

VISCERAL CHANGES IN WOOD ALCOHOL POISONING BY INHALATION.

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PART I. THEORETICAL.

1. Introductory.

VERY few investigations have been made of harmful effects of inhalation of methyl alcohol—I am referring to the work of Eulenberg (1), Poincaré (2), Tyson and Schoenberg (3), and Loewy and Heide (4) and Mueller (5). Of these only Poincaré and Tyson and Schoenberg have studied the histo-pathological changes. But these results, although not numerous, leave no room for doubt as to the extremely dangerous effects of inhalation of wood alcohol. To quote Tyson and Schoenberg: "There exists a striking similarity between the effects of ingestion and the inhalation of wood alcohol."

The work of Loewy and Heide is of very great importance and interest as they were the first investigators to study the question of the relation of concentration of methyl alcohol in the air to its absorption.

2. Pharmacological and Chemical Data.

In comparing the effects of ethyl alcohol with those of methyl alcohol one is confronted with the fact that a single dose of the former is more poisonous than the same dose of the latter.

As pointed out by Harnack (6),

Fuehner (7) and others, the intensity of action (*Wirkungsintensität*) of equimolecular solutions increases with the increase of the number of atoms of carbon, as well as with the greater solvency for lipoid substances (Meyer Overton), and inversely as the surface tension of the solutions. (When, however, the number of carbon atoms reaches 7, *i. e.*, after heptyl alcohol is reached, these laws are no longer true since the higher alcohols, such for example as cetyl alcohol, are almost solid, insoluble in water and are as a rule non-absorbable.)

These investigators claim that ethyl alcohol, *i. e.*, its action, is from two to four times as strong as that of methyl alcohol in single doses,—for example, codeine (a methyl preparation of morphine) is much weaker than dionine (an ethyl preparation of the same alkaloid).

But Pohl (8) observed experimentally that while no bad effects followed immediately after the administration to an animal of a small dose of methyl alcohol, very serious results were noticeable a few days later, the experiment in many instances terminating fatally. If a small non-lethal dose be repeated a few times fatal issue occurs invariably, while ethyl alcohol, similarly administered, produces no such effects.

How are we to explain such paradoxical phenomenon? Why does a substance, non-lethal in a single dose, become lethal after a few repeated doses, and *vice versa*? The explanation as given by Pohl is as follows: Ethyl alcohol is very rapidly oxidized in the animal body, in fact so rapidly that over 90 per cent. of it is converted to carbon dioxide and water, whereas methyl alcohol is oxidized very slowly, with the formation of formaldehyde and then formic acid.

It is formic acid and its cumulative action that is responsible for the untoward effects of methyl alcohol, the

variability of individual results depending on the individual power of oxidation, the action of wood alcohol thus becoming especially dangerous in those who are ill nourished.

Placet (9) constructed the following table showing the difference in the elimination—that is, the rate of elimination of the two substances.

In other words, the complete elimination of wood alcohol requires five times as much time as that of ethyl alcohol, and we are dealing here with a cumulative action.

In rabbits the elimination of wood alcohol while faster than in dogs is

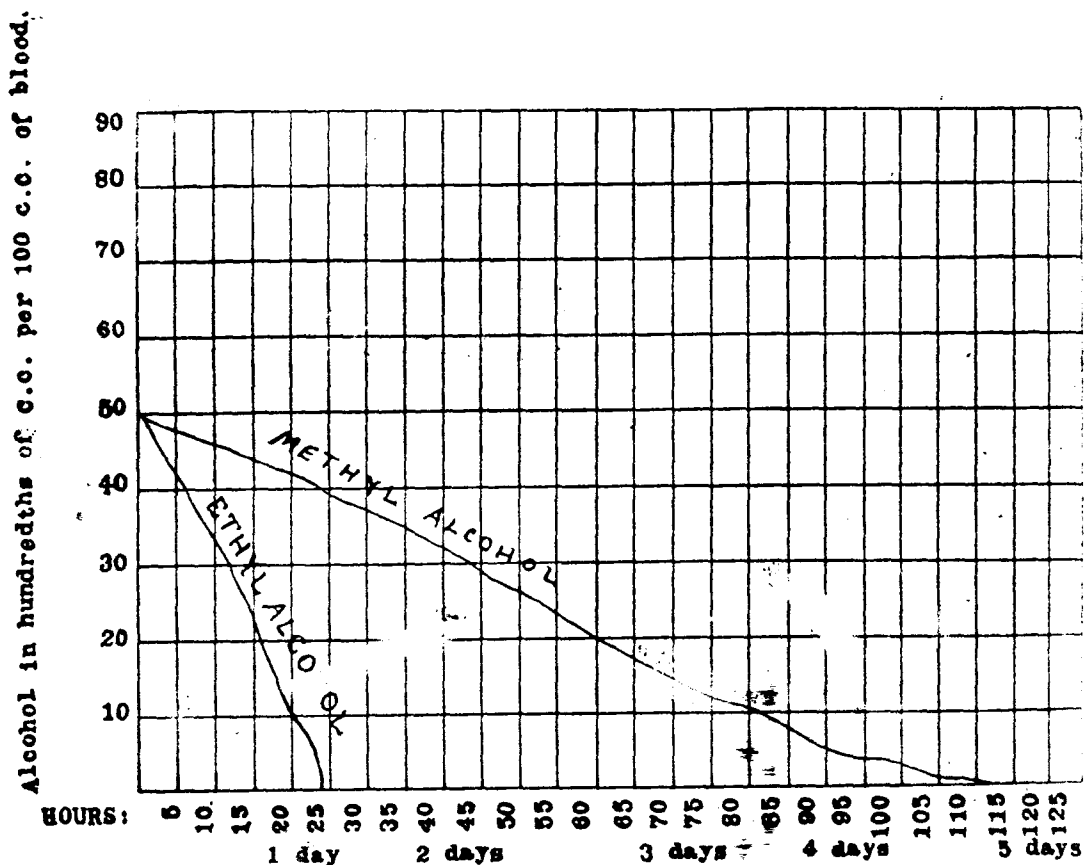


CHART 1.

The curves of elimination of ethyl and methyl alcohol after ingestion of 5 cc. of alcohol per kiloweight, in the form of a 10 per. cent solution. (Dog.)

