

Bauer (L.)

ORIGINAL LECTURE ON **EUCALYPTOL;**

The Etherial Oil of the Leaves of *Eucalyptus Globulus*—Its
Uses in Medicine and Surgery.

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Eucalyptus Oil has been known and used as a remedial agent in Europe for the last fifteen years. Its high price has interfered with its general use, and even now, the same cause hinders its rapid introduction into practice. Like all powerful drugs, it has found its warm advocates and also its adversaries.

But since Eucalyptol has been recognized as a more reliable and agreeable, and at the same time less dangerous antiseptic than carbolic acid, and since Professor Lister has emphatically indorsed and adopted it, the interest of the profession in all relating to it has been commensurately increased.

My attention was first called to its therapeutic virtues by Professor Mosler, of Germany, and I then resolved to enter upon a course of experimental investigations. Unfortunately, I have been unable to find leisure for the elaboration of the subject, and, therefore, I have had to content myself with giving it a trial as opportunity offered. On the whole, I can but confirm the observations of Mosler and others, and must confess that I am most favorably impressed with the action of this drug.

Although I have failed to carry my original design into effect, I will do the next best, by acquainting you with results of the latest investigations into the subject in foreign lands.

Dr. Hugo Schultz* of the university of Bonn, in Prussia, has just published a pamphlet on "Eucalyptus Oil." He has not only collected the literature on the subject, but he has gone over the entire field with that thoroughness which is peculiar to the German mind. In addition, he has instituted numerous experiments to elucidate the action of this substance. By the aid of this literary auxiliary, I am enabled to render you cognizant of all which is thus far known about the subject.

The author devotes more time and space to the physico-chemical characters of the oil than we have

at our command on this occasion. We must refer those who wish to study the subject *ex fundemento* to the original work itself.

The impression prevails that the tree of *Eucalyptus globulus* gives protection against malaria. Prompted by this idea, the French government has commenced its cultivation in the south of France and in Algeria, and the Italian authorities have adopted similar measures to improve their swamp lands. Future observations will decide as to the hygienic virtues of this tree.

From a perusal of the literature of the subject, and taking merely the opinions of such writers as are favorably impressed with the therapeutic properties of Eucalyptus Oil, it would seem that it constitutes one of the most serviceable remedies in the physician's armory.

In the European markets several qualities of the oil are offered for sale, all more or less impure. Some of them had to be prepared for use by re-distillation. Cloez subjects the crude article first to the action of caustic potash and a solution of calcium chloride, and subsequently to distillation. The result is a colorless, transparent, oily fluid, with an aromatic odor. Its specific gravity is 0.905; it boils at 170 to 175° F. The substance thus prepared he called "Eucalyptol," by which term it is now generally known in Europe.

I am not aware that any brand of the article has been imported into the United States other than that of Sander & Sons, of Sandhurst, Australia. The Eucalyptus is indigenous to that part of the world, and grows there in great profusion. The article furnished by this firm, corresponds exactly in its chemico-physical properties to the Eucalyptol of Cloez, and it is this imporation that I have employed in my clinical tests.

With the view of ascertaining the physiological effects of Eucalyptol, Gimbert, Seitz, Siegan, Schultz, and others have taken ascending doses of the article; Schultz as much as ten grms. (= two and a-half fluid drachms) at one time.

*Das Eucalyptusöl pharmalogisch und klinisch dargestellt. Bonn: Cohn & Sohn, 1881.



Eucalyptol never interfered with digestion, excepting acting as an appetizer.* Only exceptionally it produced ephemeral nausea; soon after it was taken, a sensation of heat was experienced in the mouth, fauces, pharynx, and in the stomach, followed by dryness. A constant effect was a certain by no means disagreeable lassitude and irresistible drowsiness. The sleep following was quiet and refreshing, and susceptible of interruption. For hours afterwards the breath was redolent with the peculiar aromatic odor of the drug, and the urine had the odor of violets. No albuminuria was to be detected.

The concentrated alcoholic tincture of Eucalyptus leaves was taken by Seitz in drachm doses. It increased the temperature of the body, and eventually gave rise to slight perspiration. The head felt heavy and as if a band encircled it tightly. The secretion of mucus was augmented in the mouth and pharynx, followed by eructations and dryness. No derangement of digestion was noticed, nor was there any material increase in the secretion of urine.

The elimination of the oil is principally effected by the lungs and bowels; it may take several days before the Eucalyptol disappears from the breath or stools. The skin and kidneys are engaged only remotely in its removal from the body. Sometimes artificial heat must be applied before the violaceous odor becomes noticeable.

One case, however, is mentioned by Mees, in which albumen was discharged under the use of Eucalyptol in malaria. In this instance, albuminuria may have pre existed; and this symptom may be attributed more rationally to the disease than to the therapeutic agent employed.

Some experiments have been instituted with reference to the *external effects* of the oil. They all show that the drug produces an irritating action upon the healthy epidermis. The raw oil causes a burning sensation, erythema and blisters; the Eucalyptol produces no burning, only a slight reddening of the skin, and miliary eruption, which manifestations disappear very gradually.

Dr. Schultz noticed a consecutive effect for which he can offer no explanation, viz: Fourteen days after the termination of the cutaneous changes evoked by the oil, he observed upon himself a new erythema over the chest which recurred every evening, gradually spreading along the course of the lymphatics (like erysipelas), towards the back and down the inner aspect of the thighs, where it became fixed and covered with acneiform pustules. These singular phenomena died out by degrees in about four weeks.

*Eructations, however, followed, sometimes persisting for four hours.

The temperature under the action of Eucalyptol.
—Gimbert and Siegan claim that animal heat is reduced by this agent. This has been proven experimentally—by Siegan upon himself. Between 1:45 and 6 o'clock P. M., he took one hundred drops of the oil. The physiological rise of six-tenths of a degree (C.) not only did not occur, but there was a fall of two-tenths of a degree below the normal standard. The total reduction, therefore, amounted to eight-tenths of a degree. A second experiment exhibited a depression of six-tenths of a degree. According to Siegan, quinine falls short of Eucalyptol in this regard. These observations have been confirmed by Liebermeister* and Jurgensen** The former administered a dose of quinine of 2.4 grams (= 37 grains), producing all the collateral symptoms usual to the action of this drug, but no reduction of the temperature after seven hours. The latter observed no change in the bodily heat after the administration of 7.2 grams (= 111 grains) of quinine, given in solution within thirty-two hours. Wachsmuth† makes a similar statement. The comparative experiments, made by Schultz, upon six rabbits, are entirely confirmatory of those referred to; while the temperature was kept below the normal in three which had received subcutaneous injections of half a gram (= 7 or 8 drops) of Eucalyptol.

Effects of Eucalyptol upon the organic elements of the blood.—On exposing the blood of the frog to the vapors of Eucalyptol, the following changes are observed to take place under the microscope: Increasing clearness of the nuclei of the red corpuscles, radial folding of the protoplasm from the nucleus towards the periphery; gradually the cell elongates, when isolated, and assumes the shape of a rhombus; when grouped, they appear as if converted into endothelium. A small drop of Eucalyptol placed upon the edge of the slide destroys the corpuscles but leaves the nuclei.

Rabbit blood is darkened by Eucalyptol, and the corpuscles are rendered uneven (crenated) at their edges. The spectroscope reveals (1) a marked difference between the blood of cold, and warm-blooded animals. The blood of frogs poisoned by Eucalyptol, exhibits the stripes of oxyhæmoglobin, while the blood of mammals, mixed with a trifling amount of the same substance, soon turns dark and coagulates.

Schlaeger states that the action of Eucalyptol obliterates all apparent differences between arterial and venous blood; according to this observer, arterial blood immediately loses its bright color when shaken up with Eucalyptus oil. (2) The effects of Eucalyptol upon the white corpuscles are more

*Archive f. Klin. Med. 1875.

**Die Körperwärme, etc., Leipzig, 1878.

†Archiv d. Heilkunde, 1863.

prominent. Both Mees and Binz have obtained the same results in this regard. The former immediately annihilated the contractility of these cells by the addition of one-tenth of one per cent. of Eucalyptol, and in fifteen minutes, by one-fiftieth of one per cent. Artificial heat failed to revive them. In this particular, Eucalyptol produces the same effects upon the leucocytes as quinine.

Another very interesting experiment was made by Mees. He exposed the mesentery of a curarized frog to the vapor of Eucalyptol. The circulation remained normal. After twenty-four, and even forty-three hours, there was no inflammation, nor was there any collection of white blood-corpuscles upon the walls of the vessels, nor any emigration of them; whereas, all these pathological changes were observed in other frogs prepared in the same way except the exposure to the action of this agent. These observations have been fully verified by Binz. Consequently Eucalyptol possesses most valuable virtues as an anti-phlogistic and as a powerful restraint upon suppuration.

The action of Eucalyptol upon the spleen.—The analogy between the actions of Eucalyptol and quinine, has induced Mosler to test its efficacy in reducing the volume of the spleen. His anticipations were fully realized. In his experiments he made use of the extract of the leaves, by the mouth and subcutaneously. He selected dogs as subjects, opened the abdominal cavity and took accurate measurements. During these experiments, the spleens were measured every hour. In four of these tests, the results were proportionate to the amount of the drug employed. That is to say, the size of the organ decreased in all its dimensions, its substance became denser and firmer, the surface assumed a slate color and more or less covered with granulations, some of them as large as lentils. Mosler has elicited the same changes by the use of quinine in a similar manner. Other experiments have verified these observations.

Action of Eucalyptol upon the heart, blood-vessels and respiration.—Numerous experiments by Schlaeger clearly demonstrate that the action of the heart and the blood-pressure are diminished by Eucalyptol, not only in man and in the mammalia generally, but likewise in the amphibia. In a frog, for instance, the action of the heart was reduced by the subcutaneous injection of one centigram (1-6 of a grain), from 48 per minute, at 10:37 o'clock A. M., to 8 beats per minute, at 4 P. M.; respiration having come to a stand-still while the heart was still contracting 28 times to the minute. Its action upon the heart and lungs explains the conversion of arterial into venous blood under its use.

Action of Eucalyptol upon the nervous system.

—The general effects of this agent upon the nervous system are obviously depressing. It reacts upon the spinal cord when given in small quantities, and its action extends to the brain only when large doses are employed. Motor apathy and indisposition to mental efforts are the inseparable results of the large doses in man. In animals, the effects are still more pronounced. Paralysis of motion supervenes, the vital functions grow weaker, and death ensues from sheer exhaustion. Gimbert affirms that the mere inhalation of Eucalyptol vapors produced paralysis in certain of the lower animals. Grisar and Schultz have furnished the most striking proofs of its paralyzing effects upon the reflex centers of the nervous system, by their experiments with *brucine*, the alkaloid of the *St. Ignatius bean*. This substance causes tetanic spasms of all the voluntary muscles which terminate only in death when it is administered in comparatively small doses. But if Eucalyptol has previously been injected the *brucine* develops only slight manifestations, and the animals experimented upon recover their full motor powers. Introduced in this way, the two drugs antagonize each other. Since Eucalyptol is absorbed but slowly, it is probably not available as an antidote in *brucine poisoning*.

Eucalyptol in Pyæmia and Septicæmia.—In the present state of our knowledge, we have to assume that the presence of micro-organisms in the body is the essential cause of pathological increase of animal heat. In a way, not as yet fully understood, the micro-organisms prompt the body to peculiar reactive efforts. All the vital functions become excessive. Oxidation of tissues goes on rapidly, and the powers of life are rapidly consumed in the struggle to eliminate the noxious invaders.

The remedies administered for the purpose of arresting the excessive and dangerous oxidation, are known as antiseptics. The action of Eucalyptol places it in the front rank of this class of therapeutic agents; not only on account of its action upon the general system, reducing the intensity of all those functions which are excited in the progress of pyæmia and septicæmia, but still more by reason of its specific destructive effects upon micro-organisms.

The correctness of this proposition has been verified by appropriate experiments. Siegan has furnished the first proof in this regard. He injected thirty grammes (nearly an ounce) of pus in the circulation of a rabbit, and Eucalyptol in the same manner at the same time. There was no rise of temperature; on the contrary, while a rise of one and three-tenths degrees (C.) was observed in another rabbit, into which the same quantity of the same pus, without Eucalyptol, had

been injected. Similar results were obtained by the use of other morbid ferments, with and without Eucalyptol.

Mees and Schultz confirm the antifibrile action of Eucalyptol by their experiments with putrid materials. When Eucalyptol is brought into contact with organic substances, their normal organization remains unchanged, in spite of conditions favorable to decomposition being furnished. Muscular fibrille, after twenty days, exhibited their normal striations. Three hundred parts of blood with only one part of Eucalyptol added, remained unchanged for ten days; the same quantity without Eucalyptol was putrid and decomposed in the same time under otherwise the same conditions.

Mees experimented with cultivated bacteria and concluded that Eucalyptol occupies the highest position among antiseptics.

Schultz compared the action of Eucalyptol and carbolic acid upon fibrine mixed with distilled water. On the eighteenth day, that mixed with Eucalyptol was preserved in its normal condition, while the presence of carbolic acid had not prevented putrescent decomposition. The same author has kept a mixture of fibrine in an emulsion of Eucalyptol in his room for a year without noticeable change. A great number of experiments have been instituted by various authors, which we omit, inasmuch as they all confirm the demonstrations cited of the superior antiseptic virtues of Eucalyptol over phenol, quinine and other antiferments.

Therapeutic Availability of Eucalyptol.—All antiseptics have their special fields of usefulness, beyond which their action fails to be serviceable. Clinical observations demonstrate the benefits of Eucalyptol in infectious fevers, and in wounds and ulcerations with decay of organic structure. Its action upon the white blood corpuscles, indicates its power to restrain suppuration.

In the treatment of malarial fevers, Eucalyptol has already acquired a good reputation. While Professor Rosenstein prefers quinine in all recent cases, he admits its value in chronic forms—particularly in those which are known as “dumb ague,” and which are complicated with enlarged spleen. Other authors state that Eucalyptol has been of service in cases which quinine and arsenic had failed to relieve.

Diphtheria has been successfully treated by Professor Mosler, in which affection it acts both as an antiseptic and restrainer of suppuration.

French physicians speak well of Eucalyptol in various affections of the lungs, such as asthma, chronic catarrh, pulmonary gangrene, etc.; but we abstain from entering into further details because of lack of space.

If we succeed in engaging the attention of the American profession to such a degree as to secure for Eucalyptol a fair test of its virtues at the bedside we shall be amply repaid for our humble labors. The remedy must stand on its own merits. We should never have devoted our time to its commendation had we not ourselves derived good service from its use, and had not men spoken in its praise whose labors for scientific advancement entitle their utterances to the highest consideration. We conclude our discourse with a few suggestions as the form of its application and administration:

Eucalyptus Oil may be given in doses of from five to twenty drops, on sugar, or dissolved in alcohol, or in emulsion with gum arabic, syrup and water.

Externally it may be applied in substance with a camel's hair brush, or its vapor may be obtained by pouring it on a warm plate; in solution with alcohol; or in emulsion.

As an injection in gonorrhœa, Mr. W. W. Cheyne uses an emulsion made with one ounce each of Eucalyptol and gum arabic in thirty or forty ounces of water, the injection to be used four or five times daily (*vide* CLINICAL RECORD for September, 1880).

Mr. Lister uses Eucalyptol with Dammar gum in the preparation of his “antiseptic gauze,” and a solution of the oil with alcohol and water, in place of the old carbolized solutions, in the latest form of his “antiseptic dressing.” It has never induced any dangerous symptoms.

In bronchial and laryngeal affections, it may be used freely by inhalation, either alone or with the vapor of water.

In diphtheria and chronic pharyngeal catarrh, it may be used in the form of a spray, or applied directly to the fauces by means of a brush.

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