, and the idea was prevalent . . . that any important affair attempted without an accompanying offer of coca would not prosper." Even at the moment of death it was, and still is, believed by the natives that, if the moribund person was able to perceive the taste of the coca leaves pressed against his mouth, his soul would go to paradise. It was also the custom, illustrated in graves where mummies have been found, to leave a plentiful supply of coca in the "chuspa"—leather pouch—and many other smaller bags of coca placed over the body.[16]

The Purics, however, very seldom had access to the prized leaf, a factor which must have enlarged their superstitious awe of and the craving for coca. Doubtless it must have given birth to the many pretty legends woven about coca. One of these has Manco Capac, the mythical first Inca, bringing it down from heaven. Another tells of a beautiful, wicked young woman, from whose grave sprang the coca plant, its leaves to be chewed only by those having sexual intercourse in recollection of the gay, dead sinner. A third legend attributes the creation of the leaf to the fascination of a conqueror for the bright eyes of a native princess who loved him to death.[10]

With Pizarro's conquest of Peru at the start of the 16th century, the use of coca, previously limited to a few, and on special occasions, became almost universal among the Purics. Certainly the most important factor was that, following subjugation by the Spaniards, the collapse of the Empire and its highly organized governmental structure, and the vicious execution of Atahualpa, the last Inca, the restrictions on the use of coca ceased. The Incas and the Curacas disappeared under the ruthlessness of the conquistadores; only the Purics, because of their numbers, survived, a sullen, bewildered and beaten race.

Quickly the Spaniards realized the subjugating side effects of the coca leaf on the natives. Although superstitiously afraid of it, the conquerors gave coca freely to the Indians to control them, and hold them more tightly as virtual slaves. Under the effects of the coca leaf the Indians worked harder, longer, and with less food. The beaten natives greedily accepted it; it also helped them, perhaps, to endure, and forget, and even escape their misery.

Although originally the Catholic rulers, Isabella and Ferdinand, had legislated to the contrary, soon the Purics were virtual slaves. They were forced to work in the silver and gold mines, in the coca plantations ("cocales"), and in the rudimentary mills where coarse cloths were woven ("obrajes"). Many more were bound as household servants, or "yanconas", and no Indian was allowed to hold public office. In later years no Indian or "criollo" (creole, mixed-blood) was permitted to have a shop, or even to trade in the streets. They were all restricted to menial, mining, farming, or servant tasks.

Scarcely 50 years after the conquest, the native population had dwindled to two million or less, from a peak of 10 millions in 1500. Moreover, an incredible variety of taxes was devised to keep the Indians in debt and the coffers of the vice-royalty replete. Ironically, some of these taxes had to be paid in coca leaves, a commodity in which the administration had a very profitable turnover.[17]

In the interim, the properties and unusual effects of the coca leaf became known in Europe. Albericus Vespuccius[30] is said to be the first explorer to discover coca.[11] Later, in 1550, Cieza de Léon[18] observed that as a peculiar habit the natives ". . . always carried a small leaf of some sort in their mouth." The first European publication on coca was that of Nicolás Monardes,[20] a Seville physician, in 1565. Towards the end of that century, Garcilasso de la Vega published an essay on the cultivation and effects of the leaf—he was well qualified to do so, since he was the son of an Inca princess and a Spanish nobleman. An eminent authority on Incaic subjects and on the history of the Peruvian conquest, he was, as well, the owner of many large coca plantations, which he had inherited from his parents.

In 1753, La Condamine, a noted French mathematician, led an expedition to Quito to measure an arc of the meridian and verify the shape of the earth.[19] Joseph de Jussieu, one of the members, was among the first to classify the coca plant, whose botanical name is *Erythroxylon coca*. Jussieu sent specimens to Paris, where they are preserved in the Herbarium of the Museum of Natural History; even today these constitute the standards for that plant. Humboldt, although quite inaccurately, also described coca in 1801.

As the indiscriminate use of coca by the natives continued unabated, enthusiastic reports by the most notable physicians and scientists of the day continued to appear. Such enthusiasm was based on the striking effects of the crude leaf on the natives and on a few European experimenters. Although these effects could be summarized succintly and objectively, a more candid description can be obtained from the literature of those times, which contains some glowing, exaggerated, and some very inaccurate reports.

J. L. Corning, one of the first and most productive investigators of local anesthesia, and one of

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coca's most enthusiatic supporters wrote: "The answer . . . is not difficult to find for those who have had the opportunity to practically study the effects of the coca leaf upon the human organism. All trustworthy travellers agree that the most noticeable effect . . . consists in a marvellous invigoration of the strength, both mental and physical. The native is enabled to undertake the most difficult and prolonged marches with little other sustenance. The absorption of large doses of coca produces a species of intoxication, accompanied by sensations of lively satisfaction as well as hallucinations of various kinds."[3]

Mantegazza, who apparently had experienced such euphoric intoxications, described them as follows: "Porté sur les ailes de deux feuilles de coca, je volais dans les espaces de 77,438 mondes, les uns plus splendides que les autres. Je préfère une vie de dix ans avec la coca, à une de cent mille sans la coca. Il me semblait être isolé du monde entier, et je voyais les images les plus bizarres et les plus splendides de couleur et de forme qu'on se puisse imaginer. . . ."[4]

The method of coca-chewing was described in 1880 in the U.S. journal, *The Medical Record*,[8] in an article which reported that the Indians carried the coca leaves ". . . in a pouch ('chuspa') at their side, along with a bag of pulverized quicklime or ashes ('llipta'), with which they sprinkle the leaves, in order to bring out the full flavour and strength. The leaves are chewed until the juice is extracted, when the quid is spit out. It is said to take away the sense of hunger, and greatly diminish the necessity for food; it relieves the muscular fatigue of severe exercise. The Indian runners travel 40 miles a day, eating only a little roasted maize, but chewing frequently the leaves of the coca."

Such lavish reports of remarkable effects primed the imagination of poets. The following is a part of a long work by Cowley:

> "Three leaves 'supply for six days' march afford;
> The Quitoita, with this provision stored
> Can pass the vast and cloudy Andes o'er."[14]

Many physicians, scientists and laymen, as well as clergymen who had worked in Peru, reported similar observations from the 16th century onwards. Yet the greatest interest in the coca plant occurred in the latter half of the 19th century, when many notable figures were recommending coca as a contemporary wonder drug. In the same issue mentioned previously, *The Medical Record* remarked: "If the drug has in fact any such properties as are described, it deserves more mention. For, in these days of pedestrianism, bicycles, and athletic tournaments, something that will prevent tissue-wasting and muscular exhaustion would be extremely popular."

At about the same period Corning[5] advocated that ". . . given a good preparation of the drug—such, for instance, as the Mariani wine—and the European or American man of letters is able to encompass an amount of mental work, which, without such an aid, would cause irritability, sleeplessness, or even protracted exhaustion of brain resources. I recommend it in the treatment of brain exhaustion, mental depression, worry, and irritability. I have become more and more impressed with its wonderful potency. The best preparation with which I am acquainted is Mariani's wine." (This elixir appears to have been a red wine with added hydrochlorate of coca, made by Signor Angelo Mariani, a Corsican. Among his clients were Gounod, Massenet, and Pope Leo XIII, who for years was supported in his ascetic retirement by Mariani's product.)[21]

Soon, and understandably, coca was being used as a cure-all for asthenia, asthma, irritability, colic, and a plethora of ailments and diseases. Inevitably, it was also tried and recommended as an aphrodisiac. Dissenting and warning opinions, however, began to appear in the medical literature. One such was published by G. A. Ward,[23] a physician who spent many years in Cerro-de-Pasco (a Peruvian mining town, the second highest inhabited place in the world, at an altitude of 14,500 feet), who warned in 1880: "I have been conversant with coca for the past eight years and would say that the great encomiums lavished upon its use are all 'bosh'. Coca will relieve and in a measure prevent thirst; so will chewing a bullet. I do not think that it will prevent hunger as well as tobacco. In the meantime I would only advise my professional brethren not to consider that the elixir of life has been found in the leaves of *E. coca*."

Ward did not deny, however, the intoxicant, narcotic and excitatory effect of coca on the natives, effects which he mentioned briefly in the same article, and which he compared not too accurately with those of betel, opium, and dundeen.

As can be expected, all such claims about a relatively new and obscure drug from the New World led many scientists to try to isolate the active principle responsible for the striking, if then controversial, effects of the crude leaf. That search itself was long, adventurous and fascinating. Many tried unsuccessfully until Niemann, a pupil of the famous Woehler, isolated the alkaloid, cocaine, in 1858.[13] A full 50 years before Niemann, however, in 1806, José Hipolito de Unanue, in his "Observaciones Sobre el Clima de Lima", had described many Peruvian diseases and plants, including coca, and had come close to the discovery of the alkaloid.[13]

The important physiological and pharmacological properties of cocaine, nevertheless, remained unknown for years. In 1862 Schraff noted the anesthetic effect of cocaine on the tip of the tongue, but neither its meaning nor possible uses were recognized. It was not until Karl Koller, a young Viennese physician, published his paper "On the

Use of Cocaine to Anesthetise the Eye" in 1884 that such significance became clear to others.[6] Within a year the medical profession was using cocaine extensively as a local anesthetic.

Corning, whose small but very important book on local anesthesia has been mentioned before, was the first to use cocaine in spinal anesthesia; he was also among the first to perfect the techniques for its local use in minor and major surgery. This is disputed somewhat, for in a letter from W. S. Halsted to Sir William Osler, the former claimed that ". . . Yes, I published 3 or 4 little papers in 1884-5 . . . on cocaine anesthesia. They are not creditable papers, for I was not in good form at the time. Corning's book on cocaine anesthesia is based almost entirely on my work. He was a student of mine."[7] It is a well-documented fact, however, that Halsted became addicted to cocaine while experimenting with it on himself. So did his assistants, but whereas they died without recovering from the habit, Halsted "kicked it" by being locked up aboard a private yacht during a protracted voyage. Osler and Welsh played a great role in Halsted's recovery and in the remainder of his illustrious career, for in 1889 they certified him cured, and Halsted was then given the Chair of Pathology at Johns Hopkins University.[25] Halsted referred to some of these incidents in his letter to Osler, quoted above.

Although the use of cocaine in major surgery was perfected by Corning and later by others, the Incas may have used coca-leaf infusions or extracts as general anesthetics during trephining operations, administered as clysters. This cannot be proved, but in the Ollachea Valley in Peru many tombs have been found containing enema syringes and a great number of trephined skulls.[9]

At this point it is also fitting that credit be given to an earlier and astute, if relatively unknown, scientist, Thomás Moreno y Maiz, a surgeon-general of the Peruvian army. In 1868, 16 years before the publication of Koller's paper, he wrote a monograph entitled "Recherches chimiques et physiologiques sur l'érythroxylon coca du Perou et la cocaïne".[22] Like countless others, he had been impressed by the effects of coca on his compatriots, but, unlike previous scientists, Moreno experimented with cocaine acetate on frogs. After assessing these experiments he wrote: "Could one utilize it (cocaine) as a local anesthetic? One cannot make a decision on the basis of such a limited number of experiments; it must be decided by the future. For the present we limit ourselves to publishing what we have seen, happy if we can direct the interests of observers to coca, which may become tomorrow an evident benefaction for all the world, and a new rich source of riches for our country."

Moreno's altruistic wishes were fulfilled: cocaine proved a boon to medicine, and pointed the way to the discovery and synthesis of many other similar and better drugs. Coca became a new source of riches for Peru, by exporting it for the extraction of the alkaloid cocaine and the preparation of alkaloid-free ingredients for certain carbonated soft drinks. (For example, the United States of America imports many hundreds of tons of coca leaf annually for the production of cocaine and beverage extract.[2] Insufficient supply from South America led to the cultivation of coca in what is now Malaysia, where it was not indigenous. The Malayan peninsula is now the world's largest producer of coca leaves.)

Nevertheless, in their scientific and altruistic and imaginative dreams, Moreno y Maiz and many others overlooked the nefarious influence of the coca leaf on its habitués, and of cocaine on its addicts. Addiction to the coca leaf *per se* has never been proved. However, no other drug has had such a deleterious and retarding influence for so many centuries on so many millions as coca has had. Unfortunately, its economic value is still important to those countries that export the coca leaf. More unfortunately still, its cultivation for export makes it unavoidably accessible to millions of people in those countries. Legislative measures, which began in the days of Viceroy Toledo of Peru,[31] to control its distribution and use have been strengthened and enlarged.[12] Similar laws were passed in the Malayan peninsula, where the inhabitants soon discovered the pleasures of coca.[2]

It can be argued that, as opposed to cocaine, the drug most likely to induce psychic dependence, coca addiction has never been proved; it may not even exist. Some maintain that after 50 years of coca-leaf chewing no untoward effects can be demonstrated in the user. Others point to the premature senility of the habitual "chewers". This may, of course, be due not to the effects of the coca alone, but, as in chronic alcoholism, to severe nutritional deficiencies, with the added effects, in the case of coca, of the inclement Andean environment, poor sanitation, and other factors. The pathological somatic effects of coca may be disputed, but the psychological and moral deterioration which affects the chewers cannot be denied. This alone is more than enough to discourage the use of coca for other than medicinal or industrial purposes. It may be argued, moreover, that without the leaf these Indians would have disappeared altogether. This may be largely true, but coca permitted such a survival only by letting them withdraw from reality into a state of detachment and tolerant suffering, without ambition and without future. This bleak picture has changed perceptibly in the last three or four decades, owing to the efforts of the local governments and to the efforts and contributions of international agencies. The Andean Indian population is at last showing signs of recovering from a chronic, crippling, endemic disease, affecting many millions, and relatively unknown by the medical profession elsewhere.

REFERENCES

1. BEALS, R. L. AND HOIJER, H.: An introduction to anthropology, The Macmillan Company, New York, 1953.
2. BURKILL, I. H.: A dictionary of the economic products of the Malay Peninsula, Crown Agents for the Colonies, London, 1935.
3. CORNING, J. L.: Local anaesthesia in general medicine and surgery, being the practical application of the author's recent discoveries, D. Appleton & Company, New York, 1886, p. 21.
4. *Idem*: *Ibid.*, p. 22.
5. *Idem*: *Ibid.*, p. 23.
6. *Idem*: *Ibid.*, p. 24.
7. HALSTEAD, W. S.: Personal letter to Sir W. Osler, No. 1500, Bibliotheca Osleriana, McGill University, Montreal.
8. Editorial: *Med. Rec. N.Y.*, **17**: 206, 1880.
9. HEIZER, R. F.: *Ciba Sympos.*, **5**: 1686, 1944.
10. MOLL, A. A.: Aesculapius in Latin America, W. B. Saunders Company, Philadelphia, 1944, p. 13.
11. *Idem*: *Ibid.*, p. 36.
12. *Idem*: *Ibid.*, p. 46.
13. *Idem*: *Ibid.*, p. 231.
14. MORTIMER, W. G.: Peru history of coca, "the divine plant" of the Incas, with an introductory account of the Incas and the Andean Indians of today, J. H. Vail & Co., New York, 1901, pp. 28 and 119.
15. *Idem*: *Ibid.*, p. 46.
16. *Idem*: *Ibid.*, p. 73.
17. *Idem*: *Ibid.*, p. 21.
18. *Idem*: *Ibid.*, p. 9.
19. *Idem*: *Ibid.*, p. 165.
20. *Idem*: *Ibid.*, p. 153.
21. *Idem*: *Ibid.*, p. 179.
22. VON OETTINGEN, W. F.: *Ann. Med. Hist.*, **5**: 275, 1933.
23. WARD, G. A.: *Med. Rec. N.Y.*, **17**: 497, 1880.
24. WILSON, C. M., editor: New crops for the New World, The Macmillan Company, New York, 1945.
25. FRANCIS, W. W.: Personal communication.
26. HOLMES, S. J.: Dependent man and some of his crutches, The Alcoholism and Drug Addiction Research Foundation of Ontario, Toronto, 1964.
27. *Idem*: *Addiction*, **10**: 14, Spring 1964.
28. BAKER, E. F. W.: *Canad. Med. Ass. J.*, **91**: 1200, 1964.
29. LARNER, J.: *The Atlantic*, **215**: 75, February, 1965.
30. PALMA, R.: Tradiciones peruanas (primera selección), Espasa-Calpe Mexicana S.A., México, 1951, p. 29.
31. *Idem*: *Ibid.*, p 44.

GENERAL PRACTICE

The Diagnosis of Early Carcinoma of the Prostate

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ABSTRACT

Careful palpation of the gland is a very important examination procedure in the detection of early carcinoma in the prostate. The finding of a suspicious area requires additional investigation, which must include histological examination of tissue from the suspected lesion. Adequate material for histological studies can usually be obtained by needle biopsy. The percutaneous perineal approach has been found satisfactory for this purpose. In those whose life expectancy is 10 years or more, prostatic carcinoma in its early stages should be treated by radical prostatectomy. For more advanced lesions or for patients whose life expectancy is less, hormonal therapy may be used.

SOMMAIRE

L'examen le plus important en vue de la détection du cancer prostatique à son début, est la palpation attentive de la glande. La découverte d'une région suspecte exige une étude plus approfondie qui doit comporter l'examen histologique du tissu de la lésion soupçonnée. On se procure généralement un spécimen de tissu en vue de son examen histologique par biopsie à l'aiguille. La voie d'accès percutanée périnéale s'est révélée satisfaisante dans ce but. Chez les malades dont la vie probable est d'au moins 10 ans, le cancer prostatique à sa phase initiale sera traité par une prostatectomie radicale. En présence de lésions plus avancées ou chez les malades dont la vie probable est inférieure à 10 ans, on peut se contenter de recourir à l'hormonothérapie.

EARLIER diagnosis may be one of the most obvious methods of improving the survival rate among patients with carcinoma of the prostate. This places much of the responsibility on the physician who has the opportunity of carrying out periodic physical examinations on patients who are in the cancer age group. It has been shown that such periodic examinations of the prostate, with appropriate additional investigation where indicated, are worth while.[1] Among males dying of cancer in Canada, carcinoma of the prostate is surpassed in frequency as a cause of death only by malignancy of the lung, stomach, and intestine. In 1963, male deaths from cancer in the various sites in order of frequency were: lung, 2829; stomach, 1861; intestine (excluding rectum), 1371; prostate, 1329. In about 30% of cases the tumour is discovered by routine physical examination for investigation of symptoms which are not genitourinary in origin. In Ontario in 1962, 405 men died of this disease,[2] and in the same period in the United States some 14,000 men died of carcinoma of the prostate.[3] There is no doubt that the involuting prostate becomes progressively more prone to carcinomatous degeneration. Postmortem studies

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