ultimately would occur and favors the production of bed sores. It obviates, too, the irregularities of catheterization which must creep in in the best conducted surroundings. Urethral drainage by no means answers the same purpose.

Now as to the laminectomy. We must not forget that unless the laminectomy is delicately carried out the performance itself may do additional damage to the cord. Rough methods of exposure are much to be decried—methods of the mallet and chisel type. Adherence to such methods is what makes operators so often speak of the "shock" of laminectomies. Shock, so-called, arises from the trauma and loss of blood incidental to rough procedures. A laminectomy should be quite a bloodless performance and unattended by jar. It, in the first place, should be a median operation, hugging the spines and laminæ, from which the periosteum should be scraped away with care.

After removal of the spines the method of entering the canal which I employ is one which I can highly recommend to others. Primary entry down to the posterior ligaments is made with a Doyen perforator through the stump of each of the individual amputated spines—five or six, as the case may be, and rarely can a proper exposure be made with less. The perforator is followed by the burr which reams away each spine in turn and much of its adjoining laminæ. The lateral bony projections which remain can then be easily nibbled off with delicate sharp-nosed rongeurs, and a broad exposure of the canal is obtained.

The yellow, elastic posterior ligament is then delicately scraped away, down to the dura, and this membrane should be opened without injuring the arachnoid. This is an important matter and one, I believe, that is rarely observed. With the dura open and the bulging arachnoid uninjured the best possible view of the cord is obtained through the thin, delicate, transparent membrane, which will often enlarge the structures as though they were seen through a magnifying glass. I am sure that the emphasis which is laid on the loss of cerebrospinal fluid as an incident to "shock" is without foundation. A patient is so apt to be upset by rough methods of entry at this stage of the operation that the upset is attributed to evacuation of fluid, rather than to the preceding rough manipulations. In all cases, needless to say, the wound should be completely closed without drainage.

DR. A. F. JONAS, Omaha: Unfortunately we are not all highly trained neurologic surgeons, as Dr. Cushing is; and usually we get very little aid from the neurologists. Most of us who do general surgery have but a limited knowledge of neurology as affecting these particular injuries.

I have formulated this plan for my own guidance: in all cases of doubt, open the spinal canal. The opening of the spinal canal itself is not difficult or dangerous, and I am sure that in none of the cases in which I have operated have I made the patients worse. The wound itself heals well, and I have never had trouble with it. It seems to me for the average surgeon doing accident work, who has not had the advantages of neurologic training, such as Dr. Cushing has had, it is best to open the spinal canal and determine the exact nature of the injury.

It is true that all patients with transverse lesions of the cord have died sooner or later; but in partial cord lesions I have had one recovery, and that is the case of the fracture of the laminæ of the fourth and fifth cervical vertebræ, in which the meninges were torn and there was a considerable accumulation of blood, and the cord lesion was evident on examination. I admit there can be no regeneration of the cord when it has been transversely destroyed. It was impossible in my cases to bring the cord ends together and suture them, because the cord was so soft and inelastic, even when there was only a limited destruction of the cord elements.

The patients who recovered were those in whom there was a blood-clot in or under the dura, and the cord was not involved. They might have recovered anyway; but I could not tell positively before operation that there was no cord injury. So I opened them and did no damage.

The patients in whom there was hemorrhage in the cord itself, died; and so far as I have been able to learn from the reported cases, all such patients sooner or later die.

THE PRESSOR ACTION OF AN AMERICAN MISTLETOE *

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A certain mystic and poetic significance is attached to the term mistletoe because of the use of a European mistletoe (*Viscum album*) in the religious ceremonies of the Druids and in those of the early Christian church.[1] Norse mythology associated it with the worship of Freya, the Norse Venus, while Ovid and Virgil attributed magical powers to it. A species of mistletoe was collected with religious ceremonies by the Persian magi.

European mistletoe (*Viscum album*) has been used in medicine from very early times, its use being referred to by Paulus Ægineta,[2] Pliny, Dioscorides, Celsus,[3] and by the Moslem physicians Avicenna[4] and Ebn Barthar, although the conditions for its use have never been accurately defined. In the Middle Ages it had a high reputation in the treatment of nervous disorders.[5] In the seventeenth century interest was aroused by Boyle's note on the cure of epilepsy by it.[6] Recently Deguy[7] claimed that *Viscum album* was very serviceable in the treatment of albuminuria, and Delassus and Gaultier[8] have used it with some success in the treatment of tuberculous hemoptysis.

The gummy material obtained from this and other related plants has been used for the catching of singing birds, and, therefore, called "birdlime." *Viscum album* has been studied chemically by Grandeau and Bouton,[9] mainly with reference to its nutritive value. It has also been examined by Reinsch,[10] who isolated a crude product called viscin and a substance, viscautschin, resembling caoutchouc. Viscin yields viscinic acid and viscin oil. It is soluble in benzin, but insoluble in water. Viscin has usually been considered the active principle of *Viscum album*, although Reinsch, who first obtained this product, made no test of its physiologic activity. More recently Pavlevsky[11] obtained from *Viscum album* a crystalline acid by treatment of the plant with nitric acid, but nothing is definitely known of it. Crude viscin has been recommended as a coating for enteric pills, as

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* From the Laboratory of Pharmacology, Leland Stanford Junior University, Cal. Much of this work was done in the United States Department of Agriculture, at Washington, D. C.

1. For symbolism concerning the mistletoe see Fraser, J. G.: Golden Bough, 2 ed., iii, 446; also a popular article on the mistletoe bough in the Eclectic Magazine, 1892, new series, lv, 116; Am. Med., 1904, viii, 1032; Hazlitt, W. C.: Faiths and Folklore, ii, 412; Knott, J.: The Mistletoe, N. Y. Med. Jour., 1908, lxxxviii, 1150. This gives a detailed historical sketch of the usage of mistletoe.

2. Paulus Ægineta: Seven Books, Transl. by F. Adams, iii, 141, 1847, New Sydenham Soc.

3. Celsus, A. C.: On Medicine, ii, 18, 19, 31, 110, 204, transl. by A. Lee, London, 1836.

4. Foy, G.: Mistletoe, Med. Press and Circular, 1887, p. 588; Am. Med., 1904, viii, 1032.

5. Mistletoe in Medicine, Bookworm, 1894, vii, 358; Howell, T. A. S.: Viscum album, Practitioner, 1882, xxviii, 22; Colbatch, J. A.: Dissertation concerning Mistletoe, n. d.

6. Boyle, R.: Usefulness of Experimental Natural Philosophy, Oxford, 1664, p. 175.

7. Deguy: Viscum album, Jour. d. Pract., 1901, xv, 393.

8. Delassus: De quelques préparations officinales du gui (Viscum album), Bull. gén. de thérap., 1907, cliv, 174. Gaultier, R.: Résultats cliniques et expér. de quelques études sur la valeur thérap. et physiol. du gui de chêne, Bull. gén. de. thérap., 1906, cli, 67, 88, 141.

9. Grandeau and Bouton: Etude chimique du gui (Viscum album Linn.), Compt. rend., Acad. d. sc., 1877, lxxxiv, 129, 500. Grandeau, L.: Recherches chim. sur le gui, Ann. de la stat. agronom. de l'Est., 1828, referred to by Ginleis and Ray (original not seen by the writer).

10. Reinsch, P.: Beitr. zur chem. Kennt. d. Weissen Mistel (Viscum album L), Neues Jahrb. f. Pharm., 1860, xiv.

11. Pavlevsky: Bull. Soc. chim. de Paris, 1880, n. s., xxxiv, 348

a substitute for caoutchouc in the preparation of plasters and as a dressing base in cutaneous diseases.[12]

Muntz[13] obtained galactose by treating the gummy material with acid, and Tanret found both inactive and racemic inosit in *Viscum album*.[14] Others, as Knop,[15] Councler,[16] and Erdmann,[17] have studied the European mistletoe (*Viscum album*) with reference to its ash content. These analyses show a greater percentage of magnesium with reference to calcium than is the rule in plants. Recently Le Prince[18] obtained from this plant a volatile base having the empirical formula $C_5H_{11}N$. This compound gave the pyrrol reaction with a pine chip. Le Prince made no tests as to the activity of this base. He also reports the presence of a glucosid and resinous body, but details concerning the two latter bodies are not yet available.

This mistletoe has been used in certain parts of France as an addition to the food of stock,[19] but its value remains to be determined. According to Heim, dogs fed with this plant show scarcely any symptoms.

The common mistletoe of the eastern part of the United States is *Phoradendron flavescens*.[20] It is at times popularly called "golden bough."[21] This plant is often confused by medical writers with *Viscum album*. Both plants are parasitic to various trees.[22] Laurent has suggested that the European species secretes a principle which is poisonous to its host.[23] In this country various species of mistletoe are causing considerable damage to trees and work is now being done to obviate this destruction.[24]

Some years ago interest was reawakened in the *Phoradendron flavescens* by the announcement that marked oxytocic powers could be attributed to it. It was claimed that it was active even when ergot failed.[25] This plant has been used to produce abortion by the negroes of the southern states, and also by the Indians of Mendocino County, California.[26] It was also once supposed to be useful as an aid to fecundity. The Kaffirs of South Africa believe their species of mistletoe to affect the secretion of the kidneys.[27] The Chimariko Indians of California are said to smoke an oak mistletoe as a substitute for tobacco,[28] while certain of the Arizona Indians use the *Phoradendron juniperinum* as a substitute for coffee.[29] Both the *Viscum album* and the *Phoradendron flavescens* are claimed to have the same medical action and have been used as substitutes for digitalis in cardiac therapy;[30] but perhaps this belief has arisen by the confusion of the two species. The Orientals, however, consider the mistletoe injurious to the heart.[31] Payne[32] studied the action of the fluid extract of *Phoradendron flavescens* on various lower animals, but failed to control these injections with a corresponding amount of alcohol, and his data were insufficient to justify any conclusions.

Both the European and American species are claimed at times to produce poisoning. The symptoms reported have been those of vomiting and purging, and collapse;[33] hallucinations and bounding pulse, stertorous respiration, rigid and dilated pupils. Certain of the Indians,[26] however, assert that it is merely mistletoes grown on certain trees which are poisonous, and Cornevin questions if the European species is really poisonous.[34]

The American plant has practically fallen into disuse as a medicine, but now considerable attention is being directed to the study of the European species. Some years ago I noted that if an aqueous or a fluid extract of American mistletoe (*Phoradendron flavescens*) was injected into the cardiac end of the saphenous vein of a narcotized dog, whose vagi nerves had been cut, there followed a temporary fall in blood-pressure, but this was succeeded by a sharp rise associated with a rapid heart-beat; this rise in the systemic blood-pressure was very persistent. If the vagi were not cut the rise was more gradual, and if atropin had been previously used, the injection of mistletoe caused no initial fall in such animals. But while the rise in blood-pressure resembled qualitatively that produced by epinephrin, extracts of mistletoe when applied to the conjunctiva failed to produce local vasoconstriction. Accompanying this rise of blood-pressure was an immediate increase of urinary secretion. This increase in urinary secretion could be determined by counting the drops as they fell from ureteral cannulæ. A short notice of this find appeared,[35] but this investigation has been sidetracked by other work.

Of the plants known as mistletoe in our western states, three were examined: *Razoumofskya americana*, *Phoradendron juniperinum*, and *Phoradendron villosum*.[36] Of these *Phoradendron juniperinum* alone

12. Vorner, H.: Ueber Viscinum depuratum, Deutsch. med. Wchnschr., 1903, xxix, 744. Riehl, G.: Ueber Viscin u. dessen therap. Verwendung, Deutsch. med. Wchnschr., 1900, xxvi, 653. Zumbusch, L.: Ueber Reindarstellung und Entfärbung des Viscins, Wien. klin. Wchnschr., 1903, xvi, 560. Loebell, W.: Verfahren z. Reinigung d. Rohviscins aus Ilexarten, Chem. Centralbl., 1906, lxxvii, 1150. Fendler, G.: Mistelkautschuk, Arb. a. d. Pharmazeut. Institut d. Universität, Berlin, 1906, iii, 287. Warburg, O.: Die Kautschukmisteln, Der Tropenpflanzer, 1905, ix, 633.

13. Muntz, A.: Sur l'existence des éléments du sucre de lait dans les plantes, Ann. de. chim. et de phys., 1887, series 6, x, 566.

14. Tanret, G.: Sur les inosites du gui, Compt. rend. Acad. d. sc., 1907, cxlv, 1196.

15. Knop, W.: Ueber d. unorgan. Bestandtheile d. Vegetabilien. Jour. f. prakt. Chem., 1846, xxxviii, 30.

16. Councler, C.: Aschenanalysen verschiedener Pflanzen und Pflanzentheile, Bot. Centralbl., 1889, xl, 129. Tubeuf, V.: Ueber Aschenanalysen von Viscum album, Bot. Centralbl., 1890, xli, 43, 80, 135.

17. Erdmann, C.: Ueber d. unorgan. Bestandtheile von Viscum album, Ann. d. Chem. u. Pharm., 1855, xciv, 254.

18. Le Prince, M.: Contribution a l'étude chimique du gui (Viscum album), Compt. rend. Acad. d. sc., 1907, cxlv, 940.

19. Giniesis and Ray: Essais sur la valeur alimentaire du gui, Bull. Soc. cent. de med. vét., 1905, lix, 355.

20. This plant was formerly named *Viscum flavescens*. See Rushby, H. H.: Phoradendron flavescens, Drug. Bull., 1889, iii, 254.

21. Nat. Stand. Dispensatory, 1907, p. 931.

22. Nobbe, F.: Ueber die Mistel, Thar. forstl. Jahrb., 1884, xxxiv, 1. Brackett, M. M.: The Mistletoe, Plant World, 1905, iii, 265.

23. Laurent, E.: Sur l'éxistence d'un principe toxique pour le poirier, dans les baies, les graines et les plantules du gui, Compt. rend. Acad. d. sc., 1901, cxxxi, 959.

24. Bray, W. L.: Mistletoe Pest in the Southwest, Bureau Plant Industry, Bull. 166, 1910, U. S. Dept. Agric.

25. Turnispeed, E. B.: Employment of the Mistletoe to Produce Abortion, Charleston Med. Jour. and Rev., 1851, vi, 448. Long, W. H.: Viscum album, (Mistletoe) as an Oxytocic, Louisville Med. News, 1878, v-vi, 132. Atlanta Med. and Surg. Jour., new series, 1888, iv, 197, 309. Baker, H. E.: Some Causes of Abortion, Oregon Agriculturist, 1902, xii, 155. Hobbs, A. G.: Mistletoe as an Oxytoxic, Louisville Med. News, 1878, v, 238. Crosier, E. S.: American Mistletoe, Louisville Med. News, 1878, v, 171.

26. Chestnut, V. K.: Plants used by the Indians of Mendocino County, Cal. Contrib. from U. S. Nat. Herbar., 1900-02, vii, 344.

27. Smith, A.: Contribution to the South African Materia Medica, 3 ed., p. 176.

28. Powers, S.: Tribes of California, Contrib. to North Am. Ethnol., 1877, iii, 93.

29. Hough, W.: Environmental Interrelations in Arizona, Am. Anthropol., 1898, ii, 142.

30. Wenzel, H. P.: Mistletoe, Tr. Wis. State Med. Soc., 1879, xiii, 231. Howard, H. P.: Mistletoe as an Oxytocic, Med. News, 1892, lx, 547. Gray, D. E.: Mistletoe as an Oxytocic, Southern Med. Rec., 1888, xviii, 253. Park, R.: Note on the Therapeutics of Viscum Album, Practitioner, 1881, xxvii, 346.

31. Ranking, G.: Mistletoe, Lancet, London, 1904, i, 756. Murrell, W., Payne and others: The Physiological Action and Therapeutic Uses of the Common Mistletoe, London Med. Rec., 1881, ix, 266.

32. Payne, R. L.: Mistletoe, North Carolina Med. Jour., 1881, vii, 253.

33. Buster, O. C.: Poisoning by Mistletoe (Viscum flavescens), Tex. Courier-Rec. of Med., 1887, v, 218; also Med. Times and Gaz., 1867, i, 26. Dixon, J.: Case of Poisoning by Berries of the Mistletoe, Brit. Med. Jour., 1874, i, 224. Dye, H.: Memphis Med. Recorder, 1855-56, iv, 344. North Car. Agric. Exp. Sta. Bull. No. 150, 1898.

34. Cornevin, C.: Des plantes vénéneuses, 1887, p. 164.

35. Am. Jour. Pharm., 1905, p. 493.

36. For notes concerning various mistletoes, see v. Tubeuf, C.: Ueber die Beziehungen zwischen unseren Misteln u. d. Thierwelt, Naturw. Ztschr. f. Forst- u. Landw., 1908, vi, 47; Ueber die Bedeutung v. Beerenfarbe u. Beerenschleim bei d. Mistel, Naturw. Ztschr. f. Forst- u. Landw., 1908, vi, 141. Vrolik, G.: Over eenige physiol. Eigenschappen von Viscum album, Verschlagen en Mededeel. d. koningkl. Akad. v. Wetenschappen, 1857, v, 263. Hough: Am. Anthropol., 1898, ii, 142. Barrows, D. H.: Ethnol. Botany of the Coahuilla Indians of Southern California, 1900, p. 80.

seemed to give the characteristic rise in blood-pressure.

In the case of the European species of mistletoe, *Viscum album*, Gaultier[37] found that the injection of extracts of this plant into the cardiac end of the vein of a dog, whose vagi were intact, was followed by acceleration of the heart-beat with a lowering of blood-pressure. Chevalier[38] traced this hypotensor action of mistletoe to saponin-like glucosids, but he did not isolate these bodies. Gaultier apparently makes no mention of any rise in blood-pressure, but he noted an increase in the urinary secretion. Doyon and Gaultier[39] have recently claimed that this extract interferes temporarily with the coagulability of the blood.

CHEMICAL EXPERIMENTS

The leaves and twigs of the *Phoradendron flavescens* were first used, but later it was found more convenient to start with the fluidextract of mistletoe such as is found on the market. All fresh fluid or aqueous extracts of the fresh *Phoradendron flavescens*, which were examined, produced this action, but some old ones were almost inactive. The fluid extract of mistletoe was bought from two of the large drug manufacturing firms of the country, in both of which botanical identifications are made. By starting with the fluidextract, the method of isolation of the active principle could thus be shortened.

At first lead acetate was used to precipitate various inert bodies. It was noted that, in removing the lead from the filtrate by hydrogen sulphid, the solutions lost their activity if this gas was passed into aqueous extracts of the plant, but not in the case of strong alcoholic solutions. As the use of lead did not simplify the problem, it was soon given up.

One hundred c.c. of the fluidextract of mistletoe were evaporated *in vacuo* to free from alcohol and the residue was then taken up in a little water. This solution (about 20 c.c.) was poured into a bottle of about 2 liters capacity and a quantity of ether poured on the fluid, and calcined magnesium oxid was gradually added in sufficient quantity to take up the water and free any base present. The bottle was shaken, preferably in a shaker, for about one hour, and filtered after five or six hours standing. Three such shakings extract practically all the ether-soluble pressor compounds. There was, however, some reason to believe that perhaps the mother fluid still contained a pressor body not shaken out by the ether. The ether, which had an amin odor, was filtered into a pear-shaped separatory funnel and a drop of concentrated hydrochloric acid added with a stirring rod. If there was merely a trace of water in the ether, clumps of beautiful crystalline needles would separate on the walls of the vessel. These crystals produced the intense and persistent rise in blood-pressure characteristic of the original extract. The amount of crystals obtained by means of hydrochloric acid was small and the yield was very uncertain, perhaps owing to the hygroscopic character of the hydrochlorid. The salt melted at about 250 C.

It was found that if, in place of hydrochloric acid, an ethereal solution of oxalic acid was used, a crystalline compound could be more easily obtained. On reprecipitation, these crystalline needles were usually perfectly white, although at times a third precipitation was necessary to remove all color.[40] If ordinary U. S. P. ether was used, these crystals gave an ash residue, but if the ether used for the extraction was first shaken with water to remove alcohol, and then distilled over calcium chlorid and sodium, the crystals obtained by this second shaking were practically ash-free and melted between 187-190 C. The oxalate was optically inactive. Some of the compound was apt to be lost in the second shaking with magnesium oxid and ether, so to avoid this only a minimum amount of water was used for solution and at first only small quantities of magnesium oxid were added, then the ether shaken vigorously and more magnesium oxid added, so as to take up all the water. Some experience is required to obtain a satisfactory yield.

Again, in isolating the base from the first oxalate, it was found necessary to use the purified ether, as the ordinary U. S. P. ether "shaking" yielded only a few crystals. The ethereal solution of the free base gave no precipitate with an ethereal solution of iodin, or of picric acid, or with carbonic acid, and the oxalate gave no precipitate with platinum chlorid. However, a platinum compound was obtained from the hydrochlorid.

On evaporating the ethereal solution of the base, freed from the colorless oxalate, a colored gummy material was left and this gave a colored solution with water, suggesting that the free base readily underwent oxydation.

Before analysis, the oxalate was shaken vigorously three times with anhydrous ether, so as to remove any attached oxalic acid and then the crystals were dried *in vacuo* over sulphuric acid. Of one sample of the second oxalate 0.1612 gm. were mixed with copper oxid and burnt. This amount yielded 0.3194 gm. CO_2 and 0.0858 gm. of H_2O, or C—54 per cent., H=5.95 per cent.

Of one lot made by precipitating three times with oxalic acid 0.0951 gm. gave 0.1889 gm. of CO_2 and 0.0549 gm. of H_2O, or C=54.1 per cent., H=6.4 per cent.

By the Dumas method and mixed with cuprous chlorid, 0.1504 gm. of one sample of the second oxalate gave 9.3 c.c. N at 21.8 C. and under 765.8 mm. barometric pressure, so that N=7.03 per cent., while .155 gm. of the second lot gave 9.75 c.c. N at 22 C. and under 763 mm. barometric pressure, therefore, N=7.15 per cent.

This would correspond to C 54 per cent., H 6.2, and N 7.09 per cent. The simplest percentage formula which would answer this requirement is $C_9H_{13}NO_4$. This would correspond to 4 oxygen atoms, so that only one oxalic acid group can be present. If we subtract the oxalic acid group, it would leave us $C_7H_{11}N$ as the probable formula. Hass[41] has shown that certain carbon compounds, when burnt by the copper-oxid method, do not yield the theoretical amount of CO_2, as some of the carbon passes off unabsorbed as methane. Under these circumstances the formula $C_7H_{11}N$ must be considered merely as provisional, at least until an analysis of the platinum-double salt can be made.

37. Gaultier, R.: Résultats cliniques et expér. de quelques études sur la valeur thérapeutique et physiologique du gui de chêne, Bull. gén. de thérap., 1906, cli, 67, 88; De l'hypertension passagère comme cong. tubere., vol. i, pt. 2, sect. ii, p. 821. Minola, G.: Sull' azione dell' estratto acquoso di Viscum album, Corriere Sanitario, 1908, xix, 66.

38. Chevalier, J.: Recherches pharmacologiques sur le gui, Bull. gén. de thérap., 1909, clv, 459.

39. Doyon and Gaultier, C.: Action de l'extrait de gui sur la coagulation du sang, Compt. rend. Soc. de biol., 1909, lxvii, 547, 719; Propriétés anticoagulantes du sang à la suite de l'injection intraveineuse d'extrait de gui, Compt. rend. hebd. Soc. de biol., 1909, lxvii, 567.

40. A control solution of ammonium chlorid was similarly shaken with MgO and ether. The white crystalline body which was precipitated from the ether by an ethereal solution of oxalic acid showed no change when heated to 205 C.

41. Hass, P.: Occurrence of Methane Among the Decomposition Products of Certain Nitrogenous Substances, Tr. Chem. Soc., London, 1906, xxxix, 570.

Barger and Dale[42] have recently shown that most of the activity of ergot is due to various amin bodies, primarily p-hydroxy-phenylethylamin, and Barger and Walpole have found that phenylethylamin is present in ergot in small quantities. This has been shown by Dale[43] to cause an epinephrin-like rise in blood-pressure. This rise resembles that obtained from the mistletoe base. Phenylethylamin has a percentage formula $C_8H_{11}N$.

As the mistletoe base gives the isonitrile reaction with caustic potash and chloroform a primary amin was indicated. These facts would suggest that perhaps the active principle might in reality be phenylethylamin, and that the carbon determinations were a trifle low, but phenylethylamin (Kahlbaum), when dissolved in ether and precipitated with oxalic acid, gave a body with C 64.6 per cent., H 7.3 per cent., and melted at 218 C. This would correspond to phenylethylamin monoxalate $[(C_8H_{11}N)_2C_2H_2O_4]$, and not to the dioxalate ($C_8H_{11}N.C_2H_2O_4$). The monoxalate demands 65 per cent. C and 7.5 per cent. H. Benzylamin was first suspected to be the pressor principle, but its oxalate ($C_7H_9N\ C_2H_2O_4$) melts at 175 C., that is, over 12° C. lower than the mistletoe oxalate. The fact that my analysis of the monoxalate of phenylethylamin by the copper oxid method gave a slightly lower percentage than the theoretical amount of carbon, would suggest that, perhaps, my carbon determinations are a trifle low and that the real percentage formula may prove to have the percentage composition $C_8H_{11}N$. So that at present, the data at hand is not sufficient to identify the active pressor principles of our southern mistletoes. Further chemical work will be done on this subject and the therapeutic possibilities discussed. The question whether this compound retains its activity when given by mouth with be investigated.

ABSTRACT OF DISCUSSION

DR. REID HUNT, Washington, D. C.: Do you consider the diuresis to be due to a direct effect on the kidney, or to result from the change in blood-pressure?

DR. A. C. CRAWFORD, Stanford University, Cal.: I have gone carefully over the early literature on ergot and have never seen any statement that there was a diuretic action associated with its use. I have not as yet analyzed physiologically the action of the mistletoe, but suspect that its diuretic action is secondary to that on the circulation; but cannot prove this at present.

HISTOLOGIC EXAMINATION OF THE FAUCIAL TONSILS WITH REFERENCE TO TUBERCULOSIS *

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The question of the relationship between the tonsils and tuberculosis is one that has been agitating the minds of pathologists and clinicians since Trautman in 1886 called attention to the possible connection.

It was not till 1895 that laboratory methods were brought to bear by Dieulafoy, who performed inoculation experiments on guinea-pigs and made the startling announcement that out of ninety-six pigs inoculated with bits of tonsil, fifteen showed tuberculosis. Later research has shown that these figures are not reliable.

The work has developed by rapid stages. Goodale in 1896 proved that minute particles of carmin could be absorbed quickly by the tonsil. Although bacteria are not so easily absorbed we have abundant proof that such absorption does take place. Dmochowitz and Wood have reported seeing the bacteria in the act of penetrating the tonsil.

The frequency of the presence of tubercle bacilli in the mouth varies enormously. In individuals in the later stages of tuberculosis of the lungs it has been shown that myriads of tubercle bacilli pass the tonsil in the sputum. Also the respired air carries tubercle germs in proportion to their presence in the atmosphere. Oral respiration favors infection from inspired air. It has been shown that air that has passed through the nasal cavities is remarkably free from bacteria. The next point that was conclusively shown is epoch-making in importance; it is that tubercle bacilli can be absorbed into the tonsils. All that is necessary is an ample dosage of sufficient virulence, without an injury to the tonsillar mucous membrane being necessary. Wood, in 1905, by experiments on hogs, which have considerable tonsillar tissue, was able to infect the tonsils and cause the formation in them of tubercles by simply swabbing on their surface virulent cultures of tubercle bacilli.

In this connection, the percentage of tonsils showing tubercles in patients suffering from tuberculosis is most interesting because we have in them the same conditions as in Dr. Wood's experiments. The percentage of such tonsils showing tubercles is so high that some men have even gone so far as to say that in all cases of tuberculosis of the lungs coming to autopsy the tonsils show tubercles.

It has thus been established fairly conclusively, by experimentation and actual pathologic observation, that the tonsils become infected with tubercle bacilli and that typical tubercles form within them. The infecting germs may be coming from within the body, in which case we have secondary tuberculosis of the tonsil, or they may enter the mouth with food or otherwise and find primary lodgment in the tonsil.

While it is conceded that tuberculosis of the tonsils is, as a rule, secondary to tuberculosis of the lung, and that primary infection of the tonsil is comparatively rare, a great deal of material has been collected in which diagnosis of primary tuberculosis of the tonsil has been made. The number of cases runs between 1,600 and 2,000 and the abundant material in the hands of different observers gives a percentage a little over 5. These figures are fairly well agreed on. The diagnosis in these cases has rested on inoculation experiments and histologic findings.

The next question is, What are the clinical earmarks by which we can look into the mouth and diagnose such an infected tonsil? Speaking as I am in this paper altogether of non-ulcerative processes, I might say that there are no signs by which the condition can be recognized. Some men have described particular features, but the majority of observers agree that there are no distinguishing signs. Danziger, for one, reports the careful examination of 100 tuberculous patients. A certain large percentage of such patients are said to have tuberculous tonsils. Danziger could recognize no points on which to make a diagnosis. When the course

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43. Barger, G., and Dale, H. H.: Chemical Structure and Sympathomimetic Action of Amins, Jour. Physiol., 1910, xli, 19.

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