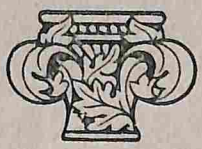
The Effects of Alcohol Upon The Bodies of Human Beings



BY
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PREFACE

In the preparation of this article, the writer recognizes the impossibility of quoting from all authorities. He has, therefore endeavored to select two of the best articles upon the subject written by thoroughly competent and conservative men. These articles are found in A System of Diet and Dietetics, edited by G. C. Sutherland, M. D., and in Osler's Modern Medicine, edited by William Osler, M. D. The writer has used the language of these writers in quotation largely in enumerating the effects of alcohol and in the statistics employed. The first quotation under each heading is from the System of Diet and Dietetics, marked 1, and the second from Osler's Modern Medicine, marked 2. Other writings and statistics have also been employed, which appear in the body of the paper. The writer does not claim to have exhausted the subject, but he has given what he believes to be the important points in the subject under discussion.

R. M. C.

Baltimore, Md., August 21, 1909.

THE EFFECTS OF ALCOHOL UPON THE BODIES OF HUMAN BEINGS

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Read before the Jefferson County Medical Association, Sept. 6, 1909.

PART I.

Introduction.

The wide difference of opinion among intelligent people as to the effects of alcoholic beverages when used in moderation and in excess and the almost universal ignorance as to the real facts and the universal error that is assumed as knowledge upon the subject and a sincere desire to set before his readers without bias or prejudice, the truth on this subject, as ascertained by the scientific method, is the object of the author of this paper.

The Scientific Method.

The aspiration of science is to learn the truth, the whole truth, and nothing but the truth. Its purposes are to discover the facts, explain the facts and to formulate the laws of their government. It makes investigations first and concludes after-

wards. It regards no previous or current opinion because of its authority, age, tradition or prestige. The investigation is approached with an open mind free from prejudice and bias, and uninfluenced by personal or commercial interests. It is not sectarian, partisan, or commercial in its nature. It is the one true democracy, recognizing but one autocrat, that of truth, and is the real aristocracy of intellect. Its field is all things in organic and inorganic nature, and the institutions of man. Its conclusions are certainties, probabilities and possibilities. It knows that many things are unknown and that some of them are unknowable. Its explanations are divided into what it knows is true, probably true and possibly true, and makes no effort at explaining the unexplainable. It traces all things from the last or outside fact to the remotest knowable fact beyond which it recognizes the Infinity, for whose omnipotence it stands the sponsor and advocate. To those who have faith in revelation, which is not science, this Infinity is the God of their revelation, which they accept through faith, not discovery.

Applying the scientific method to the subject under discussion, the purpose is to record the truth and what is probably true, with such deductions as logically follow.

The problem to be solved is the following:

1. What is alcohol, its origin, composition and intrinsic tendency?

2. What is its effect when taken into the human body in different quantities:

   (a) upon the functions of different organs and systems?

   (b) upon the protoplasm, cells, tissues and structure of these organs and systems?

3. What is the general result of its use to the life, health, potency, etc., of (a) the individual, and (b) his posterity?

In answering these questions, the following is the scientific method:

1. A study of the subjective and objective symptoms, that is, to say the modification of function following the ingestion of alcohol.

2. A study of the morbid anatomy, that is to say the disease changes in the structure of organs and systems by the unaided senses, the microscope and laboratory.

3. The compilation of statistics showing its effect upon mortality, health, disease, fecundity, heredity potency, etc.

Facts of Common Knowledge.

That alcoholic beverages, spirituous, vinous and malt liquors are found universally among civilized peoples; that these are articles of extensive industry, commerce and consumption; that a large majority of adult males and a considerable percentage of adult females, and in some countries children, use them; that some use them through a long life without apparent physical, mental, moral or economic injury; that others are affected periodically to a greater or less noticeable degree; that they are often the cause of accident and crime, and contribute largely to the delinquent, the dependent and defective classes.

Popular Errors.

That alcohol is purely a stimulent, without producing depressing or organic conditions; that it is a necessary and safe food; that it increases energy, strength and endurance; that it increases and maintains the temperature of the body; that it favors fecundity and procreation; that it is a constructive agency; that it is an important and essential medicine.

An Explanation.

At this time one of the live questions in Alabama is the liquor problem and its regulation. The method of its regulation is not discussed in this paper. It is not written for the purpose of influencing any man in his vote, but to enlighten him upon the subject of the use of alcoholic drinks as it may affect his body in health and disease. The writer has no other motive and has endeavored in this paper to record the truth, when known, as recognized today by an enlightened medical profession. To this end he has read a great deal upon the subject and can bring to bear upon it an experience of thirty-four years of active practice in his profession under circumstances that afford a good opportunity for personal investigation. He regards the whole question as one of science and should be studied by the scientific method. It is not a problem of theology other than that the influence of religion, growth in religious life, pious aspiration and religious environment all contribute in a scientific way to restraining evil on the one hand and to inspiring good on the other hand, and thus by the employment of the principles of environment and habit contribute to a reformation of conduct and in this way lead, in accordance with well-known scientific principles, to reformation of character. He emphasizes the fact that alcohol is a poison and alcoholism is a disease, and that it is not the effect of spiritual and moral depravity. The writer in discussing the question before the public has adopted this

method, and has found that, in the main, it is new doctrine, even to the most enlightened, including the leaders of the prohibition movement itself. He has been requested by many to prepare an article upon the subject in line with his public discussion. He has also been informed that some have quit the use of alcoholic beverages after hearing the discussion. If an apology is needed for this paper it is found in the last few lines. Up to this time he has not had the time, but at the present, while engaged in attending the clinics at the Johns Hopkins Hospital, he finds some hours daily at his disposal, and here in the library of that splendid institution and amid the environment of scientific study and method here employed, all dedicated to humanity, to man and not to money, this paper is written.

PART II.

Ethyl Alcohol.

Its History, Origin, Preparations and Intrinsic Tendency Upon Living Things.

Historical.

"The discovery of alcohol probably does not date further back than the time when man first began to cultivate the vegetable kingdom for food Certain it is that extant pre-agricultural peoples were ignorant of it until they came into touch with agricultural man; while, on the other hand, practically all the agriculturists—the redskins of America, the negroes of the vast continent of Africa, the inhabitants of the numerous islands scattered through the Pacific—have long brewed alcohol, a fact not, we think, generally known. * * * We have no means of guaging with precision the date in which agriculture arose; we shall probably not be far wrong in placing it some thirty thousand years back, i. e., about fifteen thousand years before the rise of the Egyptian civilization. * * * In any case, it is clear that man had come well within reach of the highest rung of a long evolution ladder before he learned to brew intoxicating liquors. * * * It was not until he had attained a civilized state, say 15,000 years ago, that chronic drunkenness was possible for him. * * * It is necessary to insist upon this point because alcohol could not have exerted any marked racial effect on man until he had the opportunity of becoming not merely occasionally, but continuously drunk." (1)

"From time immemorial man has used some substances to help increase the joys of life, or deaden the keen edge of sorrow. Alcohol in some form has probably been most extensively employed for these purposes, and whenever used it has been to excess. The monuments of the Egyptians show the use and abuse of wine; the oldest Chinese manuscripts contain records of drunkenness; and in the Vedas there are prayers to the Deity beseeching him to condescend to come and get drunk with the worshipers, that he might grant their request and bestow favors upon them which, when sober, he would refuse. The Old Testament contains records of its widespread use, of consequent drunkenness, and warnings against the evils which follow alcoholic excess. As civilization developed, man learned to make liquids containing a higher content of alcohol and the civilized races have taught the uncivilized to substitute the distilled for the weaker fermented liquids. Acute and chronic alcoholism have been from the unknowable past to the present day, and their occurrence has always been bound up in the routine of man's daily toil, in the expressions of his emotions and in the performance of his religious rites." (2)

From these quotations it appears that alcohol is coeval with civilization and has been a part of the life and doings of the people.

Origin.

Alcohol is the product of a biologic and not a chemical process. The preformed sugar of fruits and the starch of grain and other starch-containing vegetables, transformed by a prior ferment into glucose or grape sugar, is acted upon by a living organism known as the yeast germ, which is a living being. When the yeast germ is introduced into a solution containing these sugars, under favorable circumstances it immediately begins to feed upon the sugar and to multiply its species. The process is known as fermentation. The products are carbonic acid gas, which goes off in the air, unless confined, and alcohol, which remains in solution. From this solution it is obtained by distillation.

Chemical Constitution.

It is composed of the elements carbon, oxygen and hydrogen, in accordance with the following formula, C_2H_5HO.

Its Intrinsic Tendency Toward Living Things.

The following observations have been made:

1. That when alcohol has been formed in the fermenting solution to the extent of about 14 per cent, that fermentation ceases; it has also been observed that when alcohol was added to the fermenting liquid in sufficient quantity that fermentation ceased; it has been further observed that alcohol added in suf-

ficient quantities before fermentation, prevented that process. In all of these experiments it was found that the yeast germ was dead, destroyed by the alcohol.

2. It has been observed that when dead organic matter is put into alcohol, that putrefaction does not occur, and also that after putrefaction had set in, that alcohol would arrest it. In both of these experiments the saphrophytes of putrefaction which are living organisms, were dead, destroyed by alcohol.

It appears, therefore, that the intrinsic natural tendency of alcohol is to destroy living things.

Preparations.

Alcohol U. S. P.	92 per cent
Alcohol absolute	99 per cent
Alcohol dilute	41 per cent
Rectified spirits B. S.	85-.65 per cent

Alcoholic Beverages.

Whiskies contain	44 to 50 per cent alcohol
Brandies	39 to 47 per cent alcohol
Red and white wine	7 to 12 per cent alcohol
Sherry wine	16 per cent alcohol
Port wine	15 to 20 per cent alcohol
Champagne	8 to 14 per cent alcohol
Beers	4 to 10 per cent alcohol

Whiskies, brandies, wines and beers contain various other solid, spirituous and volatile matters. Whiskies and brandies are obtained by distillation.

The Effects of Alcohol Upon Function.

This is a study of the symptoms that follow the ingestion of alcohol. These symptoms depend upon many circumstances—the amount taken in a given time, the physical condition of the partaker, the degree of his tolerance, his natural temperament, habits, occupation, culture, social condition, heredity, etc. The amount may be small, large or great. Its use may be classified as moderate, immoderate and excessive. The time covered may be long or short. The intensity of the symptoms may be from a mere facial blush to the most profound symptoms of intoxication—loss of will, hallucinations, delirium, convulsions, paralysis, coma, heart failure, suppression of urine, etc., and death. It follows, therefore, that each case is a study within itself. A classification is difficult, but certain generalizations can be made and which apply to a

greater or lesser degree to all. It must be remembered that the quantity may be so small as to produce no subjective or objective symptoms whatever. It must further be remembered that the quantity that would be nil in one would be moderately effective in another, and what would be moderate in one would be immoderate in another. As to what these amounts are, measured in ounces or glasses, there is no fixed standard. Therefore, in studying the symptoms it is presupposed that a sufficient amount has been taken in a given time to produce symptoms.

In studying these, the following order will be observed:

1. The cardio-vascular system; (heart and blood vessels).
2. Cerebro-spinal symptoms; (brain and nerves).
3. Digestive system;
3. Urinary system;
5. Respiration;
6. Temperature;
7. Muscular system.

1. Cardio-vascular system.

"On entering the stomach alcohol causes the gastric blood vessels to dilate. Absorption is rapid, the maximum amount being present in the blood about 15 minutes after ingestion. Once in the blood, alcohol produces a dilation of the cutaneous arterioles, thus diverting a large quantity of blood to the surface of the body and giving rise to a feeling of warmth. This is especially noticeable in the hands and feet, should these have been cold previously. In some alcohol is liable to cause flushing of the face, and, if freely indulged in, it may in such subjects lead to a permanent dilation of the vessels of the cheeks and nose, at the same time predisposing to acne roseacea. The latter affection, however, it should in justice be observed, is not infrequently met with in the strictly temperate, just as, contrariwise, inveterate drinkers may retain pale faces. Large doses of alcohol paralyze the heart. Small doses may cause an increased frequency of the beat, in part reflexly by stimulating the gastric mucous membrane, and in part, perhaps, by acting directly upon the nerves and muscles of the heart itself. Alcohol can hardly, however, be said to be a genuine cardiac stimulant under normal conditions, though in fainting and in debilitated states of the body it may act as that." (1)

"After the ingestion of ethyl alcohol, the first action produced, aside from that on the mucous membrane of the mouth and stomach, is the flushing of the face and skin. This often follows small doses, which show no other effect upon the circulation. Sometimes a slight swelling of the hands and face accompanies this flushing. This may be due to a beginning paralysis of

peripheral capillaries without altering the blood pressure and without any stimulation or depression of the heart's action. The pulse rate is not altered after moderate doses, and an increase does not occur until doses sufficiently large to cause a fall in the blood pressure have been given. It has been long noticed, however, that a change in the character of the pulse does occur and it feels fuller and stronger after a moderate dose of alcohol. * * * Large toxic doses of alcohol gradually lower the reflex excitability of the vaso-constrictor centres, dilating the arteries and capillaries of the sphlanchnic and peripheral areas, lowering the blood pressure and acting directly on the heart muscles as a powerful depressant, weakening first the auricular and then the ventricular systole, causing more or less distension of both cavities and gradual diminution in the output of blood. The action of alcohol, therefore, on the circulation after moderate doses is a change in the distribution of the blood and perhaps an increase in the power of the heart's action, without increasing the pulse frequency. In large doses it paralyzes both the control of the vessels and the heart muscle." (2)

2. Cerebro-Spinal Symptoms.

* * * "Thus we find that alcohol very early affects the mental activities. When the supreme psychic centres are in unrestrained activity, the emotional nature is under fullest control and least apt to dominate thought and action; then it is that mental vision is clearest, judgment keenest. Alcohol, by weakening the sway of the higher centres and allowing the emotional nature to assert itself, blurs the judgment. When a man indulges in it, his ideas flow more readily, his tongue is loosened, and there may be a show of brilliancy, but it is a brilliancy of the spurious and superficial kind, appraised at its true value by severely sober companions and often by his own cooler judgment the following day. The successful man of business does not act on judgments formed under the influence of the convivial glass, but is careful to check them subsequently by the cold, clear light of undrugged reason. The alcoholized individual is apt to form an exaggerated estimate of his own powers, and on this account we must not too readily accept the opinion of people as to the effect of alcohol upon their working capacity. They may be under the impression that alcohol increases their capacity for muscle and brain work, when all the time it is actually having the opposite effect. It is largely because alcohol relaxes the control over the emotions that its so-called stimulant action is due. If we define a stimulant as that which unlocks pent-up energy and renders it available for use, then alcohol may be said to act as a stimulant, when it arouses the combative instinct and incites to acts of violence; but it should be noticed that in this case the liberated energy is misdirected—not turned to

the vaso-constrictors, or, as Meltzer believes, to a stimulation of the vaso-dilators, or of some inhibitory function acting on the vasomotor centre and inhibiting its tonus. In either of these last two cases it would be a stimulation, and not a paralysis of a normal function. Most observers find that moderate doses dilate the useful account—and being, moreover, followed by a period of reaction, we have scarcely here to do with a genuine instance of stimulation. It is now, indeed, generally admitted that the action of alcohol is sedative and narcotic rather than stimulant. * * * True, alcohol by weakening restraint allows many potential characteristics to reveal themselves, but if the real man is to be estimated by all his psychic potentialities, by all the emotions, thoughts and acts of which he is capable under drug influence, then surely none of us will see salvation. Rather should we take the measure of the man when his will has undisputed sway and when the baser part of him slumbers in the depths of his own conscious being." * * * (1)

"The action of alcohol on the brain is still the subject of dispute. Binns holds that alcohol first stimulates and then depresses; Schmiedeberg, Bunge, and others that the apparent stimulation of alcohol is a paralysis of the higher functions, and that alcohol depresses from the beginning. Kraepelin claims to have proven from his experience that in the early stage of its action alcohol truly stimulates the motor functions of the brain, but that all reaction requiring nicety of judgment is dulled by even small doses. Kraepelin has also shown that small doses diminish the accuracy and ability to add numbers or to learn numbers by heart. Smith has shown that this is especially noticeable when small doses of alcohol are taken daily, and that when the alcohol is cut off the ability to add and to memorize immediately returns. It is also noticeable that the tendency to erroneous judgments in increased. The subjects experimented upon believing that they had performed their reactions better under alcohol, when, as a matter of fact, the reactions were diminished in accuracy and rapidity. Alcohol in moderate doses does not increase the quantity or vigor of mental processes, and the flow of ideas with the feeling of mental richness is due to the removal of normal inhibitions. Alcohol clearly tends to lessen the power of clear and consecutive reasoning and decidedly lowers the acuteness of the senses. After large doses the judgment is lost, the powers of self-control and will are in abeyance, all idea of proportion is gone, the sense of responsibility and of restraining impulse is destroyed, and finally, the motor power for speech and motion disappears and torpor and coma supervene. The result of continued action of large doses is the permanent loss of these mental functions and the chronic alcoholic becomes an irresponsible animal." (2)

Digestive System.

"But whatever view may be held as to the effect on digestion of a moderate quantity of sound alcoholic drink, it is certain that when taken immoderately, or in impure forms, alcohol leads in course of time to degenerative changes in the whole of the alimentary tract. Most conspicuous among these is catarrh of the mucous lining. This leads to excessive outpouring of mucous and to a gradual atrophy of the epithelium with concomitant fibrosis." (1)

"Moderate doses of alcohol taken not too frequently would seem as the sum total of their action to favor an increase in the digestive process, but after repeated consumption, the digestive processes are perverted and diminished." (2)

The Urinary System.

Moderate doses of alcohol increase the secretion of urine in which there are a number of foreign matters, and which denote, as Welch says, a mild inflammation.

Respiration.

Alcohol exercises no particular influence on respiration except to diminish its frequency and to create stertorous breathing when taken in excessive quantities.

Temperature.

"The consumption of alcohol leads to an increase in the production of heat, which, however, is met by a corresponding, or even greater, heat loss; it may possibly furnish energy for muscular contraction, but, on the other hand, it diminishes the capacity for sustained muscular work." (1)

"As to whether alcohol is a source of heat when oxidized, Atwater found in his experiments, the heat given off from the body was equivalent to the potential energy of the material oxidized. This was as true in the experiments in which alcohol made part of the diet as in those with ordinary food." (2)

Muscular System.

"It has been proved incontestably that while the taking of alcohol may doubtless by its action on the nervous system lead to a temporary spurt in muscular activity, it reduces the total daily output of work, and the fact is so well recognized by employers of labor that when it is urgently necessary to get the maximum of work out of their men, they do their best to keep alcohol from them. Sir Frederick Treves says: 'As a work producer alcohol is exceedingly extravagant, and like all other extravagant measures, leads to physical bankruptcy. It is also curious that troops cannot work or march on alcohol. It was in the relief column that moved on Ladysmith, and of course it was an exceedingly trying time on account of the hot weather. In that enormous column of 30,000, the first who dropped out were not the tall men, or the short men, or the big men, or the little men—they were the drinkers, and they dropped out as clearly as if they had been labeled with a big letter on their backs.'" (1)

"General observation and the results of practical tests on a large scale show such beverages to be of doubtful value or even harmful. Alcohol apparently increases the power of fatigued muscles, although it does not restore to them the same amount of power as they possessed before they were fatigued, and this restoration of power is only temporary and of short duration. It also lessens the sensation of fatigue, acting in some measure through the nervous system. To non-fatigued muscles it gives only a temporary increase in the work done. Alcohol will thus enable a brief spurt to be made, but it will not give sustained muscular power and is followed by a depression of energy to below the normal." (2)

Summary of Symptoms.

To sum up, it appears that moderate doses of alcohol dilate the blood vessels, increase the strength of the heart's action, enlarge the size of the pulse without raising the blood pressure, and that in larger doses it acts as a depressor upon the cardio-vascular system, which may be carried to such an extent as to result in death; that its effects upon the brain is to produce a feeling of exhilaration and well-being, followed by more or less lassitude and depression; that it stimulates the emotional centres and inhibits the thinking and reasoning faculties and excites them to activity in baser passions, and if carried to too great an extent will produce convulsions, coma and death; that it moderately stimulates the digestive system, causing an increase in the secretion of saliva and the gastric juices, but inhibits the digestive ferments in the processes of digestion, and may lead to inflammation of the mucous lining of the stomach and to the absorption into the stomach and intestines of other elaborated noxious poisons; that it effects the kidneys by an increased quantity of urine and the presence of foreign bodies and altered proportion of the nitrogen excretion and may produce a sub-acute or active inflammation; that the respiration is indifferently effected, but possibly moderately stimulated at the beginning, to be followed by slowing and stertorous breathing in large doses; that the temperature of the body is not increased, but on

the contrary reduced, the dilatation of the blood vessels facilitating the elimination of heat, and the sensation of warmth after takintg alcohol is sensory and not actual, as the temperature frequently falls one or more degrees; that fatigued muscles may be temporarily excited into more vigorous action, but after the action, they are more fatigued than before, and that normal muscles may be capable for a short time of increased action, but that this action is not sustained, and upon the whole muscular power is reduced.

The above discussion of the effects of alcohol relates entirely to the symptoms produced and does not presuppose the presence of organic lesions. After excessive doses, or long-continued use of alcohol, the various organic lesions appear, which are diseases within themselves, and therefore present their own symptoms and signs. No attempt will be made to discuss these symptoms and signs in this paper.

2. Effect Upon Protoplasm, Cells, Tissues and Structures.

This has reference to organic change in the organs themselves. By organic change is meant a change of structure in its constitution, relation, position, etc. Pain in the eye would be functional and subjective. A hole punctured in the eye would be an organic lesion. The organic lesions produced by alcohol, except in certain acute cases of alcoholism, are the result of the long continued use of alcohol in immoderate quantities. The lesions, therefore, as a rule, are of a degenerative nature.

Degeneration from Chronic Alcoholism.

"The most characteristic degenerative changes met with in chronic alcoholism are fatty change and atrophy of the parenchyma with a corresponding increment of connective tissue. These changes, as might be expected, are generally most pronounced in the alimentary tract and in the liver, but no tissue is exempt from them. Their distribution varies in different subjects—sometimes the liver is most affected, sometimes the nervous system, sometimes it is the cardio-vascular system—a fact which lends support to the view that the changes in question are produced not by the direct action of the alcohol only, but by the indigestion toxemia which it sets up, the nature of this toxemia differing, as we may suppose, in different subjects. The liver in the chronic alcoholic tends, in the first instance, to become congested. Later fibrosis occurs, together with fatty degeneration of the liver cells, though it is doubtful whether fibrosis, culminating in hobnail liver, is so characteristically associated with deep potations as has been generally thought. The heart of the alcoholic tends to undergo

a fatty degeneration and frequently exhibits fibroid change. It has also been definitely shown that excessive drinking favors arteriosclerosis. While chronic alcoholism predisposes the kidneys in common with all other organs and tissues, to inflammatory infections, it cannot be regarded as more than a subsidiary factor in the causation of granular kidney. The nervous system is peculiarly susceptible to the action of alcohol, and tends in the inebriate to degenerate throughout its entire extent. The changes may be acute, as in peripheral neuritis, or as more frequently happens, chronic. In the latter case, the neurons atrophy, their place being taken by fibrous tissue. One of the first changes observable in the body of the neurons is a diminution in the number of dentrites, and this interferes not only with the more organic aspect of neural function, such as muscular co-ordination and vaso-motor action, but with the proper association of ideas on which memory, judgment and all the higher operations of the mind attend. These dendritic changes are accompanied and followed by changes in the body of the neuron; the nucleus travels toward the periphery, the protoplasm ceases to take up stains in the normal way, and finally the whole cell shrinks, becoming the mere ghost of its former self. In addition to these parenchymatous changes, an abundant fibrosis occurs throughout the brain and spinal chord, while an inflammatory thickening of the meninges, especially those of the brain, is often met with." (1)

"Since Anstie classed alcohol as a nervous disease, it has been generally so considered. * * * All the viscera are affected by chronic alcoholism, the cerebral symptoms dominating only because of the special function of the brain. Death from acute poisoning by alcohol is rare and usually follows large doses in those unaccustomed to its use. * * * In studying the lesions of chronic alcoholism, one is forcibly struck by the great variations in their intensity in the various organs of different individuals In one person the brain may show the greatest change, and in another the heart and arteries seem chiefly affected; in others it may be the liver or the kidneys which seem to have borne the brunt of the toxic action. * * * In the heart, we find lesions resulting from direct poisoning and from associated conditions. Fatty degeneration of the muscle is the most common lesion; brown atrophy combined with fatty degeneration is the second most common; brown atrophy alone the third, and fibroid myocarditis the fourth. The most common conditions found in the lungs are oedema, congestion and the various forms of pneumonia. It is also very common to find tuberculosis in various stages. The liver has always been considered as especially prone to show changes from chronic alcoholic poisoning, with fatty degeneration and cirrhosis as the two special forms of degeneration. The enlarged cirrhotic liver seems to

be the most frequent, and the true biliary cirrhosis the less frequent. In the spleen chronic congestion and fibrosis are the most common pathological conditions. It has been frequently demonstrated, as Welch points out, that the urine, even after a single alcoholic excess, often contains abnormal elements indicative of transient irritation or of slight inflammation. The stomach shows various forms of gastritis; chronic gastritis is one of the commonest lesions. It has long been recognized that alcohol has a special affinity for the highest nervous centres and especially on those coming more into the clinical aspect of the disease. The lesions in the central nervous system seem to be brought about either from the degeneration of the cerebral arteries or from the direct action of alcohol on the nerve cells. Oedema and congestion of the membranes are usually present. Congestion of the cerebral tissues was found in 54 per cent of the men and in 14 per cent of the women. Adhesions of the dura to the skull, with increase on the pachyonion bodies, are common, and very frequently there is thickening, opacity, and adhesions of the pia. Chronic meningitis was observed in 65 per cent of the men and 41 per cent of the women, and combined with this, atrophy of the convolutions is found in 31 per cent of the men and in 41 per cent of the women. Microscopical examination of the cerebral tissues shows an intense degree of artheromatous degeneration of the minute vessels, which are often enlarged, tortuous and unevenly distended, usually by fusiform dilitations, and their tissues covered with nuclear proliferations." (2)

Summary.

It appears that chronic alcoholism manifests itself by various organic lesions found throughout the body. These organic lesions are of a degenerative type, which means a deterioration and transformation of the normal protoplasm of the cells into some form of degeneration. There is but one tissue in the body that undergoes proliferation or growth under the influence of alcohol and that is the connective tissue, which is the structure that connects together the cells, tissues, organs and systems of organs of the body. This tissue undergoes an increased growth from the direct effect of alcohol and in this way leads to an overgrowth of the tissue in the various organs of the body. A characteristic of this tissue, after its new growth, is to contract, and in this way it hardens the organs of the body, e. g., the heart, liver, kidneys, arteries etc., and in this way presses upon the cells of the organs and causes their atrophy and degeneration. This tissue often takes the place of normal cells, producing fibrosis in the structures. A brief review of the lesions set forth above will convince anyone that alcohol stands in a

causative relation to disease second to no cause of disease. A recognition by the lay public of these extensive and great variety of organic lesions, and which are in the main incurable, and which as a rule progress to a fatal result, would undoubtedly awaken in them a new and vital interest in the whole subject of alcoholic beverages, and it is to be hoped that individuals among the public accustomed to excessive or habitual drinking will recognize the fact that these lesions may be insidiously forming and will have become firmly established before some prominent symptom, such as hemorrhage in the brain, a convulsion, or suppression of urine may announce their existence.

3. Statistical Evidence.

(a) On life. It is a difficult problem to determine statistically the average longevity of abstainers and non-abstainers of alcoholic beverages. For such statistics to be effective the habit of drinking should be the only difference in the two clases. In a general way this is established among the insurables, and I quote the following: "An eminent physician, many years medical adviser to an insurance company, assures us that at its offices the greatest care is taken not to accept the lives of any non-abstainers, but the most severely temperate, and that in spite of this the mortality of the total abstainers is found to be considerably below that of the temperate drinkers. This shows that what is regarded as strictly temperate drinking tends to shorten life. But it gives us no indication of what constitutes the harmless maximum for the average individual." (1)

It is also known that the use of alcohol invites disease, and greatly diminishes the resistance upon the part of the person attacked.

"It has long been observed that intemperance renders the tissues vulnerable to disease, that in the sot wounds are apt to fester, that he is not only more liable than his temperate brother to contract pneumonia, but to die if he does contract it. Such facts as these we now explain by saying that alcohol when taken in excess weakens the natural defenses of the body against certain bacteria. This is now known to be true of a large number of microbic affections, foremost among which is tuberculosis." (1)

"That alcoholism reduces the resistance to infectious diseases has long been known and is generally recognized. This increased liability to disease is undoubtedly true in the temperate and northern climates. In the temperate zones an attack of infectious disease in a chronic alcoholic is exceedingly prone to cause delirium tremens and the prognosis under these circumstances is

always grave. In Bellevue Hospital, New York, in 1904, there were 1,001 patients with lobar pneumonia; of these 667 gave a history of alcoholism. Among these the mortality was 50 per cent, and among the non-alcoholics 23 per cent." (2)

It is a fair conclusion, then, that the use of alcoholic beverages shortens life. First, by the tragedies of the habit, accident, murder, etc., and second, by the direct poison of acute alcoholism, and third, by the development of degenerative diseases, and fourth, by predisposing to acute diseases and a diminished power of resistance.

(b) Potency. It must be admitted that the potency of the individual as a unit of society measures in part the potency of society as a whole; that the intemperate use of alcoholics will diminish the potency of mind, body and morals requires no argument. Statistics show that intemperance contributes more largely to the delinquent, dependent, and defective classes than any other single agency.

(c) Fecundity. That alcohol diminishes fecundity is sustained by all authorities and statistics. The reasons for this can not be discussed with propriety in this paper. The fact, however, is apparent to all medical men who know the reasons.

(d) Heredity. This is a very important branch of the subject. That like produces like is not only a theologic but natural law. This is not only true of species, but also of peculiarities of species. That many diseases are actually inherited is not true; but that the tendency or predisposition to many diseases is inherited is undoubtedly true. This is true of alcoholism. The chronic lesions of alcoholism are not transmitted from parent to child, but the alcoholic constitution is, and in that way heredity plays an important part in the effects of alcohol.

"It has long been known that inebriety runs in families. and that the children of drunkards are often degenerates, displaying a tendency to drunkenness, epilepsy and other neuroses, even if they are not actually imbecile. * * * * While, therefore, chronic alcoholism produces profound individual deterioration, it does not cause racial deterioration. It does, however, produce a racial effect, but this, far from being an injurious one, as some, among them Dr. Forbes Robinson assume, is, on the contrary, beneficial for drunkenness, tending as it does to fasten upon congenital degenerates, hastens their elimination; and this. from a racial point of view, is an advantage. In short, those lacking the moral grip, or unmistakably degenerate, tend by means of alcohol to be eliminated more speedily than they would be otherwise. * * * By the elimination of those who are least capable of risisting alcohol, the race is becoming increasingly resistant to alcohol." (1)

"That alcoholism tends to the degeneration of the race, and after a few generations to extinction, has been abundantly shown. Legrain observed 215 alcoholic families, in three generations of which 814 members were hereditarily tainted; 197 of these were alcoholics, 322 were weak-minded or idiots, 161 still-born, 37 prematurely born 120 died shortly after birth; so that 496 were either mentally or physically degenerated. Denny observed that only 17.5 per cent (of children) in the alcoholic families were healthy, while practically only 18 per cent in the non-alcoholic families were not healthy. * * * The mortality of children from alcoholic mothers is thus 2.5 times greater than from non-alcoholic mothers in these statistics. Animal experiments show the same relative mortality between the alcoholic and non-alcoholic animals. Morel draws attention to the fact that individuals who are given to alcoholism in their youth, as well as the descendants of drunkards, are noticeable for their small stature and feeble muscular development. presenting a type of infantalism. Lancereaux believes that, pushed to its extreme limits, alcoholism creates a special race, as it were, which can continue itself for a certain period with its physical infirmities and vicious tendencies, but happily it lacks the elements sufficient to reproduce itself for any length of time; with its descendants cursed with impotence and sterility, it is not slow to disappear." (2)

Morel illustrates in a striking manner the question, as follows:

"First generation, depravity, alcoholic excess, degradation; second generation, drunkenness, maniacal attacks, general paralysis; third generation, hypochrondical tendencies, melancholia, suicidal and homicidal tendencies; fourth generation, undeveloped intelligence, mental obtuseness, sterility and extinction." (Journal of Inebriety.)

Alcoholism also exercises a marked heredity in many diseases. Bourneville in 1,000 cases of imbecility found alcoholism in the father 471 times, and in the mother 84 times; in both parents 65 times. Denny found alcoholism in 81.9 per cent of parents, and, moreover, that in families of alcoholics only 17.5 per cent of the children were normal. Peterson attributes 9 to 16 per cent of the cases of imbecility to alcoholism. (Journal of Inebriety.)

Epilepsy is also shown to frequently occur in alcoholic parents.

"The natives of Caucasus quench their thirst not with water, but with wine, and the wine is no light one. It contains from 5 to 15 per cent of alcohol. Wine drinking is so common that no one considers it inebriety. Everybody knows what a nigh percentage of epilepsy is caused by the abuse of alcoholic beverages. I have spent the the summers during the last fifteen years in Caucasus, where I have a medical practice drawn from a large district, and in no other place have I had so large a proportion of epileptics among my patients." (Kovaleosky.)

Ferre found in France that among 308 male epileptics 118 were descendants of alcoholics, and of 286 females, 130 were descendants of alcoholics. Kawalewski could prove drunkenness in 60 per cent of the epileptics. Wartmann found in Germany the same history in 130 of 452 epileptics.

That the tendency to insanity, paresis and other brain and nerve diseases is inherited from alcoholic parents is abundantly sustained by statistics. From these statistics cited, and many others which could be incorporated, the conclusion is inevitable that the posterity of alcoholic parents are decidedly prone to degenerative diseases, and ultimately to extinction. Further argument and statistics might be made to show the effects of alcoholic beverages, but it would indefinitely prolong this part of the paper.

PART III.

General Considerations.

In part 2 of this paper the author has endeavored to give the findings of an intelligent investigation, on scientific lines, of the effects of alcohol upon the individual and his posterity. He now invites the attention of the reader to certain general consideration

Good Things and Bad Things.—In the beginning good and evil were placed before man. In the mineral, vegetable and animal kingdoms, in the thought, words and conduct of men, and in the institutions of civilization, etc., there are good and bad things. A good thing is that which constructs and which adds to the usefulness, happiness and prosperity of the race without doing harm to others. A bad thing is the opposite. Bad things sometimes result from good things, and bad things are sometimes done to produce good things, but as a rule, a good thing

is good all the way through and a bad thing is bad all the way through. Common sense demands that we should select in the world the good things and employ them, and to discover the bad things and avoid them, and if possible, destroy them. The question is to which of these classes—the good things or bad things—does alcohol belong? To answer this question, we must know its effects, which we have attempted to outline in part 2 of this paper. That it may sometimes do good is not questioned, but that it more often does harm has been abundantly demonstrated. As a primary consideration the question arises to what class does alcohol belong? Is it a food or a drug? In answering this question we must briefly discuss

Metabolism.

Metabolism is the process consisting chiefly of chemical action, by which nutritive material having been prepared by the process of digestion and conveyed by absorption and the circulation to the cells of the body, is incorporated into the protoplasm of these cells. This is constructive metabolism. The process further consists in the oxydation in the cells of this nutritive material, thus liberating energy and transforming the protoplasm into waste. This is destructive metabolism. Metabolism is, therefore, a normal and physiological process. The following law may be enunciated: Any material taken into the body, which is not capable of becoming a part of cellular protoplasm is foreign material and therefore injurious and must be eliminated; any material when taken into the body, though capable of forming a part of protoplasm and becoming oxidized, thus liberating energy, which at the same time exercises a chemical or special function upon the cells of the body which is injurious to those cells, is a dangerous material. Alcohol is to a certain extent a food, and in small quantities is capable of being exidized, thus producing heat and liberating energy, but it does not possess this property in a greater or special degree from other nutritive materials of identical elementary constitution, differing from it ,however, in the combination of elements. For example, fats, sugars and starches. It also exercises a special effect upon the cells of the body while undergoing oxidation, which have been enumerated in part 2 under the discussion of the symptoms and when in excess of the amount that can be exidized, it exercises a destructive effect upon the constitution of the cells themselves, which has also been discussed in part 2 of this paper. The conclusion, therefore, is inevitable that while alcohol is in moderate quantities a food, it possesses no special advantages and is

not essential and is undoubtedly dangerous. Alcohol belongs to the drug class and is identified with all other drugs whose effects are narcotic, intoxicating, depressing and toxic. Hence, as a safe physiological food, alcohol can not be too unqualifiedly condemned.

Alcohol belongs to that class of drugs which primarily operate upon the nervous system, producing appreciable effects, all of which have been discussed in part 2 of this paper.

That man has long craved something that would thus affect him has been known since history began. The question arises is this longing and craving for narcotics and stimulants based upon any physiological principles? We know that there is a natural difference in the temperaments of people—some are constantly optimistic and others as constantly pessimistic. Some are enthusiastic, joyful and happy, while others are depressed, serious and sad. It is difficult to account for these differences in temperament by recognizing any differences in the anatomy, or inherent properties of individuals themselves. A theory has been advanced that there circulates in the blood certain unknown materials known as harmones which operate in such a way as to produce stimulation upon the brain and nervous system and thus produce a feeling of well being and comfort and which when present give to the individual his temperamental enthusiasm and optimism, and, when absent, their effect is lost and therefore pessimism, and depression. Whatever the truth of this theory, it is undoubtedly a working basis to account for the almost constant and universal desire for stimulants and narcotics. By this theory we can also account for the increasing demand and tolerance of these drugs, because by their artificial action they have displaced a natural principle with its physiological exercise and have become indeed a part of the potencies that effect the individual. Whatever theory may be adopted to account for it, the fact is that the vast majority of mankind feel the want of these drugs, and herein lies the fundamental danger in their indulgence. All authorities recognize this craving and all authorities condemn the use of alcohol and other drugs to satisfy the longing. It thus follows that intemperance is a progressive acquisition growing out, in all probability, of natural conditions; and this again behooves all to abstain from the use of these drugs.

Moderate and Immoderate Use.

There is no fixed rule measured in quantities that constitutes the moderate and immoderate use of alcoholics. All writers agree that any amount that is in excess of the capacity of oxida-

tion is immoderate; and all writers further agree that any amount that will keep up for any considerable time the physiological effects of alcohol is also immoderate. And all agree that more and more is required to excite into activity its effects. This is based upon the principle of a gradually acquired immunity of the toxic action of alcoholics. It is known as Mithratadism. Mithratades was an ancient king, who by constant use acquired a tolerance of deadly poisons, so that he could take many times over a fatal dose for others. In this way he poisoned his enemies by putting a fatal dose in the wine, of which he and his enemy drank and which did not affect him, because of his immunity, but which killed his enemy for the want of immunity. This is true of almost all this class of drugs and indeed of nearly all poisons, such as morphine, strychnia, cocaine, chloral, etc. In the case of alcohol, however, while a tolerance is acquired that requires more and more to produce its effect, its oxidizability and the powers of nature to oxidize it are not increased, and therefore in order to obtain the effects of alcohol, when tolerance is acquired, there must of necessity be a large surplus circulating in the blood and saturating the tissues, and in this way organic lesions inevitably follow.

If the writer were to attempt to define the moderate use of alcoholics applicable to any individual, it would be something like this: In whatever form it is taken, whether spirituous, vinous or malt, it should be free from associated poisons and other impurities. Of this not more should be taken than would give rise to the least possible perceptible effect, and that no more should be taken until that effect had entirely disappeared and a total abstinence of at least twenty-four hours. The moderate drinker should be particularly careful never to drink to keep up these exhilerating effects, and that under no circumstances should he increase the dose as a gradual tolerance is acquired. The writer would further define immoderate drinking as that in which the more active effects are produced even at long intervals, or in which even the moderate effects are maintained for a long time to attain which there must be constantly increasing doses. While the writer thus attempts to define moderate and immoderate drinking, he does not wish to be understood as advising the experiment.

Alcohol in Medicine.

The writer of this paper has had an enormous experience in the treatment of disease and traumatism. When he started in the profession, 34 years ago, he went into it with the idea well

grounded into him that alcohol was a stimulant and should be given practically in all cases where were indications of failing heart, collapse, etc. He was even taught that alcohol promoted constructive metabolism and that it limited disintegration or destructive metabolism, and that in all cases where there was a minus repair and a plus decay alcohol was indicated. These conditions are particularly true in most all of the fevers, especially typhoid. Carrying out his education in this particular for nearly twenty years, he gave an abundance of alcohol in the treatment of disease. He has also observed a great many cases of serious traumatism in which shock and sometimes hemorrhage were present, and in which he formerly gave alcohol as his chief remedy. From the beginning, alcohol did not come up to his expectations, and he has long since concluded that its administration in fevers, tuberculosis, and all of the infectious diseases is chiefly that of a food and that in this particular it falls far short of other foods which possess more of the protoplasmic materials of the body, and that it should not be given when these can be employed. He has found it entirely useless in shock and indeed he believes, for the reasons given in its effects upon the cardiovascular system, that it is an injury in shock. In a word, for the last fifteen years he has largely discarded alcohol as an important part of his therapeutic administration. Where he formerly gave gallons, he now gives ounces, and he further gives it as his opinion that so far as its stimulating effects are concerned, there are substitutes, particularly strychnine, which is far superior, and that there are other treatsments available in great debility and exhaustion of acute infectious diseases far superior to alcohol. In fainting or syncope, in which condition there is a weakened heart's action, alcohol promptly administered is of undoubted service, but to stand the patient on his head is much better. In the syncope following hemorrhage, he has found alcohol of no avail unless associated with other appropriate treatment.

There are many aspects of this question which require further discussion and elaboration, indeed could be indefinitely prolonged, but the author believes that he has placed before his readers the important points of the discussion and that a careful study of what has been said will result in enlightening him upon the subject of the effects of alcohol upon the bodies of human beings. He could have gone more into detail in discussing the relation of alcohol to insanity, paresis, and other nervous diseases, etc., and to the part that it plays in producing pauperism, crime and other misfortunes, but it would prolong this paper to

too great a length. He will, therefore, conclude with the following

Conclusions.

1. That alcohol is essentially a drug, belonging to the narcotic and anaesthetic class, and is a poison.

2. That while it possesses some food properties, it has no particular advantage over other foods with analogous constitution, either in the production of heat or in the liberation of energy.

3. That it exercises a powerful influence upon the functions of the body—at first mildly stimulating, but followed by a greater depression.

4. That the prominence of the symptoms after its ingestion are the result of different phases, stages and doses.

5 That all alcohol in excess of what is oxidized in the body is a foreign material and like all foreign materials, must be eliminated by the organs of elimination; and while present in the body in a free state acts as a poisonous drug effecting first the functions and then the organic structure itself.

6 That the power of the body to oxidize it does not increase, but that a gradual tolerance is acquired which calls for more and more to produce its effects—the effects which are wanted by the drinker, and therefore more and more free alcohol accumulates in the blood and tissues, to disorganize and destroy the organs and structures and to overwork, thus producing disease in the organs of elimination, especially the kidneys.

7. That it produces a profound, widespread and lasting degeneration of the essential structures and organs, particularly the brain and nervous system, heart and blood vessels, and digestive system, of the latter particularly the liver.

8th. That these degenerations constitute the special pathology of many organic diseases, of these several organs, and which have a symptomatology of their own, and which as a rule ultimately end in death.

9. That many deaths recorded as apoplexy, convulsions, paralysis, angina, pulmonary, digestive and kidney disease, etc., are but terminal lesions or conditions of chronic alcoholism.

10. That many dying from these lesions were considered

by themselves and friends as moderate drinkers, and who were never known to be drunk in their lives.

11. That death may result from acute alcoholism, or what might be called a common drunk, by the direct poisonous action of the alcohol itself, or by some accident, fight, or exposure to cold, heat, or other dangers.

12. That aside from the special dangers enumerated in 11, an occasional drunk, not too severe, and not too often repeated, and with total abstinence between the drunks, is in the end less dangerous in all respects than so-called moderate continuous drinking.

13. That the mental and physical potencies are diminished even by the smallest quantity, and that through the operation of the inhibition of rational judgment, and the stimulation of the baser passions and the liberation of maniacal energy, it undoubtedly plays an important part in the production of character.

14. That there is a greater susceptibility to all infectious diseases, particularly pneumonia and tuberculosis, and diminished resistance to their action and diminution of power to react from shock and injury and in open wounds at least, a much greater liability to infection.

15. That while alcoholic lesions may not be inherited, the alcoholic constitution is, so that the posterity of alcoholic parents are not so well developed, are more liable to disease, especially to diseases of the degenerative type of the nervous system, and are much more liable to succumb in early life, and less liable to overcome injurious influences, and are undoubtedly predisposed to excessive drinking.

16 That it promotes sterility and ultimately tends to the extinction of the race of individuals whose ancestors indulged in its use.

17. That its importance and usefulness as a medicine has been greatly over-estimated, and for which in most instances there are substitutes more efficient and far less dangerous.

18. That the use of alcohol for its effects calls for more and more, and is wholly incompatible with temperance, and if persisted in will certainly lead to acute or chronic alcoholism.

19. That any quantity of alcohol taken into the system in excess of what can be oxidized, either in the dose taken at one

drink, or in several drinks within a given time, is immoderate and excessive and will ultimately leade to alcoholism.

20. That the word "temperance" is wholly a relative term—there being no universal standard measured in quantity for all individuals, each individual being a law unto himself. And that when the uncertainty of the effects of what may be supposed to be moderate and temperate uses are considered, and when the known tendency to an increase in its use follows, there can be but one safe and certain course to follow, and that is total abstinence.

(Read before the Jeeffrson County Medical Society September 6, 1909.)