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terator buys the latter, ignorant that severe poisoning, blindness and often death lurk within it.

The pharmacology of this poison has been presented by Pohl<sup>1</sup> and Hunt,<sup>2</sup> and we would refer the reader to their original papers. The violation of the food law and the criminal aspects of our cases are being investigated by the proper authorities, and we shall merely record the findings in the six fatal cases, with points in diagnosis and treatment and methods for detecting the poison.

Similar but meager histories were obtained, and we were unable to determine the quantities of the poison taken. Four of the patients were admitted to St. Vincent's Hospital, one to Bellevue Hospital, and one patient died in his own home. All had taken whisky a short time previously, and all had complained of violent abdominal pains, incessant vomiting and extreme weakness. Three of the patients complained of blindness. Three of the St. Vincent's patients and the Bellevue patient came into the hospitals in coma; one (Case 1), who was admitted while conscious, said that he had taken whisky a short time before; soon thereafter he noted intense abdominal pain, vomiting, increasing weakness and dimness of vision; finally he collapsed in the street, and was brought to the hospital, where he died half an hour after admission. The patient had the appearance of being in a severe toxic condition or collapse. The important points in all the physical examinations were slow respirations, dilated pupils, weak and rapid heart action, cold and clammy extremities, and deep coma.

In Case 1, stomach washings were obtained, and also some of the liquor that he had drunk. Both were found to contain wood alcohol.

The examination of the urine during life in Case 2 revealed albumin and casts, and gave a Fehling reduction (aldehyd formation?).

The diagnostic features of the acute type of poisoning are extreme physical weakness, acute gastrointestinal symptoms, blindness, and deep and prolonged coma, ending in death with cardiac collapse. In the chronic type of cases, blindness is the chief symptom.

A differential diagnosis from epilepsy, and especially all types of coma—uremia, cardiac, diabetic, cerebral, toxic and traumatic—must be made. This frequently is very difficult; but if we bear in mind the important symptoms mentioned above, and obtain a history of whisky drinking, together with an alcoholic breath, we should be suspicious, at least to the extent that we are dealing with some form of alcohol poisoning.

The treatment, to be at all efficacious, must be promptly instituted, and consists essentially of ridding the body of the poison, and supportive measures. The poison is but slowly and incompletely oxidized in the body to more dangerous poisons, namely, formaldehyd and formic acid, and as such very slowly (for four to five days, and even longer) eliminated by the kidneys. Mayer<sup>3</sup> has demonstrated that the relative toxicity of formic acid is six times greater than that of wood alcohol. For a considerable period of time, the alcohol is excreted unchanged into the stomach and intestine (Bongers<sup>4</sup>), and it is therefore important that early and frequent gastric and rectal lavage be carried out. The stomach washings should be imme-

## FILE COPY

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The prohibition by our government of the manufacture of distilled liquors will unquestionably lead to much "moonshining," adulteration and dilutions of liquors offered to the public. That such is the case, even at this early period of the war, is quite evident from the recent poisoning in this city of over thirty persons, six of whom died, with a whisky sold in one of the poorer sections of the city that on analysis proved to contain a considerable amount of wood (methyl) alcohol. Believing that similar cases will occur and with increasing frequency, despite the vigilance of our revenue and state officers, we feel it timely again to warn physicians, coroners and health officers, in order that they may be on their guard in similar cases as prompt and efficient therapeutic measures must be instituted to hold any hope for recovery of the patient, and, furthermore, to detect any violations of the food laws.

It is our belief that the introduction into beverages of the dangerous poison, wood alcohol, is nearly always due to ignorance on the part of the blender. Many physicians and nearly all of the lay public are unacquainted with the chemical and physiologic differences between the relatively innocuous ethyl or grain alcohol and the dangerous methyl or wood alcohol when applied to the body or introduced into it. The refined wood alcohol tastes like ethyl alcohol, and, moreover, is considerably cheaper; hence the adul-

Methanol  
Brain  
Lungs

Odor

1. Pohl: Arch. f. exper. Path. u. Pharmacol., 21, 281.
2. Hunt: Bull. Johns Hopkins Hosp., 1902, 13.
3. Mayer: Arch. f. exper. Path. u. Pharmacol., 21, 122.
4. Bongers: Arch. f. exper. Path. u. Pharmacol., 33, 29.

parachymatous  
degeneration kidney  
Liver

Brain Odor 146, pH/m odor v Problem, 146

diately examined for wood alcohol. Intravenous saline or sodium bicarbonate infusions and phlebotomy and transfusions, if the latter can be had quickly, should be administered. In addition, warmth and strong stimulation with strychnin, digitalis, caffeine, camphor, epinephrin and oxygen must be given. It is said that ethyl alcohol is indicated to replace the methyl, and that it acts as a powerful stimulant; but we doubt this. For the treatment of the chronic form of poisoning, we refer the reader to the article by Buller and Wood,<sup>5</sup> who collected the histories of 275 American cases up to 1904, and to Birch-Hirschfeld,<sup>6</sup> who discusses the eye condition in considerable detail.

The postmortems in Cases 1 to 4 were performed by Dr. Otto H. Schultze, and in Cases 5 and 6 by Dr. A. V. St. George, in the presence of Dr. Benjamin Schwartz, coroner's physician. The gross anatomic diagnoses in all the cases were: marked cerebral congestion with increased cerebrospinal fluid; marked congestion of all the viscera, and acute pulmonary edema and congestion. In addition, in all cases except Case 2, only dark fluid blood was distributed throughout the heart and vessels. In Case 2 there was an aortic stenosis, and a soft red clot was present in the left heart. The brain in Cases 1 and 5 had a suspicious odor, not, however, distinctive of alcohol; no odor could be detected in the stomach or its contents. In

**Reduced Fuchsin Test.**—To 2 c.c. of each of the distillates (both oxidized and nonoxidized), 3 drops of (colorless) reduced fuchsin were added. A red color develops if an aldehyd is present. This test is not specific for formaldehyd, but is given by the aldehyd group in general.

**Casein Test.**—To 2 c.c. of each of the distillates, (both oxidized and nonoxidized), an equal amount of milk, then an equal volume of hydrochloric acid, and 2 drops of ferric chlorid are added. This is brought to a boil. If formaldehyd is present, a violet to red color develops. This test is specific for formaldehyd and is very delicate, detecting formaldehyd in dilutions of 1:250,000.

**Resorcin Test.**—To 2 c.c. of each of the distillates (both oxidized and nonoxidized), a few drops of 0.5 per cent. resorcin are added, and stratified on sulphuric acid. In the presence of formaldehyd a red ring develops. This test is specific for formaldehyd.

The brain in every one of the six cases was found to have methyl alcohol present. The tests before oxidation were negative, showing that no oxidation to aldehyd occurred in the brain.

In Case 5, blood and urine also were available. These were examined according to the method given; both the blood (490 c.c. of blood being used) and the urine (220 c.c.) showed methyl alcohol but no formaldehyd.

It is important to note that the refined wood alcohol, in addition to being used as a diluent of whisky, is frequently used in the preparation of essence of peppermint, Jamaica ginger, lemon extract, punch, cologne, liniments, Florida water, bay rum, witch hazel and in the arts in lacquers, varnishes, etc.

#### CONCLUSIONS

Physicians and health officers should warn the public of the dangers existing in the preparations of the kind enumerated above when applied to or introduced directly or by inhalation into the body. European authorities have shown that the denatured ethyl alcohol serves every purpose in medicine and in the arts as well as wood alcohol or better. We suggest, therefore, that legislation be enacted bringing about the prohibition of the sale of wood alcohol for domestic purposes, similar to laws now obtaining in England and Germany.

#### RESULTS OF TESTS

	Reduced Fuchsin Before After Oxidation	Casein Test Before After Oxidation	Resorcin Test Before After Oxidation
Case 1, brain....	— +	— +	— +
Case 1, lavage...	— +	— +	— +
Case 1, beverage...	— +	— +	— +
Case 2, brain....	— +	— +	— +
Case 3, brain....	— +	— +	— +
Case 4, brain....	— +	— +	— +
Case 5, brain....	— +	— +	— +
Case 5, urine 220 c.c.....	— +	— +	— +
Case 5, blood 490 c.c.....	— +	— +	— +

Case 6 there was, in addition, a chronic pulmonary tuberculosis. In Case 5 there was marked parenchymatous degeneration of the kidneys and liver. Microscopic section of heart, kidney and liver did not show an increased amount of fat. Pohl reported that he found an increase in the amount of fat in the liver. Sections of the optic, vagus and phrenic nerves show marked degeneration of these structures.

Parts of the brain in all of the six cases were examined chemically according to the method given below. We selected the brain tissue for the performance of our tests, because of the assumption that the poison has a selective action on nerve tissue, as is indirectly proved by the blindness and deep coma.

#### CHEMICAL ANALYSIS OF BRAIN

The sample was finely ground, and water was added to make a thin suspension; it was placed in a distillation flask; 3 drops of liquid petrolatum were added to prevent frothing; it was acidified with tartaric acid and distilled with steam. Thirty c.c. of the distillate were collected. Of this, 5 c.c. were placed in a test tube and oxidized by the plunging of a red hot copper spiral into it six or eight times. This oxidation is for the purpose of converting the methyl alcohol to formaldehyd.

The oxidized material as well as a little of the original distillate was tested by the following three methods:

5. Buller, Frank, and Wood, C. A.: Poisoning by Wood Alcohol, THE JOURNAL A. M. A., Oct. 1, 1904, p. 972; Oct. 8, 1904, p. 1058; Oct. 15, 1904, p. 1117; Oct. 22, 1904, p. 1213; Oct. 29, 1904, p. 1289.

6. Birch-Hirschfeld: Arch. f. Ophth. (von Graefe's), 54, 68.