Compound Oxygen and its Therapeutical Value.

United States
Compound Oxygen Company,
Springfield, Mass.
U. S. A.

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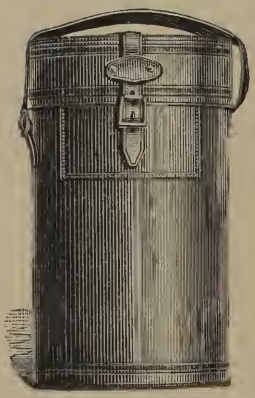
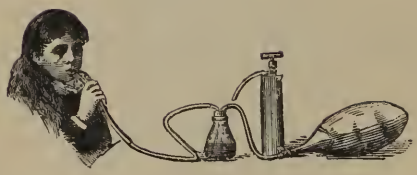


COMPOUND OXYGEN

AND ITS

THERAPEUTICAL VALUE.

SPRINGFIELD, MASS., U. S. A.:
UNITED STATES COMPOUND OXYGEN COMPANY.
1889.



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"Materia Medica and Therapeutics," C. D. F. PHILLIPS, M.D.
"Hand-book of Therapeutics," . . SIDNEY RINGER, M.D.
"Practical Treatise on Materia Medica and Therapeutics,"
ROBERTS BARTHOLOW, M.D.
"The Year-book of Treatment," 1887.
"Text book of Physiology," . . M. FOSTER, M.D., F.R.S.
"Class book of Chemistry," . EDWARD L. YOUMANS, M.D.
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"Lectures on Chemistry," . PROF. BENJAMIN F. SILLIMAN.
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INSCRIPTION.

With sentiments of high regard for all honorable medical practitioners, and in the hope that our effort may prove a valuable contribution, we venture respectfully to inscribe these pages to the "profession."

U. S. Compound Oxygen Co.

We are indebted to V. M. Simons for valuable services rendered on this book. Also to D. J. Brown, M.D., for translation.

HISTORICAL STATEMENT.

CHAPTER I.

In a treatise, such as is now proposed, not much need be said by way of historical statement. It is assumed that those into whose hands this work will fall are sufficiently informed, if not of the general truth of oxygen treatment, then of the history of oxygen as a gas. With a brief word, therefore, let us proceed to consider the relations of oxygen to the treatment of various diseases. The history of oxygen, from the time of its discovery by Priestley in 1774, covers a period of more than a century, during which experimental chemistry has enlarged the domain of our knowledge of it, until it has now come to be thought of, by many eminent medical authors and practitioners, as a powerful remedial agent in an increasingly wide range of those ills under which our bodies waste and suffer.

Oxygen was first employed as a remedy in disease in a single case in 1783 by Caillens. There is, however, only a brief reference to the case. Six years after Chaptal made record of two or three cases. Then the French government desired an investigation of oxygen with special reference to its use in disease. The investigation was intrusted to Fourcroy, but he proved himself too much of a theorist and contributed little really valuable to the subject.

"Everything," says Prof. Silliman, "connected with

the history of oxygen is elegant, beautiful, and instructive. Without it there would be no beginning of animal life nor any adequate means of *producing and regulating heat.*

"What has been called the modern theory of chemistry was occupied principally in unfolding the agencies of oxygen and this exposition still continues the most important part of the science."

We seek, in these pages, to set forth the relations of this "unfolding agency of oxygen" to disease, more especially to its relief and cure.

SCIENTIFIC BASIS.

CHAPTER II.

THE very nature of things suggests the fact of the scientific basis of oxygen treatment in disease and as a prevention of disease. All nature indicates the relations of oxygen to the maintenance of life and to the integrity of even inanimate existence. The earth itself lives by its atmospheric enswathement and molecular interpenetration of oxygen.

Prof. Youmans says, and the same, in substance, is said by every writer on the nature and relations of oxygen in the economy of human life: "Oxygen is the universal supporter of respiration, and hence, as this is the most important of the vital processes, it is the *immediate supporter of life.*" And as the body is an intricate "oxidizing apparatus," in which every organ, muscle, nerve, and membrane is constantly operated upon and chemically and physiologically changed, there is an ever-present primal necessity that this apparatus be constantly supplied with the requisite quantity of oxygen. A lack here, and especially if long continued, may involve the whole body in irremediable ailment. Prof. Liebig has strongly set forth the value of the discovery of oxygen and of the vast practical consequences to civilization of that discovery. He says:—

"Since the discovery of oxygen the civilized world has undergone a revolution in manners and customs.

The knowledge of the composition of the atmosphere, of the solid crust of the earth, of water, and of their influence upon the life of plants and animals, was linked with that discovery. It may well be said that the material prosperity of empires has increased manifold since the time oxygen became known, and the fortune of every individual has been augmented in proportion."

Says another eminent scientist: "The discovery furnished the master-key by which man has been enabled to open the mysteries of nature."

In no department of scientific inquiry and application is this truer than in the increased knowledge which more recent years have brought to us on oxygen as a valuable therapeutic. By this knowledge the physiological fortune of every individual has been augmented and in a sense and to a degree not thought of by Prof. Liebig when he wrote this wonderful paragraph. Let us see how this is.

What Liebig calls "*eremacausis*" goes on in all the vast domain of nature. But for this nature itself would by the processes of corruption and congestion, themselves not only causes but forms of disease, waste and die. This "*eremacausis*," this oxidation, serves to keep the whole realm of nature pure from noxious contaminations and to relieve it from the vast accumulations of a surplusage of elementary decay. This is a principal office of oxygen in nature. This may explain the fact of its great superabundance, entering as it does, in proportion to other elements, so largely into the constituency of all material things. Though forming only about one-fifth of the composition of the air we breathe, yet it is distributed everywhere, and the total quantity of it, pressing down upon the earth's surface, has been computed to be

not less than 1,178,158,000,000,000 tons. This, if spread over the earth in a layer of uniform density, would be a mile deep.

Oxygen serves in human life a purpose similar to that which it serves in nature. Human life, like nature, is itself supported by a continual "*cremacausis.*" Without this it withers and dies. Hence the whole matter of the physiological conditions of the "*eremacausis*" is, if we would keep ourselves in health, or if diseased recover ourselves, of prime concern to us. Inasmuch then as all forms of disease are only forms in which the want of vitality shows itself, and inasmuch as oxygen is the chief element of that vitality, it is easy to presume that the idea of the treatment of disease by inhalations or applications of oxygen would prove to have, upon close study, a thorough scientific basis and that some diseases would assuredly be amenable to such treatment. If oxidation, going on through all the vast realm of nature, serves to keep it pure and sweet and full and round with life, if in this way its constantly accumulating impurities are purged away and its pestilential predispositions held in check, and if where this oxidation is wanting these impurities gather and spread themselves into epidemics and contagions and these pestilences assert their devastating power over vast districts, and if human nature is constituted with reference to the same principle of oxidation, then the claim for oxygen treatment in certain emergencies of diseased human nature is thoroughly scientific. The simple truth then is, that the oxygen treatment involves the very science of properly regulating the physiological conditions of the "*cremacausis,*" the oxidizing work which, if carried on as it should be, promotes life and preserves health, and if otherwise carried

on superinduces disease and death. This is all there is of it, the real secret, the whole simple science of the oxygen treatment.

THERAPEUTICAL VALUE.

CHAPTER III.

What has been said in the foregoing chapter on the "Scientific Basis" of the oxygen treatment is clearly justified by the facts entering into its therapeutics. Let us then, without going too much into detail, consider these facts.

In ascertaining the therapeutical value of oxygen, conditions of activity must be taken into the account. The same individual will, when active, absorb more oxygen than when at rest. Lavoisier and Seguin have shown that activity greatly promotes both pulmonary and muscular oxygen absorption. The man who in a quiescent state will receive into his system about 19,000 cubic centimeters of oxygen per hour will, when active, use nearly three times as much. Spallanzani, by experiments with chrysalis formations as compared with the higher life-states, has shown this, while the experiments of Regnault and Reiset, upon the marmot, demonstrate the same fact of largely increased oxygen consumption under active conditions. Whoever, then, would rightly estimate the therapeutical value of oxygen inhalations must not only consider the general physiological state, but also conditions of rest and activity. In short, all the conditions that interfere with perfect health must, when we would intelligently appreciate the value of oxygen, be taken into the account. A chief reason of this is that oxygen

inhalations and carbonic acid exhalations go on together. They are interdependent and are regulated, according to this interdependence, by substantially the same physiological relations and conditions. We mean by this to say that muscular exertion increases the carbonic acid exhalations largely beyond those that take place when the body is inactive. Prof. Scharling's experiments have indisputably settled this point. So also in practical experience with oxygen, "age, sex, constitution, and development," as Prof. Dalton says, must, for the same reason, be carefully considered. If, as we have said, there is an interdependence between oxygen inhalations and carbonic acid exhalations, then the therapeutical value of oxygen treatment, in any given case, cannot, except in consideration of the differences above named, be estimated, for the individual variations are very great and very marked. Androl and Gavorret made investigations touching certain of these differences, upon five different subjects, as nearly as could be under uniform conditions. These investigations showed, in the minimum and the maximum, a variation in the quantity of carbonic acid exhalations per hour of more than seventy-five per cent. The lowest was 15,888 cubic centimeters per hour and the highest 26,060 per hour.

Moreover, considerations of age are of great importance. This difference of age must have close attention. A young person does not require as much oxygen as one in mature years. Hence any treatment with oxygen gas should be made, if the matter of therapeutics is thought of, with reference to this physiological fact. An eight year old boy throws off, under conditions of health, an average of 9000 cubic centimeters of carbonic acid per hour ; when he is twice as old nearly double the quan-

tity. The maximum is supposed to be reached somewhere from twenty-five to thirty, at which time the average exhalation is, in round numbers, 23,000 cubic centimeters per hour. During a period of from ten to twelve years thereafter this becomes the regular order of things, and then diminution slowly begins. For twenty years it is usually very slight. This is during the period of full life. Afterward the diminution is likely to go on rapidly until the quantity of carbonic acid gas thrown off in a given time—say an hour or a day—is reduced to that of young manhood or even boyhood. It has been known to fall during this period as low as 13,000 cubic centimeters per hour and in the case of a very old man—a centenarian—as low as 11,000 cubic centimeters. This is the general law, though of course subject to not a little modification. Thus no consideration in theory or practice of the therapeutics of oxygen inhalation can be relied on, as even approximately correct, which does not mark these differences of "age and sex and constitution and development," in short, the general physiological *status*.

The law of interdependence is so fixed in its principle and so immediate and powerful in its action that no view of the therapeutical value of oxygen treatment that does not make these just distinctions can be of much worth. The professional who handles oxygen in a mercenary and unscientific way will, of course, miss the mark with it and bring it perchance into undeserved disrepute. In general, then, it may be said that certain physiological conditions, such as are common to us all,—eating and fasting, waking and sleeping, action and repose, vigor and fatigue,—must not, in a right view of the therapeutics of oxygen inhalations, be overlooked.

It is in conformity with this general physiological truth that many eminent practitioners claim so much for the oxygen treatment. Dr. Flint, Jr., says, "It is the only rational basis of the practice of medicine," and which, as he distinctly intimates, will be with the profession generally, more and more controlling in its influence.

Dr. Birch says: "Facts in my own experience have clearly proved to me that, in permitting and augmenting for a certain period daily the natural transformations of tissue, we *pro tanto* confer upon the system an increased power of reconstruction. The bodily powers which may have been long depressed by disease, unable to get the necessary lift up to par, and consequently becoming weaker daily and incapable of renovation by any other available means, will frequently, under a judicious exhibition of this powerful remedy, at once receive permanent invigoration. Then the almost stagnant circulation resumes its healthy motion, the torpid digestive and assimilative functions again become active, and congested organs are again capable of their work of secretion and excretion, and the constitution, after the lapse of a proper period, becomes renewed." Indeed, if, as has been said in the chapter on "Scientific Basis," the whole philosophy of the oxygen treatment involves nothing more and nothing less than the regulation of the physiological conditions of the "*eremacausis*," then what Dr. Birch found in his experience is only what we might expect.

Oxygen is not properly classed among the stimulants but rather among the non-stimulating exhilarants. It does not, in its physiological work, come under the law of stimulation. If it were a stimulant like alcohol there would indeed be a large chance that the medicinal use of it would prove injurious. It might then super-excite the

physiological action only to fall back to corresponding reaction. This is the law of the operation of a stimulant, and more or less pronounced as the stimulation is pronounced. But the oxygen treatment comes under no such law. As Dr. Wallian well says: "The stereotyped impression that oxygen is a physiological stimulant belongs with scores of other scientific delusions. The feeling experienced after inhaling oxygen, artificially prepared, is one of restfulness rather than one of stimulation." Dr. Birch, in his first essays with oxygen, and, as he says, "before he had fully initiated himself in its application," was troubled with occasional *contretemps,* but with more knowledge and larger experience overcame them. He found, what every other wise experimenter with oxygen gas before or since has found, that there need be, even in constitutions predisposed to "vascular" excitement, no injury. He says: "Far from being a temporary stimulant, it frequently is not felt as a stimulant or excitant at all. Even where oxygen has been inhaled daily for some months I never met with one indication of excitement or irritation of the lungs, but on the contrary I have had several striking cases of cure in chronic pulmonary congestion which had been pronounced incurable, as well as in sub-acute inflammation." Demarquay is of the opinion that one of the chief medical offices of oxygen inhalations is to facilitate the absorption into the blood of the remedies prescribed. An eminent practitioner said recently to us: "I am able with oxygen, in average cases, to get better results and get them quicker than I could without it, and in some cases I get results with it that I could *never* get without it."

Where then lies the secret of the therapy of oxygen inhalations? Where but in the strange power oxygen

has to take hold of the very innermost centers of vitality and thus tone up the nervous and muscular systems? Thus it is able to augment largely the general functional force and maintain or re-establish, as may be, the physiological integrity. The treatment, then, is most likely to be indicated as a therapeutic in those cases where the vital force has suffered no long-continued drain, and yet it has wrought wonders, as the "Clinical Exhibits" show, in not a few cases of utter vital exhaustion. In these cases it has done what all other means failed to do. "It is possible," says the New York Medical Record, "that the systematic very slight increase in the per cent. of oxygen in the blood caused by inhaling pure gas may give an impetus to the growth of hæmoglobin, especially when the substance is below the normal amount. The best results appear to have been obtained in the dyspnœa of pneumonia, asthma, asphyxiation, gas poisoning, and anæmia."

Dr. Birch notes some of the physiological conditions in which, *par excellence*, the oxygen treatment in his hands proved eminently satisfactory. Among these he specially mentions "a state of general *malaise* with great liability to colds and sluggish circulation, either constitutional or super-induced by an atonic and oppressive condition through over-feeding or other luxurious and indolent habits."

The study of oxygen gas as a therapeutic agent must be among the first steps in this called-for and much-needed advance. These general remarks, in support of the remedial value of oxygen inhalations, may be considered prefatory to what follows in the chapter on "Pathological Indications." In the detail of those indications the therapeutics of the treatment will be especially seen in the light of high authority.

PROPHYLACTIC FUNCTION.

CHAPTER IV.

To prevent is sometimes better than to cure. The prevention of disease is coming to be almost as truly a science as its cure, and prophylactic as compared with therapeutic treatment is having among physicians much attention. We must therefore put in an earnest word for this truth of prevention and for the power of the oxygen treatment as a preventive. "Medical science," says Dr. Fleck, "has grown beyond the mere art of prescribing remedies. It has become a science of protecting man against disease and enabling him to attain threescore years and ten." Dr. Thomas J. Mays in his "Therapeutic Forces" says, "There is no question of greater magnitude to the sanitarian than that of the relation which exists between oxygen and the preservation of life. To secure to man a liberal supply of this vital gas, whether he is in his office or dwelling, in his counting house or store room, sitting in church or walking in the street, delving under ground or working in the factory, or whatever legitimate calling he may follow, is a problem which presses itself for solution upon the attention of every thoughtful individual." "The conception," says Dr. B. W. Richardson in his large work on "Preventive Medicine," "that disease can be *prevented* is of modern times, and indeed we may say practically of the present century or even of the latter two-thirds of the present

century." This is a truth worthy our attention. Indeed, the fact that in this country so great a change in the standpoint from which the highest medical authorities view disease as that implied in Richardson's statement is one in which we may all rejoice, for "an ounce of prevention is worth a pound of cure." Beside, the expense of prevention is as a rule indefinitely less than that of cure. The most distinguished medical practitioners are intent now upon availing themselves of those remedies that offer in their use the power of timely prevention of disease. The remedies sought out and used have been largely curatives, while to prevent the need of their use by preventing the disease has hardly, until recently at least, been thought of; and now the entire scheme of prevention as well as cure is challenging more and more our attention. With this there comes, of course, broader and wider consideration of remedial agents. Some are now added to the list that never would have found a place there but for this state of things. Through long-continued and stout opposition electricity has at last come to be definitely recognized as a valuable therapeutic with special virtue to prevent disease. In like manner the treatment of diseases by applications or inhalations of oxygen gas has now, after a century of struggle with strange vicissitudes of favor and disfavor, come to its time and power and come to stay. And one of the fields inviting its very general use is that of prevention, technically its *prophylactic function.*

Let us see why this is so. The reason will be found in that *famine of oxygen* under which we all, in our modern civilized life, suffer, in the systemic possibility of large *oxygen absorption*, and in the *physiological action* of oxygen especially in its relations to *organic processes.*

Multitudes of people are suffering from what an English physicist calls "oxygen starvation," a physiological misfortune incident to our civilized mode of living. Nature seems to have taken good care that our necessary oxygen supply should not give out but be freely and fully met. However, physicians agree in the opinion that a large proportion of deaths come directly or indirectly from the slow process of *oxygen starvation.* This same physicist, considering the causes of this, finds a principal one in the fact that we live so much indoors and in such compact populations. Every great center, like New York or Philadelphia or Boston or Liverpool or London, in which large numbers of people are crowded together, becomes a source of *oxygen exhaustion* and so of *oxygen starvation.* We may prate against this truth and say it is not so, but all that does not change the conditions of impoverishment nor relieve the famine.

Dr. Wallian states what is patent to our observation, namely, the fact that the ratio of "human beings," and especially those in "civilized life," who, for the lack of oxygen, suffer what he calls "vital robbery," is constantly increasing. He says, "True, nature, ever on the alert for compensatory substitutes and conservative reparation, does her best in many ways to render this deprivation comparatively harmless; but as constant trickling finally splits in twain mountains of adamant, so this physiologic deprivation, so steadily persisted in day by day, at last makes inroads. The starved blood falters, the robbed nerves cry out, tissue-changes flag for want of material, or the tissues themselves degenerate until disorganization in one or another of its fatal forms is finally inaugurated. Anæmia, neuralgia, dyspepsia, diabetes, albuminuria, scrofula, tuberculosis,—these are the mile-

stones on the downward road, the direct or indirect results of imperfect oxidation, the *misere physiologique* of Bouchardat."

Some of the more recent foreign experimenters with oxygen, notably those of Germany and France, have undertaken to show that there is a point beyond which the blood cannot be saturated with oxygen. There is, however, better authority for a contrary view, and, if there were not, this non-absorption notion, more a notion than a fact, would have really no practical bearing on the question of the prophylactic function of oxygen treatment. For, as a celebrated medical writer says, "Ordinary mortals are in about as much danger of being translated as of damaging themselves by an excess of the vital element in question." The ordinary mortal cannot get this excess : indeed, he cannot get the supply of oxygen which nature demands. As says the writer just quoted, "Unfortunately civilization implies a sort of human hibernation, and the average modern individual is compelled to eke out his disease-pestered days on one-half this allowance or even less. And he clearly states the result which, in the absence of any health-giving interregnum, he pronounces "inevitable." His own words to state this result are best. "Functions are imperfectly and incompletely performed, changes and metamorphic processes, though initiated, necessarily flag and result in half formed tissue, or in products inimical to the healthy organism. Toxic, carbonaceous elements accumulate : degenerative processes are set up and chronic disease is the inevitable result, if even malignant demonstrations do not end the disastrous history."

The unscientific assumption that there is a narrow and fixed natural limit to the *oxygen absorbing power* of the

blood, what one writer tersely calls "that scientific stupidity," which until more recently has gone substantially unchallenged, and out of which the question of therapeutical negation has come, must now be looked upon as exploded. Both Dalton and Phillips declare against it and support their declaration by the facts of deeper, truer knowledge. While the effect of oxygen inhalations is the reduction of the carbon in the system, yet there is another and more life-giving effect, an effect of *oxygen absorption directly into the blood.* This, we think, since the experiments of Magnus, is indisputable, and, to use the language of another, "This is doubtless the key-note to the action of oxygen therapeutically exhibited." "It would be a waste of time," says this same writer, "to prove that the blood can and does under certain circumstances absorb an unwonted increment of oxygen since a large majority of the race live under conditions which positively forbid the utilization of anything like a normal supply."

Thus the highest truth of modern scientific inquiry is that of the possibility of this large super-oxygenation of the blood, the end of which may be in the best sense a *materia alimentaria*, and so a sort of standing contribution to the physiological intent and the still unimpaired integrity of all the force and power of the *vis medicatrix.*

In a single paragraph Prosser gives us the true philosophy of the imperfect oxidation of the blood and of the entire absence of oxygen when "the gas is entirely prevented from reaching the alveoli." He says, "This want of oxygen sets up convulsions. These seem to be due to stagnation of blood in the brain,—venous blood, poor in oxygen, rich in carbonic acid,—for they occur when arterial blood is prevented from going to the brain as well as

when venous blood is prevented from returning, and also after hemorrhage," and he goes on to show how a "long-continued want of oxygen" not in an extreme but in a "moderate degree," lowers the temperature, increases respiration, relaxes the arteries and capillaries, and results in cyanosis.

From the consideration of this truth of *oxygen starvation*, let us now pass to consider the larger, more important and more comprehensive truth of *oxygen absorption;* the physiological power the system has to absorb abnormal quantities of oxygen and store it away for emergent use.

The question that arises at the outset is that which Phillips raises, whether or not an abnormal quantity of oxygen can be "taken into the blood." Some aid to the proper answer of this question may come from the many experiments made with animals which have been under certain conditions super-oxygenated. Priestley, Beddoes, and others have done much to convince us of the possibility of the blood, perhaps it were better to say of the system, taking into itself under favorable conditions more oxygen than can be supplied to it by the processes of natural atmospheric inspiration. The opinion to the contrary held by Regnault and Reiset has been so entirely contradicted, by more recent facts of experience, that it is no longer tenable, but must be abandoned. Preyer, Demarquay, Allen, Pepys, all agree that the blood and muscles may thus be surcharged. Indeed, by actual experiment it has been shown that on the other hand the blood may, for certain reasons, lack proper oxidation, and on the other that, even where there is a normal quantity of oxygen, that quantity may be increased. The experiments of Kollmann, showing the lessened elimination of uric acid under special oxidation,

are of much value. He makes this record :—

300 grammes of urine,
236 milligrammes of acid.

The same quantity of urine after the inhalation of 12 liters of oxygen contained only

122 milligrammes of acid,

a decrease of nearly *fifty per cent.* In another case he found the decrease under inhalations of oxygen to be still greater. Gubler has put on record a case of his own which, if there were not another, would be practical evidence of the claim that it is possible to store away in the blood and muscular tissues a reserved quantity of oxygen. Thus what Demarquay says can be done by venous injection, it is reasonable to presume can also be done, under right physiological conditions, by pulmonary inhalation, namely, the *circulatory system and the tissue substance can be surcharged with oxygen.*

Examining the physiological action of oxygen, Dr. Lasvkewitch insists that the blood will absorb a greater proportion of artificially prepared oxygen than that contained in atmospheric air ; and as a result of this he notes the following : (1) increase in the daily excretion of urea, (2) augmentation of the temperature of the body, (3) increased strength and fullness of the pulse, (4) diminution of reflex activities.

Of course this would be of no account unless there might come with it and because of it certain especial and invaluable therapeutical results, results that would not otherwise come. "It is estimated," says Dr. W. B. Clarke, "that the blood is capable of being saturated with about three times the amount of oxygen it can ever get from the ordinary air when the body is at rest, a most impor-

tant fact in relation to the inhalation-treatment of anæmic or bedridden patients." According to Gubler the physical capacity of the blood, rather than any vital necessity of hæmatosis, determines the quantity of oxygen it will, at any given time, receive.

What the globules do not need passes freely into the system and hence into life sustaining combinations. For this reason any diminution of the corpuscles lessens the oxygen absorption. A plethoric man would naturally have a larger oxygen capacity than a thin, spare man, though the thin man might, under certain physiological conditions, need the oxygen more than the other. The reason why, as a rule, oxygen treatment is indicated in cases of anæmia is that there is a deficiency of corpuscles or a lack in their power to take up the oxygen. Quinguand has made an interesting calculation concerning the possible power of the blood to absorb oxygen. Healthy blood will, according to his view, take up on an average, 240 cubic centimeters of oxygen to every 1000 grammes of blood. We cannot, however, agree with him in the opinion that physiological conditions make no difference in this absorption. Evidently a series of pathological conditions are against it. Others have supposed that not the pulmonary demand, but rather the demand of the tissues, regulates the absorbing power of oxygen. A candid survey of the very limited field of literature on this subject warrants the assertion that the blood can and often does take more than a normal quantity of oxygen, and that this extra absorption has a certain pre-therapeutical value.

Beddoes made extensive and critical experiments with oxygen gas when he was professor of chemistry at Oxford. His experiments are, to any one seeking reliable informa-

tion, of great value. Two or three facts are shown by these experiments, facts not so much of a technical as of a general character, and of interest to the average reader.

(1.) His experiments show that the blood can be surcharged with oxygen.

(2.) That when thus surcharged it may be depended on to supply to the system sustenance under deficient respiration, whether from lack of air or because of bad air.

(3.) That blood thus oxygenated will, by its heat producing energy, resist physiological or atmospheric conditions of cold.

"The blood then by virtue of its corpuscles, these by virtue of their hæmoglobin, takes up oxygen in the lungs, becomes, as we say, arterial, and goes as such to the tissues where the oxygen tension is low. They therefore receive oxygen from the blood and *store it up in some suitable combination*, leaving the hæmoglobin reduced, that is, more or less of it according to the activity of the tissue."—"Therapeutics of the Respiratory Passages," by Prosser James.

It used to be thought that the oxygen taken into the blood by respiration was simply dissolved there, but this theory has been shown to be untenable. It may be *absorbed* but it is not *dissolved*. Dr. Foster says: "The absorption of oxygen by the blood does not follow the general law of absorption according to pressure," atmospheric pressure he means. "Certain phenomena of that absorption suggest," says Dr. Foster, "that the oxygen in the blood is in some particular combination with a substance or substances in the blood of such a kind that disassociation rapidly occurs at certain pressures and

temperatures." That substance is beyond a question the hæmoglobin. This substance in arterial blood is well-nigh saturated with oxygen. Increase the pressure of the oxygen contact and by simple absorption the blood takes into itself more oxygen. The quantity may be almost insignificantly small, but the increased tension of it makes its physiological action of great value. It is the hæmoglobin in the blood, in the red blood corpuscles, that makes them absorbents and distributers of oxygen all along the course of the circulatory system. In this oxyhæmoglobin is to be found the principle and substance of tissue building.

The natural physiological absorbents of oxygen are the blood globules and the tissues. Oxygen taken into the blood globules is carried by the circulatory force to the extremities of the system, in which passage the oxygen is measurably or entirely exhausted. The explanation of this loss of oxygen in the blood, and its consequent change of color from that of arterial to venous, is to be found in the absorbent power of the tissues. Different tissues have different powers of absorption. This power of absorption is greatest, first in the muscles, then in the brain, then in the kidneys, then in the spleen, and least in the anatomy. This order and degree of oxygen absorption may serve in a general way to make up the indications of the oxygen treatment and enable us to prognosticate with tolerable assurance its therapeutical value in various diseases. Muscular depravities, brain weaknesses, kidney troubles, and disorders of the spleen would, as compared with some other diseases, be likely to yield to the treatment. Practically this has been time and again proved.

Foster, and he is good authority, considering the ques-

tion of how oxidation takes place, whether in the blood or in the tissues, says: "On the one hand the muscle seems to have the property of taking up and fixing in some way or other the oxygen to which it is exposed, of converting it into inter-molecular oxygen, in which condition it cannot be removed by simple diminished pressure, so that the tension of oxygen in the muscular substance may be considered always nil." "The respiration of the muscle, then, does not consist in throwing into the blood oxidizable substance, but it does consist in the assumption of oxygen as inter-molecular oxygen, in the building up by the help of that oxygen, of explosive decomposable substances, in the occurrence of decomposition. We cannot as yet trace out the steps taken by the oxygen from the moment it slips into its inter-molecular position to the moment when it issues, united with carbon, as carbonic acid. The whole mystery of life lies hidden in the story of that progress."

All this suggests to us the fundamental truth of the *physiological action* of oxygen, and especially in its relation to *organic processes*. The physiological action of oxygen is, in the general sense, twofold: that is, it is external and internal. The external action is mostly local, as a surface treatment, applied to diseased parts. In this application of oxygen gas, sometimes in its pure but more especially and generally in its diluted form, it has a good effect upon the mucous surface and upon the skin under certain eruptions and abrasions. Some writers say that when thus used it is "stimulating." Phillips in his "Materia Medica and Therapeutics" says that the "external and local action of oxygen in contact with mucous membrane or denuded skin is moderately stimulating," that is, stimulating in the tonical, not in the narcotical

sense ; for, as has already been said, oxygen administered either externally or internally is not, technically speaking, a stimulant. The other part of this twofold action of oxygen is internal. Here, as it is taken by inhalation, it reaches, with wonderful power, the most secret sources of vitality. Because of this, certain physiological changes of an absolutely therapeutic character are, to a degree not attained by medicines, brought about, and are, as a rule, of a *permanent* and *substantial* character. Indeed, when it is considered that the oxygen treatment is a constitutional treatment as contradistinguished from local medication, this is what might be expected, for the effects reached by constitutional remedies are likely to have the most reliable conditions of permanence. Of course we do not by this mean to say that the results of oxygen treatment in those diseases in which it is undoubtedly indicated involve no possibility or it may be probability of lapse, for that would stand for a physiological integrity impossible under the unfortunate conditions in which we "live and move and have our being"; but we do mean distinctly to say that the results of oxygen treatment as compared with those gotten by the use of medicines are likely to be, so far as thoroughness and permanence go, more satisfactory. Many eminent medical practitioners who have given oxygen treatment practical attention have become aware of this fact. All forms of disease are largely some sort of decay or devitalization, and in a final analysis this can be traced to the relations of oxygen to the physiological system. Given a lack of oxygen in the air or a lack of respiratory function and the deficiency may be enough to account for bad nutrition and imperfect tissue-change, and, indeed, in a final analysis, for the whole round of physical ail-

ments. All the varieties of disordered functional activity may have and often do have their principal cause here. With a lack of oxygen supply or with no adequate power in the vital organs to receive it, assimilation is deficient, the blood becomes corrupt or sluggish in its channels, the general warmth of the body diminishes, the extremities become cold, and if this state of things continues for any great length of time, the vital forces lose their tone, disease comes on apace, and sometimes death ensues. If, then, in the very incipiency of this downward course, in the early genesis of it only for the lacks named,—insufficient oxygen or insufficient absorption of it,—some treatment were entered upon that would overcome this lack, the far away fatal consequences might be prevented. And for this, the oxygen treatment, as it supplies the deficiency in the oxygen breathed and increases the capacity to breath it, must be put down as invaluable.

But it is in the *physiological action* of oxygen in its relation to *organic processes* that we may especially see its prophylactic power, and here its power is connected with and depends upon preceding conditions and facts of tissue absorption and storage.

That oxygen in the physiological economy of man sustains a vital relation to the processes of organic substance and force is a well-known fact. "Life," says Dr. Frank Donaldson, "implies change, and its activity is in proportion to change, and for this oxidation is essential for the development of force." Not only does it enter into the very composition of the tissues but it enters the body, there to form certain chemical combinations by reason of which force is generated and functional integrity maintained. As this is so, the need which the body has of a proper supply of oxygen is an imperative one.

If there be any lack here, and especially if it be great and long continued, the whole system suffers. This lack often opens the way to the taking on of serious ailments, ailments that would never, were the body supplied with oxygen according to its full demands, attack it. "The large amount of force which is constantly given out by the body in the shape of mental, muscular, or other work, originates," says Dr. Mays, "mainly from the oxidation of carbon and of hydrogen." He adds, "Oxidation is the main process by which depuration of the body generally takes place, by which those tissues that have survived their usefulness in the body can be prepared for removal." The action of oxygen upon the albuminous tissue illustrates its depurating power. It changes these tissues from an indiffusible condition into the crystalloid state, and in this state through the uric and carbonic acid and other forces the work of depuration goes on as it should. Let there be any lack, however slight, in the normal supply of oxygen to the system and this deficiency is likely to become a disease breeder. The active physiological force must correspondingly suffer. The very large accumulation of carbonic acid in the system and especially in the lungs may and often does lead to fatal results, results that might have been, had the system been supplied in some way with the required oxygen, prevented. Dr. Mays distinctly says that "deficient oxygenation is the chief cause of mischief to the body." Where the exhalation of carbonic acid is in quantity under what it should be, and that acid remains too long a time in contact with the tissues and membranes, poisoning results. This is known as carbonic acid poisoning, and, as Dr. Mays says, "be this process ever so slow, its impress will nevertheless be

stamped on the body, and especially," he says, "on those organs which are mostly exposed to its deleterious influence, as the right side of the heart, which will especially bear the brunt of its action." A paragraph in Dr. Mays' book is so full of truth stated in plain terms that we feel warranted in quoting it. "This organ (the heart) is the receptacle of all the blood coming in from every part of the body, already loaded with carbonic acid even in the natural state, but when under certain circumstances the blood becomes almost completely saturated with this effete product its deteriorating effect must be vastly multiplied, and if such an abnormal state of things continues for any length of time the walls of the right side of the heart will soon begin to show signs of disintegration, the tricuspid valves will become deranged, and regurgitation, with all its natural consequences, will follow, such as anasarca, hæmorrhoids, and congestion of the abdominal organs."

Not only may every physician understand this and fully enter into its meaning, but as well the average unprofessional reader, and both may further understand that the prevention of this state of things may be brought about by guarding against that dearth of oxygen in the system out of which these results come; and if they have come, and especially if they are in their incipiency, or if there are evident signs of their coming, then the oxygen treatment is doubtless indicated and should be entered upon. Indeed, to neglect it where it can be had, may be criminal as it may be fatal. Bronchitis, pneumonia, or general respiratory enfeeblement and disorder are but the natural and inevitable consequence of withdrawing from the system for a long continued period that supply of oxygen which health and strength demand.

Sometimes under some form of artificial aeration the victim seeks to overcome these results, and it may be measurably succeeds, but as a rule the capillary resiliency is so little that real and permanent recovery is impossible. All this shows the vast importance of timely attention to any remedy that will prove a healthful prophylactic. Such a remedy is oxygen gas taken by inhalation. It is, in the nature of it as well as in its relations to human physiology, both preventive and curative—not only a valuable therapeutic but as well a powerful prophylactic.

PATHOLOGICAL INDICATIONS.

CHAPTER V.—PART I.

In this chapter we propose a somewhat detailed setting forth, from the standpoint of well accredited authority, of the pathological indications for oxygen-treatment. We shall then be pardoned if, in order to show this authority, we make the setting forth largely in the language of others. The reader will then be sure that we do not speak of ourselves nor give merely our own unsupported opinions

SUPPORTS LIFE.

Oxygen supports life eminently in respiration and is the only agent that is adapted to this purpose, but it is necessary that its great energy should be mitigated by *dilution.*

Prof. Benjamin Silliman.

RELATION TO DISEASE.

Oxygen gas is eminently salutary in some cases, especially in diseases of the thorax, in paralysis, general debility, and so forth.

Prof. Benjamin Silliman.

DEFECTIVE RESPIRATION.

When from any cause there is defective respiration and the system suffers in consequence from imperfect oxygenation of the blood, the inhaling of pure or slightly diluted

oxygen, by enabling something like a normal quantity of the gas to be presented to the blood at each inspiration, affords prompt and decided relief, and is, of course, *pro tanto* of great benefit. Hence in such affections as asthma, pulmonary emphysema, croup, diphtheria, dyspnœa from heart disease, inhalations of oxygen are then exceedingly useful. In other diseases, generally those of mal-nutrition, such as consumption of the lungs, anæmia, severe dyspepsia, indolent ulcers, and so forth, experience has shown that in some cases much benefit has followed inhalations of oxygen.

EDWARD CURTIS, M. D.,
New York.

SECRETORY FUNCTIONS.

In persons of "plethoric habit," and especially if the "functions of one or more of the secretory organs" have been interfered with, Dr. Birch says oxygen-treatment is undoubtedly indicated. In such cases he says: "The commencement of the curative process has sometimes been ushered in by sudden and unexpected efforts of nature to throw out peccant matters, efforts for so long a period previously unattainable from the most judicious treatment, and so immediately following two or three large doses of the gas, as to afford almost unquestionable evidence of the true sequence. The assistance urgently demanded by the system has been given. Nature has thus had a starting point and a critical discharge has made its appearance.

"It has been my fortune to see this exemplified in cases of long suppressed catamenia, in torpidity of hepatic functions with pent up biliary secretion, and in gouty affections with much cerebral, nephritic, and other dis-

tress. In the last I have known the urine, which had been for many weeks uniformly clear and limpid, to become, to the horror of the patient, turbid, dense, and loaded with urates and phosphates. I would venture particularly to draw attention to the ascendency of oxygen over the cutaneous capillaries not unfrequently felt on the commencement of its use in torpid and unhealthy conditions of the cutaneous function, and cachexia arising therefrom. The benefit afforded will occasionally demonstrate itself in profuse perspiration when a dry, harsh skin had been previously the order of the day, or a relaxed and moist state of the cutis with consequent chilliness and liability to colds will give place to a warm, healthy, and comfortable state to which the invalid had long been a stranger. Even inveterate skin affections the history of which points to a congenital origin, and incurable, in the permanent sense of the word, may, nevertheless, receive much benefit from an occasional resort to this remedial agency."

BOILS AND CARBUNCLES.

Dr. Birch also records "its occasional singular value in unmanageable boils and carbuncles." He was able "under the influence of oxygen," and "where every other known means had failed and the patients were apparently in a hopeless state," with "rapidly spreading ulcers and sloughing even of the worst description," as well as "slowly progressing senile gangrene, to get the best of results"; his experience with oxygen in such cases warranted him in expressing to the profession his conviction to the effect that "not a few fatal cases of these difficulties might be prevented, were oxygen administered at the right time and with sufficient care."

That the whole range of surface ulcers and gangrenes may, under given conditions, be favorably subjected to applications of oxygen gas is, we think, beyond reasonable question. Of course the treatment may, if not rightly given, excite rather than allay inflammations. Envelop an abrased or ulcerous limb in some kind of "rubber sleeve" and introduce the gas into this sleeve, and the chemical action of the contact will inevitably produce excitement. But apply the gas without such envelope freely and openly upon the surface of the diseased parts and such application may be very salutary.

In the external application of oxygen there would seem to be no doubt that it has power to resist the progress of tissue destruction, to subdue inflammations, and materially aid in the work of restoration to a natural state. "Dr. Goolden," says Prof. Phillips, "has recorded several severe cases of phagedenic ulceration" in which this use of oxygen was successful. He especially notes one of severe throat affection in which the treatment was phenomenally successful. So profoundly convinced is Dr. Goolden of the great value of oxygen applications to gangrenes and ulcers that no longer ago than 1879 and as recently as 1886 he has advocated its use in strong though conservative papers in the London Lancet. Dr. B. W. Richardson, after declaring his opinion to the effect that oxygen is indicated in many acute, sub-acute, and chronic diseases, in chronic and sub-acute rheumatism, in scrofulous tumors, in paroxysms of whooping cough, in chronic bronchitis with dyspnœa, and in phthisis (early stages), and dyspepsia, distinctly says, "It is useful as an antidote to the narcotic poisons and as a local application to gangrenous ulcers."

Maurice Raynaud ably discusses the whole philosophy

of the production and procession of gangrenes, and concludes that the want of oxygen sustains, as much as anything, the existence and continuance of the "lesion." It was, however, left for another—Langier—to do what Raynaud did not do, namely, suggest the use of oxygen and to make application of it directly to the affected parts; and he found such applications successful in relieving the pain, reducing the inflammation, and in eliminating and measurably or entirely curing the difficulty. The professional reader is referred for further truth of this sort not only to Demarquay but to Bull's Therapeutics.

SCROFULOUS DISEASES.

In strumous and scrofulous subjects Dr. Birch proved the great advantage of resort to oxygen-treatment, and this, too, in cases "where all the usually anti-strumous remedies had failed." He says, "It ought to be regarded as a *sine qua non* whenever glandular enlargements and ulcers and vascular congestions, internal or external, have been found unmanageable or incurable under ordinary treatment with the best hygienic regulations, while, for example, pulmonary consumption in strumous subjects affords a special example of the positive necessity of oxygen, if such disease is to have a fair chance of cure." Nearly a century ago Dr. Alexander Thomson, an eminent medical author and practitioner, wrote in a published work of his on the "Prevention and Cure of Disease" these words: "The most extraordinary instances that we meet with of success in treating scrofulous trouble are some cases in which the inhalation of vital or super-oxygenated air has performed a perfect cure after all the usual remedies had been tried to no purpose. This unexpected discovery is of singular im-

portance and if fully ascertained by a greater number of trials will serve to extirpate a disease which has hitherto generally baffled the utmost efforts of medicine."

HEADACHES AND NEURALGIA.

These, says Dr. Birch, as well as "other nerve affections of the most persistent kind, will often succumb to oxygen, either alone or with gentle adjuncts, suitably prescribed. In a few instances even intense, long continued suffering has yielded in a few days." We can but feel that in the whole range of nerve disorders the oxygen-treatment has a large and legitimate field, and that its wider use would avail to subdue many of these ailments which are now, under the usual courses of treatment, mostly intractable. This feeling grows out of our experience for several years in the administration of the gas in a variety of nerve-disturbances. Having witnessed its power over these disturbances, even in their severity and long continuance, we could not, if we would, doubt that the oxygen-treatment is, as a rule, distinctly indicated, and is for the debilitated nervous system a valuable therapeutic. Birch records several cases of both acute and chronic neuralgia which resisted other treatment and yielded to this, and Dr. Hooper had a similar experience. "Oxygen," says Dr. Richardson, "is a remedy for all excess of nerve-action."

"Oxygen can," says Dr. Birch, "in many susceptible temperaments and in certain diseased conditions, exercise a peculiarly powerful influence rarely met with in persons enjoying perfect health, and by taking advantage of this peculiarity many cases will quickly undergo a change for the better, where the most enlightened and judicious treatment had previously failed to produce any

beneficial effect." There can be no doubt of the power of oxygen inhalations to strengthen the nerve-tone and favorably disturb the nerve-centers.

DERANGEMENTS OF THE LIVER AND SPLEEN.

In such derangements and especially where there is "congestion of the portal and mesenteric veins and tendency to piles," Dr. Birch found oxygen treatment "strikingly exemplified." "Many cases of these difficulties," he says, "which prove either very troublesome or fatal might be cured with the timely and judicious agency of oxygen." He records "an extreme case" which was a wonder to himself. The case is reported *verbatim* under Clinical Exhibits.

TONIC DISEASES OF THE HEART.

In these diseases Dr. Birch found oxygen "a remedy of high value," though sometimes, because of evident contra-indications, he advised care in the selection of subjects. He says, "Fatty degeneration, relaxation of the muscular walls, dilatations, and passive congestion are the abnormal conditions in which oxygen will usually be found to yield the most satisfactory results. It has been the means of saving several apparently hopeless cases with death impending, where all stimuli had become useless or worse than useless."

He makes extended notes of a case which he calls a "clinical curiosity." In his own language the case is this. "Nearly a dozen years ago a lady, aged 48, came under my care, with all the symptoms of fatty degeneration, dilatation, and passive congestion of the heart, in a puffy relaxed subject, possessing flabby muscles with large deposit of loose, interstitial fat. She was kept alive

for three years under my frequent observation by a dose or two of oxygen almost daily. On many occasions, during this patient's treatment, the heart's action, capable of only partial and temporary restoration from collapse by brandy and other stimulants, began instantly to revive under the influence of oxygen. She lived by exercising great care, avoiding much physical exertion and inhaling almost daily, according to circumstances, from fifteen to forty pints of oxygen in thrice the quantity of atmospheric air; a good example of direct super-oxygenation. During the latter half of the three years healthy nutrition and power (cardiac and general) were regained step by step, and then was afforded a remarkable proof of "*that singularity of action and peculiar development of potency under altered conditions of the animal economy which it devolved upon me originally to urge* in opposition to authority. The patient after requiring such large doses for so long a time, and feeling pleasure as well as surprising benefit therefrom, became quite intolerant of the full dose, undue cardiac excitement and uterine irritability following any dose beyond from two to four pints, and then the minimum quantity being borne with advantage only in alternate doses. Thus was also offered some testimony of the groundless nature of the fear often expressed that oxygen, if used for any length of time, would lose its influence."

Pepper says, "Defective oxidation in whatever way brought about seems the common factor in all forms of fatty degeneration." Where there is a "special proneness to fatty degeneration of the heart muscle" he positively says, "So great is the need of an abundant oxygen supply that it early feels any deficiency and in consequence is the first muscle to show nutritional changes."

Because of this it is easy to see how valuable might be the work of artificial aeration.

BRONCHITIS.

"Chronic bronchitis and congestion of the lungs are," says Dr. Birch, "it is almost needless to say, pathological conditions peculiarly indicative of the use of oxygen by inhalation, ordinary means failing to cure. Many a valuable life on the very point of being extinguished from bronchitis or congestion of the lungs might be saved by properly detailed management with oxygen, all other means proving futile. Sometimes I have been inclined to wonder why life has been permitted to slip away without even a trial of oxygen. Not unfrequently my opinion has been requested when too late, even where twenty-four or forty-eight hours earlier would probably have sufficed to save the patient."

ASTHMA.

In asthma or in asthmatic asphyxiation there is a very general, almost a unanimous, concurrence in the opinion that oxygen may be relied on. Such men as Beddoes, Poulle, Stoll, Marching, Chaptal, Thornton, and others made frequent use of oxygen inhalations in asthmatic cases, and with large success. Indeed, the treatment relieved or cured in most of the cases. "What more rational," says Trousseau, "than to offer a purer and more vivifying air to the unhappy patient who inspires so little oxygen and becomes asphyxiated?" "An attack of asthma," he says, "is an affection very suitable for the use of oxygen." There may, of course, be reason in the nature of things to doubt the exceptional value of oxygen inhalations in hard cases of humid asthma, but even then it may sometimes avail to bring relief. Trous-

seau records a case of asthma treated by oxygen inhalations and with remarkable, yea, almost phenomenal success. It was that of a young woman who suffered annually about mid-summer with the disease. He was called to her in the night and found her suffering severely from asthmatic suffocation. Gradual inhalations of oxygen were resorted to, and in a half hour relief came. The respiration was reduced from 40 to 18. The pulse, which was slightly accelerated, remained about the same, save that it became ampler and stronger, and in an hour the asthma had subsided and the patient was soundly asleep. He followed up the treatment for several days until conditions of permanent relief were established. The dyspnœa ceased, the suffocation was overcome, the respiration became normal, and the pulse asserted its energy and power. We are not surprised, then, to find him saying, "There are few remedies which give hope of such speedy relief in asthma as oxygen."

Dr. Birch says, "In asthma there will be found a fair percentage of cases in which oxygen can cure or greatly relieve. As a rule the subjects most benefited are those in which we can trace no congenital or hereditary predisposition, and where the affection owes much of its origin to chronic bronchitis or partial congestions and indurations of the pulmonary parenchyma."

Dr. Solis Cohen thinks this disease is that where oxygen is specially indicated. Phillips gives an interesting case reported by Dr. John Hooper. The patient was 52 years old and had been for a long time afflicted with asthma, suffering periodical paroxysms that would yield to nothing but oxygen inhalations. Under these, however, he found rapid and wonderful relief in greater mobility of the ribs, in increased power of inspiration, and in the disap-

pearance of lividity. Demarquay, in his "Essay on Medical Pneumatology," page 725, reports the case of a young man "subject from childhood to asthmatic attacks which ceased as if by magic as soon as he began to inhale oxygen." Secretary Stanton's case is well known. Under the directions of Surgeon-General Barnes he took daily inhalations of oxygen and they never failed to arrest the dyspnœic spasms and give relief. Dr. Ehinger reports the case of a woman 60 years of age afflicted for thirteen years with asthma complicated with emphysema, a very bad case. The patient had to sit nights propped up in a chair. She could not walk far nor go up stairs without being all out of breath. There was at times great derangement of the stomach, so much so that it would not tolerate either food or water. She could not, because of her coughing, sleep nights. Dr. Ehinger gave her oxygen, home-treatments sent out in rubber bags, not a very good way to administer the gas, certainly not the ideal way, yet spite of this the woman began at once to improve, and continued to improve until, at the expiration of the third week of treatment, she "often slept through the whole night without coughing, and this too in bed instead of in her chair as formerly." He continued the treatment for two months, during which time all the symptoms improved and "almost every trace of asthma" left her.

ALBUMINURIA.

Many observations have been made testing the effect of oxygen inhalations in albuminuria. Eckart made several and with a uniform result of marked cessation. Trousseau gives us an interesting case, a form of Bright's Disease (see "Treatise on Therapeutics," Vol. III., page 232) in which oxygen inhalations brought about the best

results. However, after a time, the bad symptoms re-asserted themselves and the patient died. But when we learn that the patient had been previous to treatment afflicted with severe cerebral disturbances, we are not surprised that, though oxygen-treatment "stopped the albuminuria in one month" and "brought back the appetite and strength for a time," yet at last the patient succumbed. However, Trousseau, notwithstanding the limited experience of himself and others with oxygen gas in these cases, and notwithstanding the partial and unsatisfactory results, thinks well enough of it to recommend its use.

Dr. C. Paul reports several cases of Bright's Disease treated by oxygen inhalations with partial success. A remarkable case is reported in the Medical Record for March, 1879. The victim was a patient of Dujardin Beaumetz, and he was in the "last stages" of the difficulty. Oxygen inhalations, as a kind of *dernier ressort*, were administered and with marvelous results. In twenty-four hours the excess of albumen had disappeared, and when the case was reported, two weeks afterward, the patient was holding his own.

Pepper recommends, in connection with other treatment for Bright's Disease, "the daily inhalations of oxygen gas," and says, "it is of very great service." An evident reason for this is, as Dr. Kollman of Munich says, that the quantity of uric acid in the urine is rapidly diminished by the use of oxygen.

PNEUMONIA.

There is no doubt that oxygen is definitely indicated in this treacherous disease, and that, if seasonably resorted to, many cases otherwise fatal might be saved. A

reverend gentleman writes to us giving the substance of his family physician's opinion of oxygen-treatment for pneumonia. "If the pure oxygen could be utilized he had no doubt it would be a good thing in certain diseases, instancing pneumonia, when, in consequence of a temporary incapacity of the diseased lung to discharge its function, the blood is poisoned and the patient succumbs. If in some way the blood might be artificially vitalized until the organ recovers its normal tone, the life might be saved." The Medical Record for November, 1885, reports the address of Dr. E. G. Janeway before the New York State Medical Association. In this address Dr. Janeway gives it as his opinion, based upon personal experience, that oxygen inhalations are of "great value in many cases of pneumonia," though he is careful to say, "they should be taken at the very commencement of cyanosis," and that when "begun later, after cyanosis is fully established, they are less useful." He recommends the continuance of the inhalations as often as the "blueness of the skin appears."

In the Lancet of March, 1866, Dr. Golden reports an interesting case of pneumonia treated with oxygen inhalation and which was in four days substantially cured. Dr. Andrew H. Smith speaks of his knowledge of a case of "circumscribed pleuro-pneumonia" which was aborted by oxygen inhalations in the short space of "36 hours." Dr. Frauenstein gave Dr. Smith notes of "a case of pneumonia in a child of two years," in which the whole "lower half of the left lung" was involved. Dr. Smith says of this case: "The disease was ushered in by convulsions so persistent and severe as to require the use of chloroform. This agent, however, produced alarming depression and oxygen was resorted to to correct its ac-

tion, which it did very satisfactorily, but only to open the way for a return of the convulsions. Chloroform was therefore repeated and its action kept within safe limits by the oxygen until the tendency to convulsions passed away. The oxygen was then continued, until at the end of three days, the inflammatory products had become almost entirely absorbed and the pulse, respiration, and temperature had fallen, and the child desired to sit up. At this time, however, a relapse took place and the whole of the lung became involved. Oxygen was again resorted to to the extent of from thirty to forty gallons daily, of which, however, a portion was wasted, as is necessarily the case in giving it to a child. Treatment otherwise expectant and supporting. In two days the patient was considered out of danger, and thenceforth the convalescence progressed steadily." He also refers to a case of Dr. Butler's, of New York, reported in the New York Medical Journal, and says of it: "It is a very interesting case of chronic pneumonia in which the deposit was rapidly absorbed under the use of oxygen."

"In his recent dangerous illness (pneumonia and bronchitis), Prof. Billroth, whose name as the great Vienna surgeon is almost as much of a household word among his English-speaking brethren as it is in Germany, after everything else that science could suggest had been done for his relief, appears to have derived much benefit from inhalations of pure oxygen. Under this treatment the dyspnœa diminished, the pulse became stronger, and consciousness returned."

Dr. Smith says: "In a case of double-pneumonia, therefore, I should not hesitate to employ it, nor should I allow any case of this disease, which appeared to be tending toward a fatal termination, to proceed without a

trial of its effect. The fear formerly entertained that oxygen would excite pneumonitis by its local action is refuted by its entire history as a remedy. Especially in the typhoid form of pneumonia I should expect to get great benefit from the gas." And yet, in the face of all this evidence of the power of oxygen gas to prevent or overcome the degenerative processes of pneumonia, there will be, it may be feared, physicians who will not use it and who, for lack of it, will allow their patients to die.

DIPHTHERIA.

J. Solis Cohen, in his valuable work on "Inhalation in Disease," refers to several cases treated by Beigel with alternate inhalations of oxygen and nebulized fluids. "One of these," he says, "was that of a child six years of age who was cured by the inhalation of oxygen gas, one gallon morning and evening, and the inhalation of a solution of the tincture of chloride of iron, ten minims to the fluid ounce of water, a remarkable alteration in the patient's condition being perceptible after the *first inhalation of oxygen*." Another case was that of "a very severe case of diphtheria after small-pox, with exudation lining the whole pharynx, laryngeal implication, suffocative paroxysms, and so forth. The patient, a boy ten years of age, was seen by Dr. Beigel on the fourteenth day of his illness, after the administration of calomel for six days had afforded no relief. The case was treated by inhalations of the spray of hot water, afterwards of lime water, and subsequently of tannin, oxygen being administered to relieve the suffocative attack with complete success and being continued twice a day as long as requisite, the combined treatment resulting in cure."

Dr. Beigel thought that the septicism connected with

diphtheria and standing so much in the way of successful treatment could be best prevented or overcome by oxygen, while, at the same time, it would serve to arrest the "danger of death by apnœa." Dr. A. H. Smith states a case which he saw in connection with Dr. Elliot, and in which "inhalation of oxygen was of great service." "The patient, a child two and a half years old, presented well-marked diphtheric croup. The dyspnœa, which was very decided, was greatly relieved by the gas, and it was Dr. Elliot's opinion, as well as that of other gentlemen who saw the case, that the oxygen also aided materially in overcoming the tendency to death by asthenia, and that without it a fatal termination would have been inevitable. The inhalation was kept up almost continuously for a week, the last three days only as a tonic, the tendency to asphyxia having ceased on the fourth day."

Ehinger reports a case of "diphtheria with scarlatinoid eruption." "The pulse," he says, "was too rapid to be counted, but seemed about two hundred." He administered oxygen "and in twenty-four hours the eruption had entirely disappeared and the pulse had fallen to one hundred and twenty. The fourth day the child sat up and ate. No other treatment except local."

Dr. Frauenstein, in a letter to Dr. Smith, refers to a case of his own, a case of diphtheretic scarlatina, accompanied with delirium and angina. He treated it with large doses of oxygen, which never failed to subdue the delirium and induce sleep. The oxygen he administered daily for about a month, and there was no accessory treatment save wholesome nourishment and local applications of chlorate of potassia and carbolic acid.

Vogelsang, so late as 1886, suggests the inhalation of

oxygenated water, and makes mention of two cases which under the treatment rapidly recovered, the false membrane sloughing away and a good appetite coming.

Pepper says, "Ozone has been used as an anti-fermentative in inhalation during four or five minutes every hour or two" in cases of diphtheria.

CROUP.

In membranous croup, in catarrhal and diphtheretic laryngitis, Pepper says, "The inhalation of oxygen has proved rather advantageous in my hands in a few instances." The case of a child is given "upon whom tracheotomy had been performed." The invasion of the bronchi by the "pseudo-membranous process" produced dyspnœa, cyanosis, and convulsions. Upon the introduction of oxygen into the lungs these would cease, to appear again when the inhalations were stopped. "It is my firm conviction," says Dr. Andrew H. Smith in his "Essay on Oxygen in Disease," "that oxygen will do in most cases of croup all that could be done by tracheotomy, but neither the one nor the other is competent to undo the mischief wrought by severe and protracted dyspnœa."

He, however, adds the caution to use it as the knife should be used, "early," and not to resort to it "only at the last minute, as if it were a more desperate remedy even than tracheotomy." Cohen and others express serious doubts, amounting well nigh to positive non-concurrence, in this view of Dr. Smith. It is, however, worth our attention, for it would seem on general principles to have some warrant in the natural power of oxygen over diseased membranes.

Beigel, in his work on "Inhalations," makes note of a

case which would seem to support measurably Smith's opinion. It was a severe case, and the usual modes of treatment had all failed. At the time oxygen inhalations were begun the patient's pulse was too frequent to be counted, the lips were livid, respiration forty per minute, and the face pale and convulsed. Oxygen was given with immediate improvement. Under the influence of it the child fell asleep and waked to gradual improvement and ultimate recovery.

J. M. Bleyer, M.D., records that he makes large use of oxygen in laryngeal intubation. He says: "Up to this date I have operated in seventy-nine cases of intubation of the larynx in croup and diphtheria. In twenty-nine cases I operated without the aid of oxygen. In the last fifty cases I have used oxygen inhalations prior to operation, to prepare my patients, and find that, whereas I could not work in the passages longer than eight to ten seconds without producing an alarming degree of asphyxiation, I can now prolong a single effort to as much as fifty or sixty seconds without serious trouble. I consider the use of oxygen prior to and after the operation of intubation so indispensable that I now peremptorily refuse to operate without its aid. My record shows a decrease in mortality of fifteen per cent. since I began its use."

RECTAL INJECTIONS.

These have been recommended on good authority as a valuable treatment in phthisis. Dr. Kellogg employed them successfully in lethiasis, and in his judgment they might be substituted in a "variety of diseases" for pulmonary inhalations. These injections insert the gas by absorption into the "portal blood" and so act directly upon the digestive and hepatic functions. Dr. Kellogg

is of the opinion that the absorption of oxygen during these injections was much greater than takes place by any process of inhalation. (Therapeutic Gazette, Sept., 1887.)

BRONCHIAL DILATATION.

"There is," says Trousseau, "only one observation of bronchial dilatation treated by inhalations of oxygen." The case is one reported by Cosmao-Dumenez in Demarquay, and in this case Trousseau suggests the inconclusiveness of the observation "as regards diagnosis." Whether there be any just reason for this depreciation of the case or not, one thing we know, both appetite and strength came to the patient under the oxygen inhalations, and the sputa changed from a purulent abundance to that which was proper in quantity and wholesome in character.

DIABETES.

Bouchardat, Limousin, Demarquay, Birch, and others report cases of diabetes successfully treated by oxygen inhalations. Limousin found that under the oxygen-treatment there was a large diminution of the "proportion of glucose," and consequently a corresponding improvement in the general condition of his patients. Bouchardat and Demarquay both proved the value of oxygen in cases of consumptive diabetics. The improvement in one of Demarquay's patients was so marked that he says, "The family thought him cured." Trousseau does not speak of his own experience, because, as he says, he has none, having never "given oxygen to diabetic patients." But he knows of no experiments, not even those of Voit and Pettenhofer, that "form a contrary indication," and he concludes from all his researches that, as diabetics absorb less oxygen than people

in health and give out more urea, "this is surely no reason for not giving a diabetic person more oxygen than the external air supplies him with." Dr. Birch says: "Diabetes as a result of a derangement of nerve-function and nutrition affords an example of a disease in some cases of which oxygen ought to be employed before the supervention of extreme symptoms."

There are many cases on record where oxygen inhalations have availed to give marked relief, though in most of them there is no evidence of conditions of permanence. Phillips makes mention of five cases in all of which there were strong symptoms of dyspnœa and cyanosis. He says that "oxygen inhalation certainly relieved for a time the symptoms mentioned, although it did not in any instance reduce the sugar in the urine." Others have succeeded better. Dr. Howard Pinkney reports two cases in both of which "the urine was excessive in quantity and high in specific gravity," in one over 1,040, in the other over 1,050. "Both," he says, "improved rapidly under the use of oxygen gas," and he specially notes the "lowering" in both cases of the "specific gravity," and a "rapid decrease in the amount of sugar." He reached in both cases substantial conditions of permanence, and for many months after oxygen inhalations had been discontinued the results still held. Dr. Pinkney himself was rather surprised at this. The reason why sea air is good for diabetics, Demarquay thinks, is the fact that it cannot be breathed without breathing a large quantity of oxygen. He records that he reached the best of results with several diabetic patients by oxygen inhalations and that too with no dietetic change. The quantity of sugar in the urine very perceptibly diminished, and while there was a notable

reduction of the corpus, there was, at the same time, an increase of life force. He recommended several of his medical *confreres* to use it, which they did with no little success. Demarquay is, however, frank enough to confess that in his opinion oxygen inhalations after all acted only or mainly upon "the symptoms of the disease"; "but in the present state of science," he says, "what other treatment can we apply to diabetes since science has not determined either the nature or the real cause of the disease?"

VASO-MOTOR NEUROSIS.

In this disease, Pepper, in his "System of Medicine," mentions oxygen as definitely indicated, and says, "Oxygen inhalations are of service."

MEDICAL USES.

Concerning the medical uses of oxygen we gather from the "National Dispensatory" substantially these facts. In chronic bronchitis and other affections of the respiratory organs attended with symptoms of asphyxia, the inhalation of oxygen has certainly appeared to prolong and even to save life. This has been demonstrated in asphyxia from emphysema with bronchitis, in laryngitis of various forms, in compression of the lungs by the gravid uterus, in opiate narcotism, in poisoning by charcoal fumes or by illuminating or privy gas, and in similar conditions. A case is recorded in which it seems to have saved the life of a child poisoned by a very large dose of carbolic acid. Its most striking benefits are observed when the gas is inhaled by dyspeptic chlorotic patients. It revives the appetite, quickens the digestion, and arrests vomiting if present, and consequently

increases the excretion of urea. Such is the testimony from Bull's Therapeutics to the value of oxygen, but Bull adds, "This improvement is not permanent unless iron is used as supplementary to the oxygen."

Dr. Richardson says, "Inhalations of oxygen in cases of tetanus are said to have caused profuse diaphoresis and muscular relaxation."

ACTION ON THE HEART.

There ought to be no fear of bad results from the administration of oxygen in cases of heart affection, provided proper care is had in the administration, the treatment is so very normal to the whole circulatory system and to the heart, the central organ of that system. A series of experiments made by different practitioners has fully established this. An experiment by Cyon is worth our attention. Taking the heart of a frog he made the double test of introducing into the cavities serum strongly impregnated with carbonic acid gas, and afterward with oxygen gas, and he found that the effect of the one was to stop the heart's beating and that of the other to restore it. Erichsen experimented on asphyxiated animals, and though at first he could get no results, yet afterward, using not atmospheric air but artificially prepared oxygen, he was able to re-excite "ventricular contraction." Whether or not the regular breathing of oxygen be indispensable to the action of the heart, one thing is certain, its right action without it is impossible.

In the Dietetic Gazette, April, 1888, Dr. L. C. Winsor, under the title of "Heart Foods," speaks of oxygen as follows: "It is a fact that tissue will absorb oxygen and give off carbonic acid without the intervention of

the circulation, and so we may believe that the proportion of oxygen is due simply to the demand of the cells, and not to any peculiar form of oxygen or any combination of it in the blood. The sluggish circulation of the blood in organic heart disease does not supply sufficient oxygen to the body, and hence the symptoms, dyspnœa, headache, fainting spells, debility, etc., which arise. A rational method of diet should not only include proper foods but also an increased supply of oxygen. We can see no objection to classing oxygen as a food and placing it permanently as such. (It may be classed as a fuel food, but as a tissue food it has no equal.) It is the basis of all tissue building. An increased supply of oxygen rather than a stimulated circulation, a saturating of the blood with oxygen rather than an increased supply of poorly oxygenated blood, is the *ultimatum* of diet in heart disease. The effect of this plan of diet will be to increase the supply of readily digestible tissue food and to furnish an abundance of oxygen, the agent which of all is the most valuable for tissue building. This done there will be but little left for drugs to accomplish.

LUNG DISEASES.

Sir Morel MacKenzie, in a paper printed in the London Medical Times and Gazette, Nov., 1865, on the "Treatment of Chronic Diseases of the Lungs by Inhalation," gives us a remarkable showing of the therapeutics of oxygen treatment. He mentions more than twenty cases treated during a period of less than four months, including ten cases of bronchitis, six of phthisis, and seven of asthma. In the phthisical cases the treatment was not positively curative but was in a direct way beneficial, inasmuch as it shortened the "intercurrent bronchitis."

In the bronchial cases positive and permanent cures resulted in eight out of the ten, relief came to one, and one was not benefited. The times of treatment ran all the way from six to forty days, the average time being less than sixteen days. A notable result in the phthisical cases, and he especially mentions four of them, was diminished expectoration and relief from pain and inflammation. One case of asthma that had defied the whole round of other treatments yielded with readiness to this. A case of "whooping cough" was immediately cured. To be sure these were not pure oxygen inhalations but medicated, yet they support the theory of the great value of treatment of disease by inhalation, and by logical consequence, as oxygen gas is beyond a doubt a valuable therapeutic, and as the best results are reached by oxygen inhalations in these ailments, they support the general truth.

HEART DEGENERATION.

William Pepper, M.D., LL.D., says: "Defective oxidation, in whatever way brought about, seems the common factor in all forms of fatty degeneration. The process may be almost confined to the heart or be more or less general in the solid viscera and voluntary muscles. The diaphragm is sometimes much involved with the heart. This is when the other muscles show no signs of the change. There seems to be a special proneness to fatty degeneration in the heart muscle, which may perhaps be associated with its incessant activity. So great is the need of an abundant oxygen supply that it early feels any deficiency and in consequence is the first muscle to show nutritional change."

FATTY LIVER.

Pepper mentions as a causative element "the formation of fat from the albumen of the hepatic cells in consequence of diminished oxidation." In the treatment of the liver when thus diseased this "consumption of oxygen" becomes then an "important factor." Inasmuch, then, as the liver from a connection of causes lacks a "supply of oxygen," and inasmuch as it is "also wanting in blood," the oxygen treatment would seem to be indicated.

GOUT.

Pepper, in his "System of Medicine," says: "The purely chemical theory of gout and diabetes, that they are diseases of sub-oxidation, a theory most ably defended by Bence Jones (see his lectures on some of the applications of chemistry and mechanics to pathology and therapeutics: H. Bence Jones, London, 1867), has much to commend it from the valuable suggestions which it affords in the clinical management of these maladies; but it must be acknowledged that while defective oxidation seems to be an essential factor in the production of gout and diabetes, it is impossible to reduce the process to the simplicity of a chemical equation." According to Garrod there may be and often is in the blood of a gouty subject, an excess of eleven one-hundredths grains of uric acid in the serum. One thing is certain, the anæmic condition often appearing in gout indicates a "marked diminution of red blood corpuscles," and so indicates oxygen treatment.

DYSPNŒA.

Of all known remedies for this distressing ailment oxygen inhalation must have the pre-eminence. It is in the

very nature of it to give relief and to make the conditions of that relief permanent, though of course the question of permanence depends upon so many possible relations and complications that too much emphasis should not be given to it. Biegel reports the case of a patient who could walk only a "few steps at a time" without being distressfully out of breath relieved by oxygen inhalations, though unable without their continued use to prevent the recurrence of the dyspnœic spasms. However, permanent good results ensued in reducing an enlargement of "one side of the chest," in diminishing the "area of tympanitic sound," and in increasing the respiratory power 1,050 cubic centimeters. Dr. Smith reports a case in the New York Medical Journal, 1869, in which oxygen inhalations relieved the dyspnœa, greatly retarded the pulse, and reduced the respiration from thirty-six to twenty. The relief with each periodic inhalation was transient, but each inhalation gave relief.

ASPHYXIA.

"Materia Medica and Therapeutics," by Trousseau and Pidoux, is authority for what follows. As early as 1776 Dr. Goodwin of Edinburgh treated asphyxia successfully by insufflations of oxygen gas. Subsequently Gorey of New Breisach, Van Marum of Haarlem, and one or two other contemporaneous celebrities, attempted a similar practice and would doubtless have succeeded had they properly distinguished between suffocation and strangulation. For the want of this they had only a narrow and comparatively transient success. Their misuse of oxygen gas tended rather to its disuse in asphyxia than otherwise. Demarquay says little of oxygen gas in asphyxia, though he does make mention of its therapeutical

value in cases of large glands that by pressing upon the trachea threaten suffocation. Trousseau is of the opinion that the lack of its use in "accidental suffocation" may be explained more by the fact that it is not usually procurable at the time than by any claim that it is not indicated. Indeed, he records a case of "asphyxia from pulmonary and cervical congestion" in which he used oxygen gas with eminent satisfaction. He gives us another case in which "asphyxia was complicated with an apoplectic condition," and resort was had to oxygen inhalations with, as he says, "still more signal service." It was a case of opium poisoning and the patient was seventy-four years old and much enfeebled. The first treatment resorted to was that of the injection of sulphate of atropia, accompanied "with black coffee." For a brief time this treatment seemed to avail to check the progress of the poison, but it was, if not all in the seeming, then all too transient and ineffectual, for in only a few hours afterward "the patient was in a state of coma and was thought to be lost." He marks the precise condition of the patient when he says, "The pulse was very rapid and hard, but full, and the respiration was only seven in the minute." Now mark what was done. "At this point we caused her to inhale fifteen liters (a little over two gallons) of oxygen; consciousness returned almost at once and she knew the bystanders. From that moment she improved and the next morning was out of danger." This one case, and there are many others, is enough to warrant the conclusion to which Trousseau comes, namely, "that oxygen ought to be tried in cases of asphyxia by suffocation."

Claude Bernard has shown very distinctly the character of what is known as "charcoal poisoning." It is not

technically considered to be asphyxia, but, to use Bernard's own words, "an intoxication by the oxide of carbon." This oxide intoxication of the blood does not facilitate the absorption of oxygen but rather the contrary, yet it has, in several cases of this sort, been successfully administered. Some of the most eminent physicians and surgeons agree in the opinion that it is definitely indicated in "all asphyxias." To refer once more to Trousseau, after stating the fact of Dr. Jackson's use of oxygen as early as 1847 in a case of ether-asphyxia of a patient of his in Philadelphia, he gives us a list of eminent names that belong contemporaneously in the same category: Blanchet, Fairre, Gianetti, Martin, Saint-Ange, but "especially Duroy and Ozanam," and while he cautions practitioners against undue reliance on oxygen inhalations in cases of overmuch anæsthesia by ether or chloroform, yet he says, "it is a resource which should not be neglected."

In the report of the committee on "Suspended Animation," made to the "Royal Medical and Chirurgical Society" of London in 1862, artificial respiration by "Dr. Sylvester's method is recommended." This report was signed by a number of eminent men, as follows:—

J. B. Williams, C. E. Brown-Sequard,
W. S. Kirkes, H. Hyde Salter,
George Harley, E. H. Sieveking,
J. B. Sanderson, W. S. Savory.

The "Scientific Committee" of this same Society, in their report on the "Uses and Effects of Chloroform," say that "the most certain means of restoring life after poisoning with anæsthetics is artificial respiration." (See proceedings of the Royal Medical and Chirurgical Society, Volume IV., 1864.)

Robert T. Edes, A.B., M.D., says : "After inhalation of various poisonous gases, such as coal, illuminating or sewer gas, oxygen may be of great value in facilitating the elimination of the toxic agent and sustaining life until the normal exchange of gas can go on again."

OXYGEN ACTIVITY.

Dr. Edes also says: "The extreme and universal activity of oxygen in the processes of organic life would, of course, as soon as this were known, suggest it as a therapeutic agent of the greatest activity."

Phillips gives to oxygen a wide range of physiological activity. "It is as essential," he says, "to respiration, sanguification, nutrition, and tissue-change as it is to life itself."

PART II.

ANÆMIA AND DYSPEPSIA.

Dr. Andrew H. Smith reports two cases in both of which oxygen treatment gave satisfactory results. One was the case of a patient brought to him by Dr. P. Hirsch. He had given him, with only partial satisfaction, quinine and iron. Dr. Smith put him on oxygen—about four gallons a day—and in ten days his pulse had been reduced to nearly a normal one, headaches had disappeared, strength increased, and conditions of permanent convalescence had been established.

The other case was that of a young man seventeen years of age and of phenomenal overgrowth. Recovering from a "malignant pustule," articular rheumatism set in and he suffered with it for a half year. The in-

flammation had been subdued and yet there was constant pain in the joints and a troublesome stiffness "in the right hip." In this condition he began oxygen treatment. The record says: "He was pale and anæmic, with pulse at 108, and so feeble that it would be lost every few seconds and the counting have to begin anew." In less than a month—four gallons daily—oxygen inhalations effected a cure and returned the man to his accustomed business.

In a case of leuchæmia, Kirnberger reports that "after the failure of arsenical treatment, inhalations of oxygen produced a rapid increase of strength, with diminution of the swelling of the spleen, the red globules regaining their normal proportion. After a few months a relapse took place, but, although the red corpuscles were diminished, the white were not increased—a pseudo leuchæmia. Finally, arsenic having failed again, the oxygen inhalations were again resumed and resulted in a definite cure."

Dr. Edes says: "In some conditions of anæmia and dyspepsia oxygen has seemed to have a beneficial tonic effect, which may, under certain conditions, be made permanent."

Dr. Smith quotes an entire paragraph from an article by Hanfield Jones on the "Functions and Diseases of the Liver." The paragraph is this:—

"The oily contents of the hepatic cells are subject to great variation both in individuals and in different classes of animals, the less perfect the type of the respiratory process the greater the quantity of oily matter in the hepatic cells. This statement suggests the inquiry how far fatty liver may be owing to defective hæmatosis. May it not be that the confinement which produces the *foie gras* so delicious to the epicure acts by preventing

the reception of a due proportion of oxygen into the blood? Surely the 'type of the respiratory process' under such conditions must be anything but perfect. In the human subject sedentary habits or improper alimentation may act to diminish the capacity of the blood to carry oxygen, and thus a condition of the respiratory process be produced approximating to the type of those classes of animals in which the hepatic cells are normally loaded with fat. Accepting this hypothesis, the systematic use of oxygen ought to be beneficial in such cases."

Trousseau, "whose knowledge," says Ehinger, "of the resources of therapeutics has rarely if ever been surpassed,"—a remark in which we shall all concur,—speaks in high praise of oxygen in the treatment of dyspepsia. He records that in several instances it availed to "recall to life women regarded as lost," overcoming the depression of the digestive powers "consequent upon puerperal hemorrhage or excessive lactation." He gives an example in the case of a young mother, which will be found in his Clinical Exhibits.

There are several cases reported by Demarquay of the successful treatment by oxygen inhalations. There can be little doubt, as Birch suggests, that it is directly in the nature of oxygen inhalations to reduce the congested liver and so overthrow one of the principal causes of dyspepsia. Birch, too, records several cases of his own. See Clinical Exhibits.

"One thing noted by all the experimenters with the gas," says Dr. Ehinger, "from Priestley down to those of the present day, is the decided and beneficial influence which it exerts upon the digestive system. It stimulates the appetite, improves digestion, and induces healthful and regular action of the bowels."

KIDNEY DISEASE.

Having given directions for reducing the dropsy, Dr. Pepper says: "For the anæmia iron given by the mouth combined with daily inhalations of oxygen gas is of very great service."

INSOMNIA.

Dr. William A. Hammond, in his valuable monograph on "Wakefulness and the Physiology of Sleep," lays down the principles that should prevail in the treatment of insomnia, and though in the application of these principles he makes no mention of oxygen, yet such mention would be as germane to these principles as that he makes of food and water, of potassium and opium, of hydrocyanic acid and valerian, and assafœtida, and all the anti-spasmodics. These principles, as stated by him, are in substance as follows, that is, they include only such remedies as may be calculated to soothe the nerves and strengthen the nervous system, or so act upon the circulation as to correct irregularities, especially to relieve the brain of congestion. To do this is the very natural and essential power of the oxygen treatment, as has been in hundreds of cases clearly shown. Dr. Andrew Baylies says, "I exercised my brain last evening to a late hour, and instead of taking a dose of bromide, as I usually have to do under such circumstances, I took your treatment for insomnia. The result was I slept well all night and felt sleepy until late in the afternoon."

ASPHYXIA.

Our best medical authors agree that where asphyxia results from poisonous gases, resort should be forthwith had to inhalations of oxygen gas. There is here, on the

part of all the authorities named, with perhaps a single exception, in the directory, a substantial agreement.

The British Medical Journal gives the substance of a case reported by Dr. Charles B. Ball. Three persons were asphyxiated by inhalations of coal gas. Two of them on being exposed to the atmosphere recovered, but the third, notwithstanding all the efforts put forth to save her, still remained unconscious, and there seemed no help for her, though she was finally restored by inhalations of oxygen, at first slight inhalations of pure gas and then larger doses of diluted gas. Prof. Phillips well says, comparing such a case as this with certain other cases of gas-asphyxia differently treated and fatal, "If we compare the result in Dr. Ball's case we shall better realize the importance of using oxygen in preference to other measures." He adds in this connection a further word, to the effect that in all forms of asphyxia artificial oxidation "offers the best means of saving life." Rosenthal, Leube, Ananoff, as well as others, have proved by unimpeachable experiments that the whole range of phenomenal blood poisons may be effectually counteracted by timely inhalations of oxygen.

Dr. Simeon Abrahams reports the case of "a young man attached to the laboratory of the New York Medical College, asphyxiated from the inhalation of the vapor of chloroform, and so far had its effects been carried that he became pulseless and all hopes of his resuscitation abandoned, and, as all the usually recommended remedies had been tried without success, nothing but the death of the young man was looked for, when I proposed as a *dernier ressort* the application of pure oxygen gas as the only chance by which resuscitation could be brought about; but at the time the proposal met with

opposition from the medical men present, who were anxiously watching what seemed to be the expiring efforts of the poor boy, expecting each moment to be his last. Having, however, consented, the gas had not been more than a few seconds applied to his nostrils when he, who was apparently beyond the help of human aid and absolutely *in articulo mortis*, arose and placed himself upon a chair, proving most conclusively how correct I was in proposing an application of oxygen gas as a remedy against the deleterious effects of chloroform as an anæsthetic."

OXYGEN USE.

Giving the views of Demarquay, Dr. Cohen says: "Oxygen is indicated in anæmia and many of the affections with which it is associated, such as chlorosis and dyspepsia. Asthma is the affection for which it is most frequently prescribed. In acute phthisis with fever it is contrarily indicated on the ground that super-excitation of the nervous and circulatory system is injurious. But in the earlier stages associated with dyspepsia and impaired appetite, its effects are beneficial. It has been of service also in dilatation of the bronchi, in chlorosis, and in many cases of cephalalgia."

"Demarquay thinks oxygen will be found of service in typhoid and intermittent fevers, in neuralgia, paralysis, and other affections of the nervous system. As the result of his extensive clinical experience he recommends inhalations of oxygen in all chronic affections associated with debility, dyspepsia, and anæmia, an enumeration of which it is needless to repeat. In most of this experience, however, oxygen was not administered as the direct curative agent but as part of system-

atic treatment for its use in surcharging the tissues with oxygen and facilitating the combustion of the elements of excretion."

He further says: "Almost all writers on oxygen cite its use in anæmia, chlorosis, asthma, emphysema, and the pretubercular stage of phthisis. It has also been used in diphtheria. Dr. Francis used it with advantage in a case of malignant scarlatina with diphtheretic exudation of the throat."

Concerning the value of compressed air, the very essence of oxygen treatment, Dr. Cohen says: "Inspiration of compressed air is indicated in dyspnœa of almost every origin, in the chronic stages of pleurisy and emphysema, in certain conditions of consumption, in bronchitis, asthma, emphysema, inflammatory stenosis of the air passages, asphyxia, insufficiency of the mitral valve, and in stenosis and insufficiency of the aortic valves.

"The physiological effect of compressed air being to drive the blood from the periphery, it follows that congestions, tumefactions, inflammations, excessive secretion, and the like, at the peripheral portions of the circulatory system, should be relieved by subjection to the treatment. The ease afforded to respiration suggests its employment in cases in which dyspnœa is associated, and we find its chief application, in fact, in pulmonary emphysema, asthma, and chronic bronchitis. The augmentation of vital capacity of the lungs acquired by the process suggests its employment in cases of insufficient expansion of thorax and therefore in non-febrile cases of phthisis and tuberculosis."

POISONING.

Ranking's Abstract, 48th vol, reports a case of opium

poisoning from Dr. Const. Paul, in which oxygen gas "was successfully used, after atropia had failed and when the patient appeared to be dying, and another in which it was successfully employed in narcosis from charcoal gas."

Prof. John Law says, "Under certain conditions the exposure of the anthrax germ to the free action of oxygen determines its death." Says the Sanitary Era, "The deadly potency of germs depends on a geneological privation of oxygen and is overpowered by propagation for a few hours in full exposure to the oxygen of the air." Pasteur says, "The oxygen of the air thus appears to be the cause of modification of the virulence of the microbe." Dr. Campbell says, "In cases of opium poisoning it is simply necessary to keep the lungs supplied with oxygen. This one condition will save nearly every case." "Recent observations," says the Scientific Miscellany, "confirm the observation of Laveran that blood drawn from the fingers of patients during a febrile paroxysm contained parasitic infusoria. Osler and Councilman have found all the forms described by Laveran, and in recent researches, in which the blood was obtained directly from the spleen, the flagellate form was almost constantly found."

"The best way to destroy these infusoria is to superoxygenate the blood, and for this what is known as the "oxygen-treatment" is, when wisely administered, invaluable."

RHEUMATISM.

Something should be said of another disease not specially named, with perhaps a single exception, by any of the authorities mentioned in this work, and yet the treatment of which by oxygen inhalations is, from a

scientifico-medical point of view, distinctly indicated. This disease is rheumatism.

A principal cause of rheumatism is the presence of uric acid in the blood and the muscular tissue. Pepper, in his "System of Medicine," says, "It has been supposed, as one atom of uric acid can be split by oxidation into two atoms of urea and one of mesoxalic acid, that uric acid was the penultimate of urea, the result of a lower degree of oxidation." If this be so, a higher degree of oxidation would result in a diminution of uric acid and so would be likely to reach and remove the chief cause of rheumatism. Practically this is what it does. We may be allowed to record in a word our own experience with oxygen in rheumatism. We have successfully treated not a few hard cases. We will not take the reader's time nor tax his patience to make showing of them in progressive detail. One case was that of a married woman who, when she began the treatment, had been confined to her bed for six weeks with inflammatory rheumatism. She suffered constantly and could sleep but a few minutes at a time, and had to be moved every hour both day and night. Up to this time, her leg had been all the while, from the knee to the foot, wrapped in cotton batting and flannel, and bottles of hot water kept near it, and yet it was cold and she often had chills. After one week's use of oxygen the leg was warm enough without artificial heat, and the chills were less frequent. In two weeks the pain was gone except when being moved, and she was able to lie without being moved from 10 P. M. until 7 A. M. From this point onward she continued to gain, her general health improved, and though now lame from the effects of the inflammation, yet her health is good and she goes and comes

much as do other people. It is three years since she began the oxygen-treatment.

Another case is that of a man for several months so afflicted with rheumatism that it was a task for him to get about. He began oxygen inhalations Dec. 16, 1885. Six inhalations, one each day, relieved him of all pain, and within a month he had no sign of rheumatism, and has had nothing of it since.

Another case was that of a business man who had suffered with lumbago for many years. Six weeks' treatment availed to give him relief and since that his general health has been better than it had been for a decade before.

Another case was that of a lady suffering with rheumaatism confined to the lower extremities. Her feet were much swollen and painful in the extreme, and it hurt her to walk and her face was puffed. One month of home treatment supplemented with one month of office treatment reduced the swelling, relieved the pain, and enabled her to walk off as well as ever. The conditions of relief were substantially permanent.

Another case was that of a business man who had suffered for years with rheumatism, dyspepsia, and a complication of troubles. He had been, before taking the treatment, laid up for several weeks. He began the treatment with the understanding that if it did anything for him its work would be slow, but he resolved on being thorough. He kept up the treatment for four months with inhalations of from two to four gallons daily, and was himself surprised at the results. He steadily gained in strength and flesh and was completely cured of his rheumatism. In short, the treatment seemed to take hold of all his troubles and physically regenerate him,

and though that was more than eighteen months ago the good results still remain.

Another case was that of a young merchant whose rheumatism, in no sense chronic, was cured in less than thirty days, daily inhalations of about three gallons of gas.

Dr. Andrew Baylies records a case of a young man who came to him after having tried various remedies prescribed by his attending physician. He put him upon oxygen and in four weeks it effected a perfect cure.

TYPHOID.

S. H. Platt, A.M., M.D., reports "two cases of typhoid almost identical in general aspects. One, besides other remedies, I gave two bags of oxygen (U. S.) a day and he was up in ten days. To the other I gave one bag of oxygen (U. S.) a day and he was up in fourteen days. Both gave fair indications of from four to six weeks' run.

CHLOROFORM NARCOSIS.

Referring to Ducroy, J. Solis Cohen adopts his recommendation to the effect that "every patient awakening from a chloroform narcosis inhale oxygen in order to rid himself of headache and other inconveniences following the administration of that anæsthetic."

FREER RESPIRATION.

"The effect of inhaling considerable quantities of pure oxygen," says Dr. Ehinger, "varies greatly in different subjects. Some will inhale a number of gallons without any apparent effect. It usually, however, causes a slight feeling of warmth about the chest, which may or may not pervade the entire body, giving a sensation of

warmth to previously cold hands and feet. The respiratory movements seem to be accomplished with greater freedom. Occasionally a tingling is felt in various parts of the body, particularly in the finger tips."

HEALTHIER NUTRITION.

It is the opinion of Dr. Gustav Lange that "the efficacy of compressed air principally rests upon the blood being more richly supplied with oxygen, and that a healthier nutrition is the immediate consequence of it."

ACTION ON THE MUSCLES AND NERVES.

What Prof. Phillips calls the "musculo-nervous system" is, as we think, likely to be, in cases of average derangement, especially amenable to oxygen-treatment. Certain facts of experiment unmistakably point in this direction. Those of Brown-Sequard are among the best. By these he proved the power of oxygen gas to excite musculo-nervous activity, even where death had, for many hours, supervened. His experiments and those of others, which are matters of accurate record, go to show that certain debilities of the muscles and nerves may be, by the oxygen-treatment, mainly overcome.

ACTION ON NERVES.

"The performance of the functions of the nervous system is dependent upon the presence of oxygen in the blood, its deficiency causing an accumulation of carbonic acid and a state of coma."

CHARLES L. HOGEBOON, M.D.

FEMALE CONGESTIONS AND WEAKNESSES.

In "congestive diseases of female life," says Dr. Birch, "especially at the primary and secondary periods of cat-

amenial change and persistent relaxation and weakness after child-birth, oxygen has, even in complicated cases, given me perhaps more therapeutic success than in any other direction," and he refers, with special satisfaction, to his record of "selected cases." These cases are given in the "Clinical Exhibits."

Dr. Smith, in his "Essay on Oxygen in Disease," gives convincing evidence of the fact that in "fatty placenta" oxygen inhalations are distinctly indicated. He reasons forcibly that if Prof. Simpson's theory be correct and such cases should be treated with "chlorate of potassa," then oxygen should, in the nature of things, be a more powerful remedy. He says, "Once prove that the fœtus perishes from a deficient supply of oxygen from the maternal blood and the indication for oxygen-treatment is as plain as in croup or asthma." There can be little doubt that oxygen inhalation may be relied on to correct irregularities of menstruation. In several remarkable cases the best results have been reached. Birch reports one in which the patient suffered every month with terrible headache which came on two days before the menses and continued for two days afterward. During all this time the patient was obliged to keep in bed and remain in a darkened room, and this had been so for several years. Oxygen inhalations effected "a perfect cure."

Dr. Smith reports the case of a patient who had reached the climacteric with a sense of fullness about the neck and at the "base of the brain," with "paralysis of one side of the tongue and impairment of some special senses." Under a course of six weeks of oxygen "a complete cure" came.

An eminent practitioner mentions a single case of

"bronchial asthma, recurring with each menstrual epoch," "very largely modified" by oxygen inhalations.

We have treated cases of restricted and painful menstruation by oxygen inhalation with good results, subduing the pain, causing the evacuations to be more full and free, and gaining under continued treatment conditions of substantially permanent relief. A remarkable case is reported by Dr. Schmidt (see London Lancet, Sept. 19, 1885) of *puerperal eclampsia*. Only by chloroform had the patient been kept from convulsions and only then by a liberal use of it until unconsciousness had supervened. A few deep inspirations of oxygen, continued until upwards of a "cubic foot of the gas" had been inhaled, were enough to bring back consciousness and there were no more convulsions, and recovery was gradual and complete.

Dr. Ehinger gives the substance of two cases of puerperal eclampsia, reported by Dr. Farr of Kharkov, in which "oxygen inhalations were followed by brilliant results." Ehinger reports one of these cases. A seamstress, aged nineteen, brought to the hospital in an unconscious state, cyanotic with stertorous breathing and frequent convulsions preceded by uterine contraction. No relief could be given by the usual means of wet packings and warm baths and enemata. Neither hydrate of chloral nor inhalations of chloroform would avail to relieve the paroxysms. As a *dernier ressort* oxygen was tried and in five minutes proved its power. The pulse fell from 120 to 90 per minute, and delightful sleep supervened.

Oxygen inhalations have been effectual in cases of *reflex vomiting*. In incipient pregnancy Lasvkewitch found inhalations of oxygen sufficient to arrest severe

vomiting, and "in two days the patient was cured." Dr. Pinard treated several obstinate cases of vomiting in this way and with the best results. In the Medical Current, F. A. Churchill, M.D., sets forth a remarkable case. The patient was in the second month of pregnancy. For three weeks, notwithstanding a variety of remedies that had been given, she had not "retained a mouthful of food nor any of the nutritive enemata given her." Dr. Churchill records that under this condition of things "one good inhalation of the gas" was enough to cause her to exclaim, "That seems to dissolve the lump in my throat." He kept up the inhalations every day for two weeks during which time "she did not vomit once," and after that she got on finely.

There is, it should be said, sufficient proof of the great value of this treatment in reflex vomiting. Tschaudnowsky makes record of gratifying success with oxygen inhalations in several cases of reflex vomiting. "In some cases of vomiting during pregnancy this treatment has," says the National Dispensatory, "arrested the symptoms when all other measures had failed."

As may be easily inferred from the foregoing indications of oxygen in disease, a wide curative range must be assigned it. Dr. Birch broadly summarizes its curative power. He says: "Certain beneficial effects of oxygen may be mentioned as not unfrequently immediate and well marked. Such are, (1) complete relief from excessive oppression of the brain; (2) sight improved in defective vision consequent on nervous congestion; (3) general warmth even to the ends of the toes and fingers, succeeding to extreme chilliness and collapsed condition; (4) sudden departure of great nerv-

ous depression; (5) permanent relief afforded to the uterus, ovaries, and spine by sudden induction of long suppressed catamenia, particularly at the change of life; (6) relief of unexpected diarrhœa of highly offensive character, with dark, inspissated bile, in long-continued torpor of the liver and portal system; (7) improved appetite and powers of digestion and assimilation, a feeling of being much more "up to the mark," less lassitude, more ability to bear physical exertion, and—that to which ladies are pre-eminently partial and some of the ruder sex not less so—a clearer, fairer, and softer skin." "It powerfully promotes," he says, "the dissolution, absorption, or elimination of morbid growths and infiltrations; hence, in a therapeutic sense, it is available in nearly every form of CHRONIC disease and in many ACUTE conditions."

"It is only necessary to consider rightly its nature, ignoring all specious claims and enthusiastic overcoloring, in order to infer the wide range of adaptability and applicability of the treatment. Without exaggeration, it is almost unlimited. Oxygenation is as essential to life and health as alimentation. No sane therapeutist asks, in what conditions and diseases is it proper to nourish his patient! And super-oxygenation is as logically and naturally indicated—fairly, in fact, self-suggesting—to overcome the diseases which result from deficient oxygenation, as alimentation to revive and restore the starved survivors of the Greely expedition. This rule or indication is simple and definite, and covers the subject better than pages of hypothesis, or whole volumes of pathological finesse."

"Oxygen alone presides over and renders possible all vital transmutations, and hence, in a more perfect oxy-

genation of elements, designed for heat production and tissue formation, we have the key to the success of the oxygen-treatment. *Hence also its unlimited range of curative action.* It is adapted to the general or constitutional betterment of nearly every chronic morbid condition to which the human organism is subject, no matter by what name it may be called."

Such, as set forth by correct authority, are the pathological indications of oxygen-treatment. Why should not every reader, and especially every physician, pay attention to this invaluable remedy?

PART III.

MONOGRAPH ON PHTHISIS.

What has been poetically called "the dream of the early partisans of oxygen," that by it a new life would come to the victims of this deceptive disease, and the whole race of consumptives be rejuvenated as by magic, has not, assuredly, been realized. Indeed, their visions, when compared with the results, seem to be hardly more than exaggerated delusions. Anxious to find some means of relief to the hundreds and thousands struck through with this lingering death, they seized upon this in the hope that it would prove a specific. While their hopes have not been realized yet something has been done in the advance of knowledge to show the value of oxygen inhalation in the pulmonary diseases, and it may yet be, in view of more recent investigations, that these inhalations will prove to have, in pulmonary tuberculosis, a value now hardly thought of. We shall, toward the close of this monograph, say something more at length of this.

Not a little doubt is expressed by various writers concerning the value, in phthisis, of oxygen-treatment. Some think it of almost no value, some think it of great value, while others condemn it as too irritating. The notion held by Lavoisier, Priestly, and their contemporaries, to the effect that, physiologically considered, oxygen undiluted when taken into the lungs by inhalation is "always an irritant," needs, to say the least of it, under our advanced knowledge, some modification. The truth is that even pure oxygen, to say nothing now of any dilution of it, is not *per se*, an irritant. When introduced into the lungs by breathing, it may or may not prove irritating. The result one way or the other depends upon the nature and progress of the disease, the general physiological condition, and largely and especially upon the character of the administration. Considering the whole matter, we think it the highest truth to say that even pure oxygen, if rightly administered, is not likely to set up inflammatory conditions. Dr. Ehinger records that he experienced no ill effects from inhaling from two to ten gallons at a single sitting, he also administered it to his patients with impunity. Thus, while he disavows the notion that the "prolonged use of pure oxygen" should be much indulged in and distinctly says that "he does not advocate its use in this way," yet he thinks that many modern "experiments demonstrate the fallacy of the old claim, that breathing oxygen will cause inflammation and other dangerous symptoms." Hausemann, Naoumoff, Beliaieff, and others reached, by their experience, a like conclusion. The experiments of Savory upon animals would seem to be conclusive against the earlier and more immature view of irritation. Dr. Bartholow

distinctly states it as his opinion that undiluted oxygen produces little if any "constitutional disturbance." A genial and general systemic warmth, specially perceptible in the bronchial region, sometimes an accelerated and sometimes a retarded pulse, accompanied with a delightful sense of exhilaration, improved appetite, and greater disposition to activity, Bartholow notes as the usual results attending upon the use of oxygen. All this would seem to assure us that there is no need in cases of phthisis of exciting by oxygen inhalations those inflammations and disorganizations and sudden relapses which Caillens and Chaptal and their contemporaries report. Something of their non-success was doubtless due to the bad character of the "vital airs" used, or to the imperfect way of using them. It may not, on the whole, be advisable, in cases of either incipient or advanced phthisis to administer pure oxygen, though in such cases it has proved, beyond a question, its value.

However, while pure oxygen may not be indicated, some dilution of it, some compound of diminished strength, and yet stronger than the atmosphere, might avail to save life. There is, we venture in the face of some professional depreciation to the contrary, reason to think that in the vast majority of cases of phthisis, and especially in its incipiency, oxygen is a valuable therapeutic.

So eminent an author as Phillips, considering well the whole subject, and himself speaking from experience, does not think that oxygen inhalations, suitably diluted, "can at all irritate or inflame the lung-tissue." This, on the whole, seems to us to be the truth. Oxygen inhalations, in dilution and properly taken, do not so much act directly on the pulmonary tissues as indirectly upon the

blood, increasing the appetite and augmenting the power of assimilation, and in this way attacking the disease, by connectional and systemic vitalization resisting its progress, and perchance overcoming it. Beigel's philosophy of the operation of oxygen in phthisis is doubtless according to the truth, that is it supplements the deficiency of oxygenation caused by the diseased conditions of the impaired respiratory surface. It may in some cases do more than this, it may carry its good effects quite beyond such as would come of breathing, under proper conditions, a normal quantity of atmospheric air.

In ten cases reported by Dr. C. E. Hackley, six of them gained under the oxygen-treatment an "aggregate of 49½ pounds," while the other four "lost 7 pounds."

Dr. Mackey reports several cases in which marked improvement resulted from inhalations of diluted oxygen. One patient inhaled a gallon every two days, and after sixteen such inhalations was so much better that no more were needed or taken. Another was the case of a young man of sedentary habit, with inherited tendencies to consumption, who began oxygen inhalations, and though cod liver oil and iron accompanied the treatment, yet he records the special benefits of the oxygen inhalations. He gives another case in which the oxygen increased the power to breathe, subdued the inflammation, diminished the expectoration, and improved the appetite : and though these results were not permanent, but transient, yet Mackey gives it as his opinion that imprudent exposure was the cause of the collapse, and that in every case the oxygen-treatment proved its value.

Considering these and other like cases, Prof. Phillips frankly says that they prove nothing against the oxygen-treatment, and considering other cases, and especially

the large number reported by Dr. Andrew H. Smith in his "Prize Essay on Oxygen Gas in Disease," he says, "The results are so favorable as to warrant still further trials with this agent." Having used oxygen gas in a score of phthisical cases, Dr. Read of Long Island records his deliberate conviction that the oxygen-treatment is of great value, especially in connection with regular and well considered medication.

In one of several cases reported by Dr. Andrew H. Smith, in all of which there was more or less "amelioration of the symptoms," the menses that had been for some time in a state of suppression started again, and consequent upon this there was a decided general improvement. Stillé, in referring to more than a dozen cases treated by Dr. Read, says, "The greater number were permanently benefited by the treatment." He goes out of his way to say of these cases that inasmuch as cod liver oil was given in connection with the oxygen inhalations "it may therefore be supposed that the benefits derived" were not so much "in a direct influence upon the pulmonary disease as in the indirect advantage which the gas conferred in promoting the digestion of the oil." This would seem to be an unnecessary and gratuitous depreciation of the oxygen, for in the first place it is only suppositive and in the next place the results with the cod liver oil are such as would not come without the oxygen.

Whatever, then, may be the truth of the relation of oxygen treatment to cases of advanced phthisis, there would seem to be no good reason to doubt its therapeutical value in the very incipiency of the disease.

The whole truth seems to be expressed by Bartholow when he disallows after "hectic fever" has set in and

"excavations have occurred," the value of oxygen inhalations save as they may relieve dyspnœa, but on the contrary avers that the evidence is satisfactory that oxygen inhalations produce good results in some cases of phthisis, and these cases, he says, are those where the structural condition of the lungs is not seriously impaired, and where the symptoms are secondary rather than primary. In diseases of the respiratory organs where the chief cause may be deficient oxygenation, inhalations have been used, says Bartholow, "with success."

He mentions certain cases likely to be amenable to oxygen-treatment and says there is no mystery involved in its therapeutical effects, but on the contrary the manner of its action is "perfectly obvious." The explanation is twofold. First, the mechanical work of breathing is made easier to the patient, and, secondly, the super-oxygenation lessens the wear and tear to the respiratory organs. Bartholow says that in most of these diseases, and he specially names anæmia, leucocythemia, diabetes, albuminuria, and others largely caused by "insufficient oxidation," the administration of "pure oxygen is not necessary." He advises, rather, some dilution of it with inhalations twice each day, "morning and evening."

In considering the "ill success" of the ordinary treatment of phthisis in all its various stages and modifications, Dr. Birch, twenty years ago, ventured to suggest to the profession the cause, or at least one of the causes, of it. He charitably calls it "the negative error" of inattention to the "scientific use of that great element, oxygen." And he refers, as is clearly evident by reference to his book, to non-atmospheric oxygen, though he allows with

Drs. Ramadge and Smith and Balbirnie and MacCormac, the preventive value, in cases of consumptive tendency, of full and strong breathing of natural air. When we consider the predisposing causes, aside from heredity or in connection with it, of many cases of consumption, it would seem to be easy to see how oxygen-treatment is indicated. These may be named in a single phrase, a vitality so lowered as to make functional integrity impossible, and the control of chemical and physiological affinity out of the question. Beginning here, a low train of disordered action leads the way to and lays the foundation for future ill results. Unhealthy nutrition, organic insufficiency, deteriorated blood, short and languid inspirations, chest contraction, collapsed air-cells, and, it may be, either chronic solidification or scattered emphysema, make up the constitutional *nidus* in which the disease burrows until the conditions of its existence make permanent interference with its progress impossible. If such conditions and tendencies do not clearly indicate a demand for oxygen then our physiology is seriously at fault. The want of oxygen becomes, as Dr. Birch says, the "great exciting cause of disease." "The products of digestion, the incipient cell-formations in the blood in their course through the capillary vessels of the lungs, cannot receive the normal vitalizing changes, nor can the blood-corpuscles get a sufficiency of oxygen to convey to the systemic circulation. The blood becomes impoverished, destructive metamorphosis and equivalent reconstruction of tissue progress too slowly, and the vital powers can no longer control the tendency to decomposition and disorganization." This seems to be the unquestionable fact, a fact that indicates not that the little oxygen the patient may be able to get is too

much for him, but rather that he wants more, and that for the want of it he is wasting away to prospective and premature death. It is not the oxygen that carries on to a fatal issue the consumption that is preying upon him and eating his life away, but the want of oxygen. Of course it may be that his vitalities have become so impaired that they cannot be restored by any work of natural breathing, but just here is where it may be possible by *artificial oxygenation* to start them up again. This has been done in many instances as will clearly appear in the chapter on "Clinical Exhibits." Let us here quote again from Dr. Birch. He says, "Based upon sound physiological principles of treatment with oxygen as an associate properly detailed and carried out, according to the peculiarities of each case, the cure of pulmonary consumption in the earlier stage ought to constitute the rule, not the exception:" and he says this without qualifying it by considerations of either "hereditary or acquired predisposition" to the disease, or the "pathological character" of it. And he carries this statement to the disease, not only in its very early incipiency, but to what he calls "the middle stage," and avers that "great success" can be attained from the "vital dynamics" of the oxygen-treatment. His, however, is not a theory of mere super-oxygenation. Indeed, he says this "must be dismissed from the mind." Nor is it a theory of more "mountain air," or more "sea air," for he stoutly protests against what he ventures to call this "prevalent scientific error." Admitting the paradox that because of "lowered vitality" the patient cannot make good use of what little oxygen he is able to take in out of the atmosphere, and that the emergency of his disease requires more, "the scientific principle," says Dr.

Birch, "presented for our contemplation is, how can we make such temporary impressions with *artificially prepared* oxygen as shall invigorate the imponderable forces in the animal economy, give an impetus to assimilation and nutrition, and augment the absorption of atmospheric oxygen." And this he thinks can be, in a large number of cases, done through the superior "vital dynamics" of artificially prepared oxygen. His own experience and that of others since makes good his statement.

Beigel gives it as his opinion that in incipient phthisis oxygen inhalations are *always indicated.* Presumably this is so. At any rate there is a general consensus of opinion to this effect among those who have given the relations of oxygen-treatment and disease sufficient attention. Beigel says: "In children predisposed to phthisis, the inhalation of oxygen gas would delay or even prevent the outbreak of the disease, and even after the development of the affection inhalations of oxygen gas sometimes render astounding service." He gives a case, that of an engineer, which is put down at length in Cohen's "Inhalation." The patient was twenty-three years of age and of scrofulous diathesis. There was "tuberculosis, infiltration of the left apex, and bronchial catarrh of the right lung," with a general systemic condition such as usually attends such an exhibition of phthisis. He inhaled twice a day "a gallon of oxygen at each time and a solution of sesqui-chloride of iron twice a day for five months, at the end of which time the patient was so improved as hardly to be recognized as the same man." Dr. Beigel saw him one year after the discontinuance of the treatment and found him still enjoying his convalescence. Cohen is frank enough to say for himself that his experience with "oxygen gas as a

therapeutic agent has been comparatively limited," though he gives as the reason the fact that he had not had the success with it which others record, yet he says, "I have employed oxygen in a number of cases of imperfect aeration of the air-cells of the lungs from deficient inspiration and with decided benefit." And though he is indisposed from his own experience with oxygen to regard it with "any special favor" as a treatment for "confirmed phthisis," yet he declares that he has "seen considerable comfort follow the institution of the treatment," and expresses his opinion that "oxygen may be legitimately resorted to upon suitable occasions."

In his valuable work on "Consumption, its Nature, Causes, Prevention, and Cure," J. M. W. Kitchen, M.D., says, "Oxygen gas is variously rated as a beneficial agent in the treatment of phthisis. In some cases the effect of its inhalation is very good. It seems to succeed better with the phlegmatic than it does with nervous individuals. It gives the patient some increased force and stimulates the general system." He agrees with a large number of eminent physicians in this, and especially in his view of the value of a timely tonic in cases of incipient phthisis. "Millions of human beings," he says, "could be saved from the ravages of this disease if a simple tonic could be administered to them at just the right period. The temporary help which they would receive at this critical time would give the pulmonary tissues sufficient ability to resist the commencing action of the disorder." What better tonic than oxygen, in incipient pulmonary debilities, can be named?

If the attending symptoms of consumption are such as are usually apparent, bad nutrition, insufficient heart action, high temperature, and excessive expectoration,

bronchial and laryngeal trouble, insomnia with night sweats, and generally low vital force, then there can be no reasonable doubt of the indication of oxygen-treatment as of probable therapeutical value. This point is now, in the advanced stage of medical science, so well established by the agreeing views of eminent practitioners that it would be superfluous to write more at length in support of it. And yet a further word may be of value. If, as Dr. Cohen says, the "systematic inhalation of atmospheric air is often of great therapeutical service," then it is reasonable to suppose that there may be physiological conditions under which the systematic breathing of an *artificial atmosphere*, properly *surcharged with oxygen*, would be increasingly beneficial. These conditions are likely to environ those of sedentary habits by reason of which the lungs are not able to do their full work, and for which lack the blood must suffer from imperfect aeration. Under these circumstances even the "forced respiration of atmospheric air," as Drs. Ramadge, Drake, Langenbeck, Morell, and others suggest, is likely to be of immediate and permanent value. Much more, then, an atmosphere enriched with oxygen somewhat above that of the natural air. The vital capacity of the lungs under systematic inhalations of oxygen gas is, as a rule, much improved. Many cases might be cited in proof of this. Dr. Cohen, in his "Inhalation: its Therapeutics and Practice," speaks specially of five cases immediately relieved from "distressing cough and copious expectoration," and he mentions a single case of phthisis in which "the vital capacity of the lungs increased from 2,850 to 3,100 cubic centimeters," and another case in which there was an increase "from 2,100 to 2,300 cubic centimeters." Such facts as these ought

to be enough to assure any candid person that in all diseases of the respiratory tract oxygen inhalation is indicated, and that phthisis, in its incipiency or its malignancy, should be considered no exception.

In a recent able and suggestive paper on "A Possible Revolution in Medicine," Dr. Austin Flint makes some statements that may naturally and easily connect themselves with the theory of oxygen inhalations in phthisis. The pivotal point of Dr. Flint's "Possible Revolution" is that of the recent more complete "discoveries in bacteriology." Speaking of this he says:—

"The science and practice of medicine and surgery are indicating a revolution of such marked importance that its limits can hardly be conceived. Looking into the future in the light of recent discoveries it does not seem impossible that a time may come when the cause of every infectious disease will be known, when all such diseases will be preventable or easily curable, when protection can be afforded against all diseases, and when no constitutional disease will be incurable." And he goes on to say that "these results indeed may be but a small part of what will follow discoveries in bacteriology." He further says, "What has been accomplished within the past ten years as regards knowledge of the causes, prevention, and treatment of disease, far transcends what would have been regarded, a quarter of a century ago, as the wildest and most impossible speculation." In his opinion, it will in the near future be shown that "bacteria play an important part" in the "physiology of digestion." He bases his opinion upon the fact that the whole intestinal region is infested with bacteria, though the part they have in the work of digestion or of indigestion is not yet well understood. Pasteur has recently

found in the mouth as many as seventeen different micro-organisms, over which the gastric juice had no power. Dr. Flint goes on to say: "In the practice of medicine recent discoveries in bacteriology have brought about changes which amount almost to a revolution." This revolution has already taken place, or is already imminent, in the treatment of such diseases as the fevers, the whole range of catarrhs, a large variety of skin troubles, most of the contagious affections, yellow fever, diphtheria, erysipelas, pneumonia, and tuberculosis. Assuming in all these the causative agency of bacteria, the question of superinducing conditions becomes an important one. "The conditions necessary," says Dr. Flint, "to the development of these diseases seem to be a susceptibility on the part of the individual and the lodgment and multiplication of special bacteria in the system." An inherited constitution or the ever present physiological integrity makes some persons only in a small degree, if at all, susceptible in the usual way to "certain infections," while others are, by a different inheritance, or a less sound physiology, peculiarly susceptible and easily take on infections. Dr. Flint expresses it as his conviction that "a person with an inherited tendency to consumption would never develop the disease if he could be absolutely protected against infection with the tubercular bacillus," and distinctly says that "in the light of modern discoveries consumption can no longer be regarded as an incurable disease." He says, and not a few physicians will be surprised to hear him say it, "In certain cases the bacteria if confined to the lungs may be destroyed." The problem, then, is, as Dr. Flint suggests in a case of pulmonary tuberculosis, to destroy the bacteria—the bacillus tuberculosis—and to

do this without injury to the patient. Here, then, is the fact: certain diseases, and among them consumption, may be cured by destroying the causative organisms. In this way fermentative indigestions may be cured. So, too, may certain skin diseases. So, too, may diphtheria, and presumably, in many cases, pneumonia. That is, the causative germs may be attacked and destroyed. Dr. Flint says nothing of the power of oxygen gas in any form to do this, but others, in some respects as eminent as he, do. They affirm that all bacteria are, under some given action of oxygen, destructible. If this be so, then there is in cases of incipient if not advanced tuberculosis, a reasonable presumption in favor of inhalations of oxygen.

There can be little doubt that were, say, a handful of bacilli directly exposed to the action of pure oxygen, the result would be their destruction. Whether or not they can be gotten at, when lodged in the tubercular matter, may depend upon so many conditions in individual cases that only a knowledge of these cases could warrant the expression of an opinion; but if they can be acted on there by oxygen inhalations with sufficient energy and without any unfortunate over-action on the ulcerated surface and the delicate pulmonary tissue, the destroying tendency of that action hardly admits of doubt. Then, too, if, as is probable, inhalations of pure oxygen might be too strong, the question arises whether or not some considerably diluted preparation, and yet well charged with the gas, would be sufficient. Perhaps if wisely taken, and taken long enough, it might be. At any rate, the probability that the bacteria might be killed or their propagation held in check or prevented by inhalations of oxygen ought to be enough to sug-

gest its use and warrant the experiment. Beside oxygen inhalations ought to have some value in relation to the theory of natural heredity and constitutional susceptibility to consumption. Where there is such a susceptibility or such a hereditary tendency it would assuredly seem to be in the nature of the oxygen-treatment to counteract it. Thus it might prove a powerful preventive, and by its timely work save many a victim from the fatal consequences of bad primogeniture or special phthisical susceptibility.

No matter, then, by what theory the deceits and mysteries of pulmonary consumption be explained, it would seem to be only the dictate of professional prudence to consider the probable value of oxygen as a natural and harmless therapeutic and in connection with other sound physiological and medical treatment to use it. Call the bacterian theory what an eminent physician has unwisely called it, "the now prevailing germ craze," yet if it be true, and as it is true, and as oxygen is both a germicide and a sporicide, and can act upon any organism permeable to any form "of infection or contagion," it would seem to be only driveling illiberality or ignorance to deny its probable value and decline its use in incipient or advanced pulmonary troubles. And if the germ theory be set aside and the fostering nidus of tubercular deposit be a conglomerate of imperfect assimilation and organization, of depreciated epithelium and the miscellaneous wastes of absorption and expiration, then we well know that all the processes of the further disorganization call loudly for such vitalizing resistance as it is in the power of inhalations of oxygen to give. Indeed, what other element could be introduced into the diseased lungs so well calculated to aid in the discharge of the decomposed fibro-

albuminoid substance, to check the exaggerated formation of epithelial cells, to prevent the undue deposit of granular and calcareous disintegrations, and to effectually stop the progress of purulent infiltrations. The one subtile substance upon which our very existence depends, the most powerful electro-negative element in nature, the means by which the physiological integrity is maintained and the equal and heathful relations of the many membered organism kept up, in short, the very *sine qua non* of life, oxygen may be the one factor in the treatment of phthisis, the omission of which may make all others unavailing. As it may in many instances offer the only chance of life, and as, in the very nature of things, it is indicated, it would seem to be unwise on the part of the physician not to recommend it.

PART IV.

PHYSIOLOGICAL ACTION FROM THE INHALATION OF OXYGEN GAS.

An Important Fact.—Gas has the advantage over a great many therapeutical agents, inasmuch as, with slight precautions, it can be administered without producing serious accidents, and in my opinion it is destined to bring about results that would be well to note.

J. N. Demarquay, M.D.

The first inhalations of oxygen are sometimes accompanied by a slight sensation of heat in the mouth, which is communicated to the larynx, from there to the interior of the thoracic cavity. The sensation is rather agreeable. This is at least what we have felt.

Beddoës experienced an ardent sensation of heat in the *chest.* This heat was transmitted very rapidly to the

hypogastric region, but it generally disappeared shortly after one ceased to inhale the gas. There is, as a rule, an elevation of the *pulse* after inhalation, from four to twenty pulsations.

Many persons experience during the period of inhalation a sensation of heat in the *skin* followed by profuse perspiration. The effect upon the senses is slightly marked, aside from the central nervous system. We experience at times slight intoxication, and nervous people experience a pricking or itching sensation in the tips of the fingers, some become excited, others have pleasant sensations, others experience a very marked want of muscular action. We have experienced a sense of constriction, many times, during the inhalation, in the temporal region. Others have experienced more or less pain, from inhalation, following the course of many branches of the *trifacial nerve* rather than those of the supra- and infra-orbital and temporal nerves.

It increases the appetite by promoting assimilation.

In 1843 Dr. Demarquay ascertained by experiments upon himself that it was possible to remain in an atmosphere heavily saturated with oxygen, without experiencing other symptoms than those of increased vitality, and it has at the start relieved fierce headaches, and by frequent inhalations many chronic afflictions of the respiratory organs have both been soothed and cured. Still further the author adds: "There is an acceleration of the pulse, ten pulsations in a minute. This symptom lasts in the neighborhood of an hour after taking the gas. The digestive functions are increased, marked by increased appetite. There is a sensation of general improvement. Also a decided improvement in the *respiratory functions*.

It is possible to be shut up in a cabinet for hours, provided you are supplied with oxygen, and have cups inside the cabinet containing lime and potassium to absorb the carbonic acid, and on coming out you will find an increase of appetite, and that night you will experience profound sleep.

The following was reported to me by a friend of mine, a professor of medicine :—

This young lady, Miss M——, aged 31 years when she came for treatment, was decidedly phthisical. She had tried every means to effect a cure or even find some ease, but to no avail. The disease was daily progressing, when she determined to try the oxygen. She commenced the 24th of April. A short time after taking, her strength, which was very much impaired, began to improve, so much so that at the end of May she was sufficiently recovered to take long rides on horseback. This young lady inhaled each day from a glass bell containing seven hundred ounces of water, keeping the nose closed until she experienced difficulty. Then we closed the bell and let it rest upon the water about twelve hours, at the end of which time she would again inhale for a period of five minutes. After which a taper plunged into the bell would not burn any better than in the atmospheric air, and sometimes not as well. The patient continued the use of this treatment during six months. She ceased the treatment in October, and died the following winter.

My friend, the doctor, was fully convinced that if she wished to follow his advice she might have lived much longer, but she abused all the benefit derived from this treatment in living a gay life.

J. N. Demarquay, M.D.

REMARKS.

REPORT OF CASE.—Among many facts which have come under my observation, there is one which is quite forcible. It is relative to a man who entered the hospital, during my term of service, to be treated for a comminuted fracture of the leg. This unfortunate man was subject to asthma; he found it impossible to remain in a horizontal position. He was obliged to have the windows open at night, and to be elevated in bed. The inhalation of oxygen relieved him, but did not effect a cure. I therefore mixed (one quart of) carbonic acid with (three quarts of) oxygen, and my patient recovered, that is to say the attacks ceased.

J. N. DEMARQUAY, M.D.

There is nothing surprising in it, if we could see the number of paroxysms controlled in certain persons under the influence of a good supply of air. Others, on the contrary, prefer low, swampy regions to elevated places; some find relief in cities, others in the country air. That would explain the good results which we have obtained from oxygen in its pure state, also mixed with hydrogen and carbonic acid. I do not find in Hill's work any mention of the oxygen-treatment in asthma. But he cites the case of a young lady troubled with a nervous cough. Tonics and anti-spasmodics cured her after two months' treatment. But at the end of a month she had a return of the symptoms; she was then treated by oxygenated air. At the end of five days, recovery was almost complete.

A very eminent English authority says that "under the influence of this medication a child improves wonderfully."

How are these facts explained? Is it by the direct

action of the oxygen or hydrogen, or the carbonic acid upon the bronchial mucous membranes that the paroxysms of asthma are modified, or rather by the action which these gases exercise upon the central nervous system through the medium of the blood?

All these questions will, no doubt, one day be solved, but for the present we must confine ourselves to facts, and we will not accept any explanation that does not point, strictly speaking, to direct observation.

Case I.

A Case of Nervous Asthma Treated by Oxygen.—It is with the greatest of pleasure that I publish the following case, with the hope that others may derive benefit from like treatment. Shortly after the age of thirteen I became subject to frequent attacks of nervous asthma which caused me unspeakable suffering. Blisters applied to the chest together with expectorants invariably soothed me, but not without many hours of suffering. A *moist* rather than a *cold* temperature seemed to be the most beneficial. My strength was very much exhausted after each attack and remained so for quite a length of time. Toward the middle of the month of September last (1795), upon the advice and under the guidance of Dr. Beddoës, I began the inhalation of oxygen gas. At the end of a few weeks my health began to improve. Towards the latter part of October I caught cold, which brought on another severe attack of asthma, less severe, however, than the preceding ones. Since that time up to the present writing I have only had five attacks, all of which have been slight and of short duration. For many years I have felt indisposed each spring. But this year I have not been ill a single hour, and during

the last six months I have enjoyed better health than any preceding year. The heat and moisture affect me less, and, contrary to all expectations, I have taken cold without producing an attack of asthma. I have inhaled the oxygen once a day—with the exception of a few interruptions—for nine months. I ceased treatment at the commencement of the present month, with the hope that I may be able to do without it, but with the intention however of resuming it in case it should reappear.

J. Hare, Esq.

Conduit St., Paris, July 29 (1796).

Case 2.

Asthma by Oxygen.—Mr. X——, aged nineteen, born in Scotland, was admitted to the hospital, for hydrocele, during the service of Dr. Demarquay, the 10th of December, 1863. The hydrocele yielded readily to proper treatment, and a cure was effected. But the day after his arrival, he was taken with an attack of asthma. Dr. Demarquay always treated these attacks by the inhalation of oxygen. And strange to say each paroxysm ceased the moment the patient began to inhale the gas. Among other things are a few details relative to the pathological history of this young Scotchman, and the results which have been obtained by the inhalation of oxygen. His mother died at an early age from pulmonary tuberculosis. His father is still living and enjoys good health. Since his eighth (8th) year he has been subject to these attacks of asthma. Up to the age of thirteen and fourteen he has had attacks regularly once a month, the effect of which lasted a fortnight. His health was very much impaired. From the 14th to 18th year the attacks were less frequent—once in two

or three months—nevertheless they caused him very much suffering. At the age of eighteen he left his native country and came to France. Thanks to a most delightful climate, which is characteristic of the latter place, the attacks diminished both in intensity and in the number. Since his sojourn here he has had but two attacks, the first three months ago, the second just after his entrance to the hospital.

December 13th. Last night, at the beginning of an attack, the patient inhaled from 20 to 25 liters of oxygen. From the first inhalation he began to grow better, and after having inhaled all the oxygen (in the bag) the attack had completely subsided.

December 17th. At nine o'clock, p. m., the patient had another attack of asthma. The oxygen was immediately supplied him, and the dyspnœa ceased almost immediately. We were informed by the nurse that a bag containing 25 to 30 liters of the gas was not emptied before the patient was asleep.

December 18th–22d. Patient had no attacks. 22d he had an attack, stopped by the oxygen.

December 23d–27th. No attacks.

December 27th. The patient had a severe attack of dyspnœa, which was immediately relieved by the oxygen.

Dr. Demarquay.

EXPERIMENTS.

INJECTIONS OF OXYGEN INTO THE CELLULAR TISSUE AND SEROUS MEMBRANES.

Oxygen can be injected into the cellular tissue and serous membranes of animals without causing any inconvenience. The results of our first experiments, corrob-

orated by Mr. Lecompt, have been recorded in 1859 in the "General Archives of Medicine." In that work (or rather report) we have not only shown how utterly devoid of harm are these injections of oxygen, ozone, acid carbonic, but also the laws of absorption.

Oxygen brought in contact with the tissues is absorbed very rapidly. Two hours and a half after the injection we can withdraw but feeble quantities of the mixture, whether we operate during a period of fasting or during digestion. But absorption appears to undergo interruptions, at least from exhalations of other gases. During these series of experiments, an important fact was the finding of more gas at the second rather than the first trial.

In the cellular tissue during fasting, for example, at the end of forty-five minutes, analysis showed $66\frac{66}{100}$ parts oxygen, and about one hour later it furnished $78\frac{35}{100}$. In the peritoneum (likewise during fasting) at the end of forty-five minutes we found $77\frac{65}{100}$; at the end of an hour, $81\frac{66}{100}$.

Animals do not seem to suffer from the injections of gas into the cellular tissue as the symptoms produced pass away. This idea of studying the action of oxygen injected into the cellular tissue occurred to Dr. Beddoës, and he reports as follows :—

"We injected under the skin of a dog four pints of oxygen ; slight ill-feeling during the first hour, but after that the animal appeared to enjoy excessive vitality. The following day the gas commenced to diminish. Towards the tenth day all of the gas appeared to have been absorbed.

Upon another dog weighing nineteen pounds, three and a half pints of gas were absorbed in eight days.

Upon a third dog weighing twenty-one pounds, three pints in eight days.

Upon a fourth dog weighing twenty pounds, three pints in seven days.

The second and third dogs were affected like the first dog, but the fourth experienced no ill feelings.—"General Archives of Medicine, 1859."

DR. DEMARQUAY.

METHODS OF OBTAINING OXYGEN.

Oxygen prepared from mercurial oxides is dangerous, as salivation invariably occurs at the end of a few days.

DR. DEMARQUAY.

At the present day many means are employed for preparing oxygen gas. We shall examine successively the six principal ones :—

1st. By the decomposition of manganese peroxide.

2d. By the decomposition of chloride of lime.

3d. Boussingault's method.

4th. Decomposition by heat of sulphuric acid upon the sulphates.

5th. Reaction of sulphuric acid upon potass bichromate.

6th. Decomposition of potass chlorate.

1. The objections to the first method of obtaining oxygen are : aid of heat, a high temperature must be kept up ; second, obtaining it by the agent sulphuric acid upon the manganese would necessitate many washings, owing to the impurity of the commercial acid ; then again the manganese contains earthy matters, and we have read of the case of an English chemist who, while preparing the oxygen from manganese peroxide, met with a serious accident, and his assistant was killed

outright, owing to an explosion. Another objection is that manganese may contain organic matters.

2. The objections when prepared from the chloride of lime are that too much chlorine is set free, which necessitates many washings with water rendered alkaline.

3. Boussingault's method consisted in employing barium. High temperature was necessary, also a current of moist air, which was hard to regulate, for if it passed a certain degree it formed a slimy paste,—hydrate of barium. It is also necessary that barium should be free from nitrates and nitrites. This, together with the high temperature, renders it unworthy of trial.

4. Decomposition by heat of sulphuric acid or of sulphate of zinc. These two methods, which we unite into one, because in both cases oxygen is produced by the decomposition of sulphuric acid, are due to Messrs. St. Claire Deville and Debray, who proposed to use it in the art of plating. Their procedure lay in the property which, by the aid of heat, sulphuric acid had to change itself into sulphurous acid and oxygen, and the sulphate of zinc to oxide of zinc,—sulphurous acid and oxygen. But, unhappily, again we must denounce the method on account of the agent employed (acid sulphuric).

5. Reaction of sulphuric acid upon bichromate of potash. You form by this method chromate of alum. The same author, Dr. Richardson, proposed treating binoxide of barium with sulphuric acid ; you form the sulphate of the protoxide of barium. We do not get all the oxygen by this method. Again, the cost is too much. Dr. Bouchardat advocated a mixture, little by little, of the peroxide of manganese with the peroxide of barium, with equal parts of rectified acetic acid. The disadvantages, in making and to the patient, are many, so we have discarded this method.

6. By the decomposition of chlorate of potash. When we decompose the chlorate of potash by heat, we obtain the *chloride* of potash and oxygen. $KClO_3 = KCl + O_3$. The chlorate of potash is the body which readily parts with all of its oxygen. The gas thus obtained is almost pure, and the operation is conducted very easily. It is with gas obtained from the chlorate of potash that I have made all my experiments.

DR. DEMARQUAY.

ANÆMIA FOLLOWING PARTURITION.

BY THIERRY-MIEG, M.D.

Mrs. L——, of Boston (U. S. A.), aged thirty-seven years, was delivered of twins, in March, 1862. Placenta adherent. Labor was followed by a post partum hemorrhage, after which there was a state of profound anæmia (lymphatic constitution), and, being worn out by successive labors, in spite of preparations of iron and sojourns in the country, she did not seem to recover, so her physician advised a trip to Europe. In July, 1864, she arrived at Spa and commenced using the chalybeate waters, which seemed to improve her considerably. But after the first three weeks the improvement received did not maintain itself. Appetite diminished, so she decided to take a month's trip in Switzerland. She arrived in Paris in September, 1864; she was yet very anæmic, feeble, could not go out without a carriage, and her appetite was absolutely gone. Having been informed by Dr. Demarquay how useful oxygen was in this case, I advised Mrs. L—— to inhale twice a day at least, before each of her principal meals, seven liters of oxygen at a time. The day after eight liters, then nine liters, until

she had reached fifteen liters at a time, and finally thirty liters, and continue that dose. Also a slight rubbing of the muscles. Rare meats, Bordeaux wine, and a slight exercise every morning. Upon the 24th of September she commenced inhalations of oxygen. The 30th of September there was yet little change. During the first days of October Mrs. L—— commenced to regain her appetite. A few days after, appetite became stronger, and digestion was much better. Her strength returned, and Mrs. L—— was able to take much more exercise. She was much better than she had been for two years, and she continued to inhale thirty liters of oxygen up to December 8th, that is to say the inhalations lasted during six weeks. She believed herself completely cured, having regained her strength, appetite, etc. However, knowing her condition, I advised the use of a little cod liver oil and the hypophosphite of iron, with a few pepsin powders, to be taken each day if the appetite diminished. Mrs. L—— passed an excellent winter, and she attributed the great change to the oxygen. In March, 1865, she experienced a sudden fright, followed by a change in her health. Her appetite disappeared. Dyspepsia appeared, and the pepsin, iron, and nux vomica did not seem to improve her. She began again the inhalation of gas, and a decided improvement manifested itself at the end of three weeks. The time having arrived to depart, Mrs. L—— was obliged to leave Paris. At the moment I write these lines, I learn that a sojourn in the mountains of Tyrol had a beneficial effect. But I regret very much that I did not prescribe the inhalation of oxygen (in Paris) at least six weeks before the departure of Mrs. L——, seeing that the last three weeks gave better results than the first three weeks. It can be

readily seen that Mrs. L—— did not improve upon iron and general tonics. I have every reason to believe, that had I insisted upon Mrs. L—— taking the oxygen for three consecutive months at the start, instead of allowing an interval of four months to elapse, the brilliant results obtained would have maintained themselves, despite the attending evils which occurred. I may say that a very distinguished physician of Boston, who always cared for Mrs. L—— during illness, insisted upon tonics, etc., for one year. Then we remember how shortly the waters of Spa lost their beneficial effect. I am, therefore, fully justified in claiming all beneficial results received as due to the oxygen.

Dr. Demarquay's Report.

Experiment 9.

"Injection of oxygen by the jugular vein.—Blood in the right side of the heart and pulmonary artery red and frothy."

May the 25th, at thirty-one minutes after ten o'clock, we injected oxygen into the jugular vein of a dog, with a slight wound. During the first thirty seconds the animal presented nothing abnormal. Fifteen seconds after we heard a gurgling sound caused by the mixing of the gas with the blood, and almost immediately the animal uttered plaintive cries, respiration became embarrassed, and he died. Nothing particular noticed on the side of the wound. Autopsy showed contraction of the auricles. The right auricle and ventricle, the pulmonary artery and its ramifications (first) were found filled with blood, red and frothy in character. On a level with the right auricular ventricular opening, also the tricuspid valve, we found fibrinous

clots of considerable density. By the aid of electricity you can determine the energetic contractions in the muscles of a living animal. The heart remains insensible to this irritation.

Experiment 10.

"Injection of eighty cubic centimeters of oxygen by the jugular vein.—Ecchymoses and watery secretion from the surface of the wound.—Asphyxia, and return of life by artificial respiration.—Experiment lasted fifteen minutes."

The dog about to be experimented upon had a wound on a level with the shoulder, dating back three days. May 29th, at 9.15 a. m., we injected oxygen by the jugular. At the end of three minutes the animal was irritable, and uttered cries. We heard at the same time in the region of the epigastrium a bruit peculiar to a chopping sound, breathing is difficult, and the heart sounds are increased. We therefore closed the gasometer. At the end of two minutes we again inject the gas. At this moment if the ear be placed near the region of the epigastrium we perceive that which resembles an intense blowing sound, which may be mistaken for a bruit (circular in movement). The appearance of the wound is an intense red in color. Its surface is riddled with blood spots and an abundant watery secretion. We continue to inject the oxygen, but at a given time the dog falls as though he had received a shock. Nevertheless we brought him back to life after employing artificial respiration for fifteen minutes.

Dr. Demarquay.

Experiment 11.

"Injection of oxygen in the jugular vein of a dog with a wound near the shoulder.—Small blood spots.—Watery secretion upon the surface of the wound."

Upon the 14th of May at ten minutes past ten o'clock we injected oxygen into the jugular of a terrier dog with large wound (which had a pale and livid looking appearance) on a level with the pectoralis major muscle. At the end of two minutes the appearance of the wound began to change. It became *rose colored.* A few reddish spots appeared on the surface. Proud flesh became more apparent, and a watery secretion was noticeable from all parts of the wound. During the first four minutes the respiration was regular, after that it became profound and difficult ; we closed the gasometer. After one and a half minutes we again established communication between the jugular and the gasometer. Very soon the appearance of the wound was a bright red, and the surface was covered with blood spots. During the second part of the experiment the animal did not show any signs of irritability or uneasiness. The experiment ended at twenty-two minutes past ten, having lasted twelve minutes.

DR. DEMARQUAY.

Experiment 12.

"Injection of two hundred cubic centimeters of oxygen by the crural vein.—Death.—Autopsy.—Blood in the right auricle vermilion red."

The 22d of June at twenty minutes past ten o'clock we injected by the crural vein one hundred and fifty cubic centimeters of oxygen at two trials and at intervals of five minutes. At thirty-four minutes after ten we injected fifty cubic centimeters of the same gas. Respiration was increased, the animal uttered a cry and died.

Immediate autopsy :—Contractions of the right auricle, blood was vermilion. We opened the anterior jugular

and we found a great quantity of gas mixed with the fluid, so much so that we asked ourselves if the gas did not pass into the circulation, and if the animal did not die from heart failure. Guided by this idea, we opened the brain, we found it very much congested. No gas was found there. It is justifiable, therefore, to believe that the gas found in the jugular flows into this vein owing to the contraction of the auricle. The right auricle was found distended with gas. We did not find one bubble of gas either in the left auricle, or in the aorta. The blood found in the liver and kidneys was fluid in character and mixed with a notable quantity of the gas.

DR. DEMARQUAY.

Experiment 13.

"Injection in thirty minutes of nine hundred and twenty-one cubic centimeters of oxygen by the portal vein.—No accidents from the heart."

The 17th of June, at twenty-five minutes past ten, we opened the left flank of a dog, slightly wounded, and laid bare the portal vein. We injected by the vein at ten different times, and at intervals of three minutes, nine hundred and twenty-one cubic centimeters of oxygen. During all the experiment the animal did not manifest any uneasiness. Upon auscultation we could hear an intense blowing sound, resembling the sound of a locomotive. At fifty-five minutes past ten we opened both sides of the chest. We saw the beating of the heart increased and confused. We made a last injection by the portal vein (the animal still living), and we could hear at a distance a sound produced by the arrival of the gas into the heart. The animal was not yet completely gone. The eye was yet capable of irritation, a few minutes after the dog died.

Autopsy the following day:—From a cut made upon the liver we could squeeze blood which was very fluid and frothy in character. We could not find any gas either in the vena cava inferior or in the right auricle, which contained dark blood.

Dr. Demarquay.

Experiment 14.

"Injection during forty-five minutes of one thousand eight hundred cubic centimeters of oxygen by the portal vein.—Intense redness of the spleen.—Injection of the intestinal capillaries.—Frothy blood found in the abdominal aorta."

The 23d of June, at fifteen minutes past ten o'clock, we injected at twelve different times, and at intervals of four minutes, one hundred and fifty cubic centimeters of oxygen through the portal vein of a dog, slightly wounded, who did not show any inconvenience from the injections. The spleen presented a very reddened appearance. If pressed between the fingers a very noticeable crepitation was produced. The intestines were very much injected, even to the ramification of the capillaries, —suggillations between the folds of omentum. The veins were brownish in color and contained gas, which was seen to travel through their walls. The blood allowed to flow from one of these veins is fluid-like and frothy. Finally, after the experiment, we opened the chest and the dog died almost immediately. We then pricked the abdominal aorta, which allowed a frothy blood to escape, thereby proving that the gas passed through the pulmonary circulation without all having been exhaled through the surface of the lung.

Dr. Demarquay.

Experiment 15.

"Injection of six hundred cubic centimeters of oxygen by the vena cava inferior.—Injection of all the capillaries of the intestines.—Death."

The 20th of June at fifteen minutes past ten we injected oxygen through the vena cava inferior of a dog, slightly wounded, by means of a syringe, the capacity of which was one hundred and fifty cubic centimeters. At the moment we pushed the injection, and applied the ear to the chest-wall, there was a peculiar blowing sound resulting from a mixing of the gas with the blood. During the experiment we have been able to observe curious phenomena occurring in the intestinal circulation. All of the capillaries were injected. All of the small vessels that are situated between the two folds of omentum, and upon the convex border of the intestine, formed a very beautiful net-work from the sufficiently closed meshes. It produced at the same time suggillations between the bands of omentum. All the capillaries had the color of arterial blood. The last injection having been pushed without interruption, the heart-beats, which had heretofore been frequent, were now suddenly diminished. Respiration became labored, then profound and less frequent and the dog died. At this moment the thoracic cavity was opened; contraction of the right auricle, that of the ventricle slightly apparent. The vena cava was distended five or six cubic centimeters below the heart with gas. The blood in the right auricle was a golden color. That in the lungs bright red.

CASE OF CHLORO ANÆMIA, TREATMENT BY OXYGEN.

S. P——, aged seventeen years, nine months, complained of a feeling of languor and general feebleness.

Palpitation and dyspnœa upon the least exercise, and especially upon going up stairs. She was pale and very much emaciated; for many months each day, toward evening, and especially after a slight exercise, the feet and ankles would become œdematous. There were gastric pains, frequent coughing, accompanied at times by pains in the side. Appetite diminished. Pulse one hundred and twelve. Menstruation had never appeared, and the patient had not even experienced the symptoms which ordinarily precede this function. She had been ailing now about two and one-half years. She had taken many remedies but without any beneficial effect.

February 14th, 1795, I advised, each day, inhalations of oxygen mixed with atmospheric air in proportion of three to seventeen parts.

February 18th. This proportion had not as yet produced any effect, I therefore prescribed seven liters of oxygen diluted with sixteen liters of ordinary air.

February 23d. After the dose of oxygen had been increased, the patient did not sleep much, and she complained of a general internal heat. Cough was more frequent. Pulse, 125.

February 26th. Could not sleep; cough increased; gastric pains always the same; pulse, 120 to 125. I then reduced the proportions to the same as first prescribed.

March 1st. At night rest, sleep; fever not so great; cough less frequent; gastric pains not diminished; pulse, 110.

March 6th. The patient suffered less from stomach. Her appetite and strength were returning. Exercise gave less fatigue and dyspnœa. Pulse, 100. The external

appearance was certainly very re-assuring, coughing was less frequent, less palpitation and dyspnœa, sleep normal. Œdema, which was constant, did not appear excepting after prolonged exercise.

March 15th. Steady improvement. The cough and gastric disturbance have not troubled her for many days. So slight is the dyspnœa and palpitation that the patient is able to walk quite a little distance without experiencing it, and without fatigue. Pulse, 89.

March 20th. General health improved; paleness has been replaced by normal color; her cheeks, lips and nails have recovered their rose tint; pulse, 81. As yet not the least symptom of menstruation; but as this function is, to a certain extent, dependent upon the tonicity of the arterial system, I have no doubt but that it it will manifest itself when recovery has become complete.

March 28th. Recovery increases each day. Prognosis very favorable.

JOHN CARMICHAEL, M.D.

BIRMINGHAM, March 29, 1795.

TUBERCULAR EPIDIDYMITIS.—PULMONARY PHTHISIS; THIRD STAGE.—OXYGEN GAS.—REMARKABLE IMPROVEMENT.—OBSERVATIONS BY DR. COSMAO DUMNEZ.

Mr. X——, aged thirty-two years, entered the hospital February 20th, 1864. Toward the end of January, the patient, after a long voyage, was taken with a very severe pain in the right testicle. The scrotum was reddened in appearance. He was obliged to call his physician, who prescribed rubbing with blue ointment, and application of poultices. The treatment was continued for many days, but the tumor was daily increasing. Mr. X—— then decided to enter the hospital. The skin of

the scrotum presented a reddish violet appearance. The size of the testicle was nearly that of the fist. The tumor was hard and dented. Pain was noticeably increased on pressure. Never had syphilis. Has had a urethral discharge for many months. At present time there is not the slightest indication of any discharge. Patient was very much emaciated, pale and anæmic. Cough of long standing, never had any hemorrhages, coughing was followed by expectorations, muco-purulent, nummular, and containing greenish shreds.

Percussion :—Dullness at the apex of the lungs, in the supra-spinous fossæ above and below the clavicle.

Auscultation :—Right side, vesicular murmur, feeble in character. Left side, if patient was made to talk during examination râles were found anteriorly in the fossa below the clavicle, moist râles in the supra-spinous fossa close to the spinal column. Fever, intense at night. Slight diarrhœa after a few days.

Treatment :—Drinks of a decoction of extract graminis ; applications of blue ointment and poultices to the testicle ; Bordeaux wine, 250 grammes.

February 25th. Application to the testicle of *emplastrum Vigo, † pil. Dioscorides, bismuth and extract of opium ; injection of starch. Diarrhœa is much more intense.

March 1st. Patient was submitted to inhalations of oxygen gas, four liters of gas to ten liters of atmospheric air.

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*The French codex gives a formula for emplastrum De Vigo, cum mercurio, *emplâtre mercuriel dit De Vigo*, which is occasionally used here. It is made by fusing together lead plaster, 200 parts, yellow wax and resin each 10 parts ; add thereto the following powders: olibanum, ammoniac, bdellium, and myrrh, of each three parts, and saffron two parts, also 60 parts of mercury extinguished by 10 parts of turpentine, and finally, 30 parts of liquid storax, and one part of oil of lavender.

† Pil. Dioscorides contains cantharides.

March 3d. Yesterday the patient experienced a sensation of fullness in the chest. Half an hour after taking there was nausea and eructations. Appetite is no better, but the cough is less frequent, and expectoration less abundant. Resting good to-night. Oxygen, twelve liters. No immediate change in the pulse. No coloration of the mucous membrane after the inhalations. The patient desires to eat.

March 4th. Yesterday slept during the day. Appetite less to-day; some cough, no expectoration. Oxygen, twelve liters. Respiration seemed better than during the first days. The pulse is slightly irregular during the administration of the gas, but returns to normal after inhalation has ceased.

March 6th. Good appetite yesterday; slept well; appearance better; general feeling of improvement; oppression much less. Took twelve liters of oxygen.

March 8th. Yesterday headache, palpitation of the heart, restlessness, troubled dreams. This morning the patient is better; took fifteen liters of oxygen.

March 10th. The patient has been about for two days promenading the corridors. His appetite is such that after partaking of hospital diet he has food sent him from town. Face has good color, and the cheeks sufficient fullness. Respiration is easy. The size of testicle is diminished to great extent.

March 12th. A point of fluctuation is felt in tumor; punctured, we succeed in obtaining about a spoonful of fluid, serous in character.

March 14th. General condition wonderfully improved. Oxygen fifteen liters.

March 16th. Mr. Cazolis, who saw the patient when he entered the hospital, found a tuberculous lesion the

size of a hen's egg ; the apex of the left lung was not acting (hepatized). Examined to-day, the doctor reports the cavity still existing, but the tissue surrounding it, which had lost its functional power, was now acting. The act of inspiration was increasing ; his chest was much enlarged, and yesterday the patient was out walking for one-half hour. His appetite is very much improved, and he states that it will be necessary to supply him regularly with food if we persist in giving him the oxygen. The digestive and circulatory functions are normal. His personal appearance is not indicative of one afflicted with phthisis. The testicle is greatly diminished in size. It is less hard and painful. Still continue the fifteen liters of oxygen. Wine of quinine and the syrup of the iodide of iron.

March 18th. Slight stomach-ache after the inhalation of the oxygen.

March 19th. Appetite always good, and his strength is such that he is enabled to take long walks. Sleep, good ; dreams at night.

March 20th. Again slight stomach-ache after taking the oxygen.

March 26th. Patient took thirty liters of oxygen. Dozed, slight vertigo, sight blurred. The cough and expectoration have been entirely suppressed. There are no râles at the point previously stated a month ago. The respiration is amphoric.

March 30th. Henceforth the thirty liters of oxygen at the request of the patient will be divided into two doses of fifteen liters of oxygen each, night and morning. Appetite is very good in the morning; general condition very satisfactory.

The patient continued to inhale the oxygen during

the month of April. His health is excellent, and he had decided to leave the hospital April 29th, when he noticed, in the morning, small cutaneous hemorrhages on the left arm and two lower limbs, purple in character. General condition good.

April 30th left hospital in good condition.

CASE OF DILATATION OF THE BRONCHI SUCCESSFULLY TREATED BY INHALATION OF OXYGEN.—OBSERVATIONS BY MR. COSMAO DUMNEZ.

Mr. S——, a banker residing in Paris, was submitted to oxygen-treatment May 10th, 1864, for a chronic affection of the respiratory tract. He has had a cough for many years, though not painful. It had increased in frequency during night and morning, and was accompanied with an expectoration of greenish spittle—opaque, and adherent to the bottom of the vessel. Respiration is generally troublesome, except during a period of moisture. Appetite slight. Mr. S—— has become very much emaciated since beginning of his illness. Auscultation revealed mucous râles disseminated here and there in the chest, but particularly at the base of the right side. Percussion did not reveal any abnormal thoracic sounds. Mr. S—— states that there is no previous history of any tuberculous affection; he is the father of many children, all of whom are enjoying good health; never had any hemorrhages; no night sweats. Taking the symptoms, and particularly the character of the expectoration, into consideration, I was led to believe that Mr. S—— was suffering from dilatation of the bronchi.

May 10th. He inhaled three liters of oxygen morning and evening, with an equal quantity of air. He experi-

enced during the first inhalations a strong sensation of heat in the chest. Nothing particular with organs of sense, nor in the œsophagus. The 11th, 12th, 13th, and 14th continued the inhalations, increasing gradually from five to six, seven, and finally ten liters, night and morning. He experienced slight dizziness after inhaling, also tingling sensation in the hands and feet. After a time this all disappeared, and the sensation of hunger produced was such that the patient was obliged to eat two or three times between meals. He stated that the cough became less frequent, the expectoration became clearer and less abundant; his general condition has greatly improved, and he began to gain in flesh. From the 14th to 18th we did not see the patient, who continued to inhale ten liters night and morning. The expectoration, which was greenish in character, became almost white; appetite was excellent. Mr. S—— then departed for London, where he continued the inhalations for many weeks, always deriving great benefit from them. We have not seen the patient for many months.

I desire to report the following case, which to me does not seem less interesting than the others. It is the case of a young lady who was afflicted with glandular swellings in the shoulder, neck, along the trachea, and probably the bronchi. She entered during my term of service to have tracheotomy performed. Under the influence of oxygen her condition immediately improved, and she left my charge, not cured, but so much improved that she was able to attend to her duties. Presently having been subjected to cold and privation, she had a relapse, and again under the influence of the oxygen the dyspnœa disappeared, and relief was immediate. The following is a report of the case.

TUBERCULOUS ENGORGEMENT OF THE NECK.—COMPRESSION OF THE RESPIRATORY TRACT, THREATENING ASPHYXIA.—OBSERVATIONS BY DR. BOUCHER, INTERNE.

Mrs. S——, aged thirty-five, entered the hospital March 14th, 1865. This woman began to menstruate at the age of fourteen, and has menstruated regularly since that time. She is the mother of a child eight years old, who enjoys good health. Family history excellent. Father and mother both living, and in good health. She had enjoyed excellent health in her youth. She had glandular swellings in the clavicular region. The cicatrices now on the left side at the angle of the jaw are probably due to the suppuration of those glands. The glandular swellings which made their appearance in youth made their disappearance at the time of puberty. About six years ago there appeared in the left supra-clavicular fossa a tumor which attained a very large size, but which disappeared very suddenly and almost completely. Three years after other glands made their appearance in the left axillary fossa. Following these appeared a number of glands in the right supra-clavicular region. When she entered the hospital we found the following condition: There were four or five small indurated glands on the left shoulder, one of these, which encroached slightly on the mammary region, had attained the size of a pigeon's egg. In the right supra-clavicular region there existed a chain of glands, small in size. All of the glands near the trachea that could be felt with the hand were hard and of good size. To the left in the cervical region there existed a mass of glands, hard, which exerted such a pressure as to cause an alarming condition. Two months before she entered the hospital the respiration was nor-

mal. But for the past few days the respiration has become so difficult that the patient is actually obliged to blow in order that the resistance to the ingress of air may be overcome. If she walks any length of time, or even rapidly, respiration becomes more difficult. In a word, walking is not to be thought of. There exists at times paroxysms of actual asphyxia. Sometimes they are spontaneous, occurring after a rapid walk, or after eating.

Respiration is slightly affected when the patient is in bed; when standing it becomes painful, and there is a whistling sound.

Percussion: Nothing abnormal.

Auscultation: Harsh respiration, whistling sound, due no doubt to pressure on the bronchi. The patient requested us to perform tracheotomy. But it certainly would not be practical to perform this operation, for the swelling did not exist alone in the cervical region, but all along the trachea, and probably the bronchi. The only thing to do was to keep up the nutrition and favor the resolution of the general ganglionic enlargement. We prescribed tonics, and at the same time advised inhalation of fifteen liters of oxygen, and continued this treatment for a month. The appetite increased a little, and some of the glands diminished in size. But when the patient was out of bed, the respiration was yet painful.

The paroxysms of asphyxia were less frequent, but yet came on from time to time. We doubled the quantity of oxygen, so that night and morning the patient inhaled fifteen liters of the gas mixed with an equal quantity of air. After five or six days of this treatment we noticed considerable increase of appetite, so much so that the patient was obliged to eat at night, and many times between meals. In the mean time the general appearance

became improved, the skin and mucous membranes had good color. We also noticed a considerable diminution in the enlarged glands. The mass of glands which were pressing upon the trachea became less hard, much diminished, and more movable. The respiration was normal when the patient was in bed. While standing it was yet difficult, but we did not hear the whistling sound. There were as yet at times paroxysms of asphyxia, but they were shorter in duration and not so painful. Walking is also less painful. We continued thus to give the patient thirty liters of oxygen each day. The most extraordinary thing is the enormous appetite. Her condition improved daily, and she left the hospital May 26th.

INTERMITTENT FEVER TREATMENT.—OXYGEN.—OBSERVATIONS BY HILL.

Mrs. Priest, of feeble constitution, was suffering in August, 1795, in the county of Essex, with such a severe attack of intermittent fever that her life was in danger. The intervals between the attacks were so short that any remedy did not seem to stop it. Quinine, mercury, balsams, change of air, and other treatments advised by different physicians, and followed for three months, did not abate it any, and finally the disease took on the form of a "tertian ague," which so weakened the patient that she was obliged to almost continually lie in bed. This general feeling of weakness was accompanied with hypertrophy of the spleen, which occupied all one side of the abdomen and produced, by compression on the vessels back of it, œdema of the lower extremities. At the outset jaundice was present, and when I saw Mrs. Priest in 1798, there were yet signs of engorgement of the liver.

Among other things the jaundice persisted during one year. Under these circumstances I had difficulty in finding some remedy. In the mean time I prescribed oxygen with the hope that it would so render the system that tonics might bring about a cure. After administering the oxygen for a period of ten days (one liter to forty air), I had the satisfaction of seeing the attacks shorter and less violent, and at the same time was restored to the body its heat, moisture, and sleep. By gradually increasing the dose of oxygen the symptoms disappeared. Thanks to this treatment, aided by iron and mild cathartics, the patient was cured in one month. The general condition was excellent. The size of the spleen was considerably diminished, although I did not attach much importance to it. I however was afterwards informed that the swelling had completely disappeared. Thus we see that impure air caused and pure air cured this disease.

PART V.

APPLICATION IN SURGERY.—LOCAL APPLICATION OF OXYGEN.

The application of oxygen to a sound or diseased limb does not present any more difficulty than the inhalation of the same agent, thanks to the great zeal and intelligence employed by Mr. Galante in constructing apparatuses for local administration of gas. We have constructed for this purpose muffs of vulcanized rubber in which we place the limb. Strips of diachylon plaster are so arranged as to keep the orifice firmly adherent to the limb on which we wish to operate. A tube is so arranged that communication is set up between the interior of the muff and the external air,—by which means the gas may be made to penetrate.

The patients upon which we have operated having experienced no sensation, one of our assistants wished to make a series of experiments upon himself. The temperature of the lower limb was taken with great care. This latter was placed in the muff and the oxygen was introduced. No appreciable sensation was experienced, but at the end of an hour when we took off the apparatus there was an elevation in temperature $\frac{2}{10}$ degree, and at another time $\frac{6}{10}$,—we thus found moisture of the limb, from the condensation of perspiration, perceptible or imperceptible. This elevation of temperature is not of much account; for we have obtained, by the application of a muff filled with air at two different trials at intervals of an hour each, an elevation of the temperature in the first case 2 degrees, in the second $2\frac{2}{10}$ degrees, therefore from these experiments it has been shown that a muff applied to a limb and filled with atmospheric air will result in a higher elevation of temperature than oxygen.

We simply state without insisting that such must always be the case; for we well know that the temperature of a limb may vary under such a multitude of influences that it is impossible to state each.

Has oxygen a chemical influence upon the part to which it is applied? To me it does not appear doubtful. If we cause the oxygen which has been held in contact with our bodies to pass through lime-water it will show great disturbance; there is therefore exhalation of carbonic acid gas, a phenomenon which was discovered by Abernethy. But there are evidently other phenomena that should be explained, and which we are incapable of determining, but which intelligent chemists will not fail to discover. A physiological proof which manifests it-

self in these conditions by a series of chemical phenomena, and that is, that under the influence of oxygen we see congested parts readily healed. I have often confirmed this fact in a case of senile gangrene, when the local congestion which surrounded it changed its appearance very promptly. The oxygen—which I employed in many chronic cases of Eczema Rubrum—caused a whiteness of the skin of the lower limbs very rapidly, which was the seat of the trouble. Here, therefore, is a fact to which we call the attention of the chemists and dermatologists. It is on account of these results that we have employed to many limbs when there were affections of the veins, with redness and alteration of the skin complicated with profound rigidity. For, under the influence of oxygen and from exudation of liquid which accompanies its application, we have seen the condition of the patient rapidly improved. True, we have not cured these affections of the veins, but we have promptly modified the complications which accompany them. We have now a case under treatment.

Brought in contact with wounds, the action of oxygen upon old wounds and recent ones should be studied. Unlike carbonic acid gas, oxygen does not provoke painful irritation in wounds of long standing. It is about two years since we gave treatment to a law student who was suffering from a large syphilitic ulcer involving nearly all the calf of the leg. Walking was difficult, in fact almost impossible. A proper treatment continued for a long time did not bring about a cure. The same treatment aided by local application of oxygen promptly brought about a resolution in the wound, which ceased to have its grayish appearance, the borders disappeared, and the young man was cured. What *rôle* did the oxy-

gen play in this case? Was the healing of this great ulcer due to the influence of hospital regimen or due to the oxygen? That is difficult to determine; however, we understand perfectly that a very bad wound was greatly improved by being subjected many hours each day to *l'air vital.* There is, as we shall see later on, independent of its chemical influences, a special influence which we shall insist upon as existing. Oxygen applied to recent wounds is not painful, there is a slight amount of heat experienced, but not so irritating as carbonic acid gas, as I have observed many times after an operation, more or less grave, on the hand or the foot. These organs placed in contact either a long or short space of time do not present any special phenomena. It is in cases of amputation of a finger, and cases where the nails are torn away, that I have made these researches. I will say so much for its action on inflamed wounds. But if the action of oxygen is kept up without interruption,—if, for example, to a simple healthy wound we apply locally the oxygen, here is what occurs. If the oxygen is allowed to remain in contact with a wound for many hours we notice that the particles of proud flesh are frothy, reddened, and have a tendency to take on a grayish appearance. The wound is covered with a slightly abundant secretion which is generally purulent in character. The pus examined microscopically does not present anything in particular; but the next day the irritation becomes so great that we are absolutely obliged to stop the gas, as the following case will prove. It is evident that in this case an action physio-chemical is produced by the application of the oxygen; but what chemical phenomenon is produced when brought in contact with this vascular proud flesh? It is that which we

find impossible to determine in spite of the importance of the question. Is it the same as in the lung—inhalation of oxygen, and exhalation of the other gases of the blood? That we cannot say. But that which is certain is that, in a healthy wound, inflammation may be brought about by excessive oxygenation.

The first patient who was submitted to this treatment was an old man, sixty years of age, who for two years had experienced very severe pains on a level with the toes of the left foot, and particularly in the second. Fifteen days after his entrance to the wards of Hotel Dieu (March 17, 1862), the pulp of this toe was black and insensible.

When the patient arrived, there was present on a level with the pulp of the second toe, a dry, black eschar, a little larger than a fifty centimes. Upon the other toes and upon the dorsal surface of the foot there were spots very red in color. Sensibility was completely gone to a level with the eschar, and was diminished to a level with the other toes. The pains were very pronounced. Examination of the circulatory system did not show any appreciable alteration with the heart, or in the passage of the arteries. We felt very distinctly the pulsations of the pedis, the walls of which seemed perfectly sound. All the treatment which this patient was subjected to was to plunge the feet for an hour each day in a vessel through which a current of oxygen was made to pass.

At the end of five or six days the pains were less intense and the length of the spots diminished. They presented a rose appearance. A few days later, did not suffer at all. The skin had assumed its normal color, except on a level with the eschar. Insensibility had diminished.

During the first days of April the formation of a furrow indicated that the part mortified was about to become detached. The eschar was thrown off April 10th, leaving a small superficial wound (very healthy looking). April 24th the patient went about walking perfectly. The oxygen baths were continued until he left the hospital.

The second patient was also an old man sixty-six years of age, who was a laborer, in spite of his great age following the profession of a carman. About one month and a half before his entrance, he experienced, in the two last toes of the left foot, great pains, which had necessitated his stopping work. He had noticed that his toes, at first livid, became black, and at the same time insensible to the touch. He then entered the hospital, April 21st, where we found that the toes were affected with dry gangrene. The foot presented livid spots; there was no appreciable lesion, neither in the heart nor vessels. He was submitted to oxygen baths, and a few days after the pains had ceased. We saw a furrow form at the line of demarcation, showing that the part mortified was about to be thrown off. Analysis of the gaseous mixture, furnished through a tube attached to a vessel, showed a great quantity of carbonic acid, a small amount of oxygen, and a very small amount of hydrogen.

These cases reported are positive facts. The process which we have had recourse to in the application of the oxygen is very simple. The part is put into a large rubber boot or muff, the upper extremity of which may be either placed above or below the knee, being well fitted and hermetically sealed by means of a large diachylon strip. The air contained in the muff or boot is made to escape, and we force in through a tube communicating

with the interior of the apparatus, with the atmospheric air, a certain quantity of oxygen contained in a balloon, the capacity of which is between twenty and twenty-five liters. The part is allowed to remain two or three hours each day in this atmosphere, after that we take it off.

The most striking results of these applications of oxygen are :—

1. Cessation of pain.
2. Stimulation of the capillary circulation.
3. The discoloration of the part, which very rapidly loses its violet color.
4. Finally, elimination of the eschar, and a cure.

SENILE GANGRENE.—PULSATIONS IN THE POSTERIOR TIBIAL ARTERY.

Mr. A——, aged sixty-two years, was attacked at the commencement of June, 1850, with paralysis, which resisted all kinds of treatment. However, the use of moxas (cautery), of blisters, of cupping, slightly relieved him. At different times Mr. A—— made trips to Luchon, where every year he passed the summer season. A cure, which seemed sure, stopped, and he was obliged to have recourse to electricity, which, in the hands of Mr. Duchenne, furnished good results. Before long Mr. A—— experienced dull pains in the two feet, also chills and tingling sensations so bad, throughout the left foot, that it prevented his going one season to Luchon. The alternation of pain, tingling, etc., persisted from time to time, and these symptoms did not disappear excepting under the influence of friction or electricity. During the month of August, 1864, the left foot was the seat of many sharp pains, more so upon the sole of the foot, and particularly near the origin of the toes. The feeling of

cold was absolute, the tingling very pronounced, and the tint violet. Sulphur water baths and douches produced no other than a burning sensation, sharp and intolerable pains throughout the foot ; a small wound began to make its appearance between the first and second toes, measuring about two millimeters. Under the influence of emollients and opiates, a new wound from four to six millimeters made its appearance upon the fourth toe, which was inflamed and indurated. Repose was necessary to re-establish health.

When Mr. A—— returned to Paris, the foot, being then red, violet, and swollen, was submitted to mercurial unctions, applications of belladonna, laudanum, etc. The swelling was reduced, but the two wounds remained stationary and would not cicatrize. At time of consultation I found absence of pulsations in the pedis, the anterior tibial, but did find them in the posterior tibial. The foot had a livid appearance. The wounds were bad looking, and did not seem to verge toward a cure. The pains were always sharp and profound. There was insomnia. I then prescribed oxygen, which was administered according to my instructions. After twelve days of local application of oxygen, the two wounds, which had resisted all other treatment, became cicatrized and the pain ceased. Since that time Mr. A—— has attended to his affairs, he walks, and could even run.

SPONTANEOUS GANGRENE OF THE THIRD TOE, LEFT FOOT.—LOCAL BATHS OF OXYGEN.—CURE.—OBSERVATIONS TAKEN BY M. BOUCHER, INTERNE.

Mrs. L——, aged fifty-five years, entered the hospital April 18, 1865. Mother of two children, one of which died at an early age. She has always enjoyed good health.

Her constitution is good. Actually there is a noticeable dilation of the trunk of the brachio-cephalic artery, perfectly appreciable on a level with the fork of the sternum. About eight days before her entrance to the hospital the toes of the left foot began to cause her suffering, without seeming in any way to localize itself to any one toe. Two or three days after—the pains being very sharp at night—the patient noticed that the third toe presented a peculiar discoloration. It was a violet throughout its length, but verging to a dark and even black at certain parts, and particularly at the extremity of the plantaris.

When the patient arrived, the toe presented the following: at the extremity of the plantaris there existed an eschar of from five to six millimeters; upon the left foot, here and there we could see spots more or less large which were of a violet aspect. The arterial pulsations were present. They perhaps appeared stronger in the right than in the left. The temperature taken of both shows hardly an increase of one degree in the healthy.

April 21st. Application to the foot of a muff enveloping it as far as the knee, and filled it with oxygen. We would leave it that way for about eight hours, after which we would apply poultices of laudanum. We continued this same mode of treatment, and shortly the patient informed us that the night pain had greatly disappeared.

April 27th. The small eschar on the diseased toe was detached and it left a very red surface. The violet discoloration was displaced by a normal color. The wound left bare by the detachment of the eschar began to cicatrize. The pain had entirely disappeared.

May 20th. We stopped the application of oxygen, and we dressed the wound with glycerine mixture. A few days after the patient got up and began to walk.

INHALATION OF OXYGEN IN THE TREATMENT OF SURGICAL DISEASES.

After the facts explained in the preceding chapters, I must now apply the oxygen for toning up patients, debilitated by suffering or suppurating wounds of long standing. In these cases anæmia and dyspepsia are often hard to conquer, so if we operate upon the unfortunate patients under these circumstances, we stand a good chance of losing them. How often, after having performed operations frequently not dangerous, have we seen our patients become so weak that we found it impossible to revive them, to find some stimulant for the nervous system, or to produce in them a condition to aid recovery. Therefore, an unfortunate patient who has suffered for a long time, who is anæmic, without appetite, the taking of food producing a feeling of disgust, we submit him to a grave operation—an amputation perhaps, or a resection, or removal of a tumor; that accomplished, we attempt to nourish him in order to repair forces which have long since been impaired, and to create, if this is possible, a sufficient quantity of blood for the accomplishment of the functions. We insist upon having the best nourishment, and use of the best wine. But the digestive functions are impaired; the blood itself is so profoundly modified both in quality and quantity that we cannot sufficiently stimulate the organism. The wounds are sluggish, the suppuration of bad nature, and without any local trouble to explain this fact. The patient is failing in spite of all that is being done. Now, if in this case we make the patient inhale night and morning fifteen to twenty liters of oxygen, pure or mixed with air, we shall very soon see the patient's strength and appetite return, and we shall have

convalescence established in him for whom death seemed inevitable.

Since I have introduced oxygen into my service, I have many times been successful in stimulating patients thus afflicted ; one striking case was that of an unfortunate young man who came to me from the country, during my term of service, to be operated on for white swelling of the tibio-tarsal articulation. I amputated the lower portion of the limb. This unfortunate, between twenty-five and thirty years of age, was in a very weak condition when he arrived. I had hoped that by clearing away the trouble his forces would return ; but unfortunately it was not to be. He remained in a languid condition and in spite of my entreaties he would take but little nourishment. He had a most profound disgust for food. It was then that I submitted him to the use of oxygen, and in a few days the appetite returned, and with it we saw the anæmia and emaciation begin to disappear. This case, which is the first in which I used the oxygen for the purpose of stimulating a patient after being operated on, has struck me very much. My patient got well very rapidly, and went about with the aid of a crutch. A short time after that, I gave Mr. Trousseau testimony of a case which was not less interesting. It was the case of a young Spaniard, afflicted with severe hemorrhages and an abundant suppuration. He refused all kinds of nourishment—loss of appetite complete. Under the influence of oxygen he rapidly regained his strength and appetite, and he lingered some time.

The two preceding cases have wonderfully encouraged me to follow the practice of inhalations of oxygen.

Here we give more in detail of another case from which good results have been obtained. This time the individ-

ual was so feeble that we continued the oxygen in spite of the fact that a very grave complication arose during his convalescence.

WHITE SWELLING OF THE TIBIO-TARSAL ARTICULATION.—AMPUTATION OF THE LEG AT THE INFERIOR FOURTH.—PROFOUND DEBILITY AND ANÆMIA.—INHALATION OF OXYGEN GAS.

October 20, 1863, there entered the hospital, a man forty years of age, married, and employed by the government. He was of nervous temperament, constitution impaired, he had been sickly for years, color pale, and body emaciated. He has had a cough for four or five years, and rarely passes a winter without an attack of bronchitis. His voice is frequently harsh. He has been under the care of a physician in Paris for one year, one season at Amelie-les-Bains to be treated for the joint trouble. Auscultation did not reveal any signs of tuberculous phthisis. The right tibio-tarsal articulation is very much swollen. The œdema surrounding it was considerable and extending beyond the malleoli. We found crepitation, which caused denudation, erosion of cartilages of the joint. The foot was kept almost immovable, in a state of extension. It is uniformly œdematous. Pressure was painful. There were a few fistulous openings near the articulation from which a very thick pus escaped, rather sero-purulent and resembling from its physical character the pus which we find in a collection coming from an abscess from congestion. The patient had suffered for two years with this joint, and for more than a year had been obliged to quit work. He remained in his room—but more often in bed. Diagnosis is con-

firmed. We do not consider the disease fatal, in spite of the constitution of the patient, which is decidedly scrofulous. M. Demarquay, after a careful examination of the general condition of the patient, and after exploring the joint and finding caries of the tibio-tarsal articulation, and certain of the metatarsal bones, decided to amputate. This operation was performed at the lower fourth of the limb October 26th. We commenced inhalations of oxygen November 3d. Fifteen liters each morning, then twenty, and finally twenty-five liters. At first the gas was mixed with one-fourth air, at the end of a few days less, and finally pure.

Here are some of the phenomena noticed :—

At the end of the inhalation, which lasted three minutes, the pulse, at first 72, was raised to 80. The skin of the hands and chest was moist. Nothing with organs of sense. No trouble with sight or hearing. No brain symptoms—no vertigo, no deafness. We did not notice any intoxication, or tingling at the tips of the fingers. This patient, who had had anorexia for a long time, nights sleepless, after a few days states that he feels somewhat improved. Having seen these phenomena among the greater part of my patients, I desire to speak of the rapid increase of appetite.

In fact, after a few inhalations the patient ate to advantage, and enjoyed it very much, and felt the sensation of hunger quite often. The nights are less troublesome. He breathes more freely and the chest dilates more easily. He experiences, many hours after inhalation, a happy feeling, and a sensation of activity.

November 10th. The patient experienced a violent chill, followed by hot flushes and finally abundant sweating. He had, before and after the feverish attack, a

general feeling of malaria, anorexia, insomnia, great thirst. (Tilleul, Sulfate de Quinine.)

The wound was more painful. The next day it was very dry and red. (Glycerine dressing.)

November 11th and 12th. The glands in the left groin were engorged, and a few erysipelatous patches were seen near the stump. Some of the lymphatic vessels were inflamed.

In spite of this serious complication, the fever, sweats, and depression, which traumatic erysipelas caused, the inhalation of twenty to twenty-five liters of oxygen with one-fourth air enabled him to resist all. The wound took on a healthy aspect, and the 5th of December we ceased using the oxygen. About the middle of the month he left the bed and walked a little ; there was a decided improvement in his general health, appetite, etc., and the wound had almost cicatrized.

It is not rare that following operations, even though they are not dangerous, we have considerable hemorrhage among individuals who are weak and debilitated by great changes in the blood and otherwise. In these cases we give iron, and we try to brace them up and stimulate the appetite. But very often their dislike for food is invincible. It is then that oxygen renders great service. It stimulates the central nervous system and produces a decided change in the patient. I have many times seen patients who have been operated on, or women very weak from metrorrhagia, for example polypus of the uterus, finally take new life.

TUBERCULOUS EPIDIDYMITIS.—PROBABLE INFLAMMATION OF COWPER'S GLAND AND ABSCESS OF THE MARGIN OF THE ANUS.—CONSIDERABLE HEMORRHAGE.—RESPIRATION OF OXYGEN.

H——, aged nineteen years, commercial man, entered the hospital October 29th. It is now five or six months since this patient came, for the first time, to the hospital, during Mr. Cazalis' term of service, for a trouble which he experienced in the left inguinal region. After a few days, Mr. Cazalis sent him to the country, and ordered him to take milk diet. In spite of all this treatment he did not improve. Soon the abdominal pains, which had diminished somewhat, began to re-appear and with it engorgement of the inguinal glands, and a tumor of the same nature in the left scrotum. Rest for three weeks, recovery followed. He returned to his place of business in Paris.

He returned to-day, October 29th, to the hospital during the service of Dr. Demarquay. He complains of continual pain in the perineal region. It is impossible for him to sit down ; he is obliged to remain standing, and when fatigued he must lie flat on his belly. He also adds that there is a small tumor in the left scrotum.

In examining the perineal region, we found at the base of ischio-urethral triangle a tumor about the size of a large walnut, elliptical in form, its great diameter being parallel with the median raphe, which divides it into two unequal portions. It is situated more to the left than right. The skin covering it is healthy and does not adhere to it at any point. This tumor is very painful, even on the slightest pressure. Dr. Demarquay thinks there is probable inflammation of Cowper's glands in the scrotal region. The epididymis is very much swollen

and the siege of three small tumors which are very hard. After the external appearances and family history, we think that this patient is suffering from tubercular diathesis, and on examination of the chest there is nothing present except, probably, hard respiration.

November 6th. The tumor seems to have diminished in size, but nevertheless is painful to the touch. On palpation we find an obscure fluctuation in it.

November 11th. Incision of the tumor, a large quantity of pus escapes; following days a pus serous and fœtid escapes; it produces considerable discoloration of the skin; the fibers of the transverse and ischio-cavernosus are bare, but there is no point of communication with the urethral canal. General condition is satisfactory.

November 28th. There was an abundant hemorrhage. At yesterday's visit the patient was very weak, the face was very pale; dullness of the eyes. The patient was found in great prostration. (For nourishment, broths and porridge.)

November 30th. Dr. Demarquay decided to have him inhale oxygen for a few days. Two days after the inspiration of the oxygen the patient was found less weak, and his appearance was much better. He could eat a little. Nevertheless the wound presented a grayish color, was fœtid, and had a serous secretion on the surface. At the end of eight days we found a great change in the appearance of the wound, and in the patient's general condition. The wound had become rose colored, face had good color, and the patient told us that his appetite had increased since the inhalation of oxygen.

December 15th. Patient was found in a very good condition. The wound presented a vermilion red color; he ate four times that day.

December 29th. He still continued to improve, and all we were waiting for was complete cicatrization of the wound.

It is evident, therefore, to all, that an operation, no matter how grave, is bad when a patient is in a debilitated condition. The pain and loss of blood inseparable to all operations is again very grave. Without doubt we hope that the individual afflicted with a disease, by an operation, will take new life, but how often are we deceived in our hopes! When I find cases where an operation at the time is contra-indicated, I submit my patient to the inhalation of oxygen in doses of ten to thirty liters a day, taken at two different times, and mixed with a certain quantity of air, morning and evening, slightly before meals, and it has been my good fortune to render the system in such a condition that it can resist any difficulty which may arise from an operation.

TUBERCULOUS GROWTH OF THE TESTICLE.—FEEBLE CONSTITUTION.—DYSPNŒA AND ANÆMIA.—RESPIRATION OF OXYGEN.—CURE.

Mr. A——, aged thirty-five years, an architect, entered the hospital July 27, 1865, to be operated on for tuberculous growth in the left testicle. This tumor was ulcerated and the ulceration extended each day with great rapidity. The patient requested an operation, which would certainly relieve him from this trouble, but which was contra-indicated by his general condition. For many months he has suffered and is very much emaciated. He has very frequent sweats. The mucous membranes are pale, appetite diminished, digestion difficult. Moreover

has had a preceding attack of articular rheumatism which has caused stiffness in many of the joints. Under these circumstances an operation was not to be thought of. The surgeon, seeing that manipulation might cause a hemorrhage from the corpus cavernosum, would have to be very careful in manipulating the patient, for this hemorrhage might cause great debilitation and, in fact, he might lose the patient. It was therefore necessary to fortify the system and tone up the appetite. At the time when we submitted the patient to the use of tonics he was made to inhale each day ten liters of oxygen. A few days afterwards he increased the dose to twenty liters ; two days after the patient stated that there was an increase of the appetite, and he began to have a better appearance. The mucous membranes had good color and his strength returned so well that by the 21st of August we performed castration. About noon he had a hemorrhage, and in order to stop it it was necessary to use perchloride of iron. In spite of this, cicatrization of the wound went on all right, the general condition was sustained, and to-day, the 10th of October, the wound is closed. The patient is in excellent health. In a word, his present condition presents a striking aspect when compared with his entrance.

This case interested both myself and the students, for certainly without the inhalations of oxygen the patient could not have stood the operation of castration and also suffer from a great hemorrhage.

I often have recourse to carbonic acid and to oxygen locally applied to combat persistent ulcers and wounds of a bad nature. After the example of Beddoës I have had recourse to the inhalations of oxygen to effect a cure in long standing wounds of an unhealthy character and

even in specific wounds, and that with the greatest advantage. Not that in these cases oxygen has a specific action, for its action is more simple and general; it acts in toning up the forces of the economy and the wounds themselves and finishes by causing a cure of the same.

1. A case of scrofulous ulcers on the arm and leg was cured after a few weeks by the inhalation of "*l'air vital.*"

2. A case of ulcer of the leg of twenty-eight years' standing, treated in vain four years by Pott and during twenty-seven months by Sharp, was cured at the end of four weeks by the inhalation of oxygen. Six months afterward the patient had no relapse.

3. A case of scrofulous ulcer of long standing and unhealthy appearance, situated on the arm of a debilitated individual, was treated by daily doses of oxygen gradually increased and diluted with atmospheric air. At the end of one month there was astonishing improvement in the general condition, but in the ulcer no tendency toward cicatrization. On the contrary, at the end of a certain time irritation and inflammation were present in the ulcer. We moderated the stimulation produced by the oxygen by adding to this gas a certain amount of carbonic acid gas. In less than a week the inflammation had disappeared and the ulcer showed a tendency to cicatrize. The dose of the gaseous mixture was increased and the patient was cured.

4. A case of ulceration of the leg of great length (four inches long and three wide), deep enough so that it invaded the muscular tissue, presenting a very unhealthy appearance and causing much weakness. During one year the patient was submitted to a number of tonics, both administered internally and externally, but without any change and with steady progress of the disease. The

patient was a Mr. Atwood, and although not bedridden, still his general appearance was very bad ; appetite poor, frequent nausea, unhealthy wound, painful at times and causing frequent insomnia. From the time Mr. Atwood was submitted to oxygen mixed with air a rapid change took place, and the appetite returned, which was the first effect produced by the gas ; sleep was better, more refreshing, the strength was restored, and finally his general condition was very much improved. It is remarkable, the coincidence between this case and those reported by Beddoës, as far as improvement by oxygen was noticed. Shortly the wound presented a better appearance, it allowed healthy pus to flow, at the end of fifteen days it was three-quarters closed, and at the end of six weeks cicatrization was complete. In these cases and in others oxygen has acted as a profound modifier of the economy, which, toned to a very fine condition, was enabled to cure itself. Encouraged by these facts and my personal experience, I asked myself if I could not administer to advantage oxygen to patients afflicted with phagedenic and serpiginous chancres. It is evident that with these individuals the most important thing is to modify their constitution, thus country air and good nourishment being frequently all the medication needed. Now, what can we do with the aid of oxygen? We develop the appetite, we profoundly modify the nutrition by favoring assimilation, we also sensibly change the state of the blood. It is not therefore astonishing that we bring about cicatrization of persistent ulcers and even of those phagedenic and serpiginous in character. The following case is a proof.

PHAGEDENIC AND SERPIGINOUS CHANCRE (IN A DEBILITATED PERSON) OF TWENTY-EIGHT MONTHS' STANDING, HAVING INVADED THE PERINEUM, THE PUBIS, AND THE THIGHS TO A GREAT EXTENT.—INSPIRATIONS OF OXYGEN.—CURE.—OBSERVATIONS TAKEN BY M. DE LAVAYSSE, EXTERNE.

The 15th of October, 1863, there entered the city hospital a young Englishman, native of London, aged twenty-five years, who arrived in Paris the same day. By the aid of an interpreter the following history was given me :—

Family history, syphilitic. He has had since the age of twenty many blennorrhagias ; the number he does not exactly know ; he has had orchitis of the right testicle. the last blennorrhagia dates back many months, before the invasion of the chancre, which was phagedenic in character ; the chancre is of eight months' standing. It occupied the meatus urinarius, did not leave much of a cicatrix, and was cured in a month. Mr. Johnson, surgeon to the St. George Hospital of London, treated him the first time. This chancre, states the patient, was completely cicatrized under the action of local treatment and internally by corrosive sublimate. About fifteen days afterwards an ulcer appeared in the groin. After having caused a slight smarting pain during many days, this ulcer, which was perfectly round, enlarged each day, until it finally became the size of a five franc piece. It commenced to cicatrize from the center outwards.

During the four months which the patient passed at St. George Hospital, the two groins, the inguino-crural folds in the perineum, were successively attacked. The

patient suffered a great deal when the wounds were exposed at the time of washing with different solutions. The wounds were red and bloody. The patient was submitted to absolute rest. He could not in any way perform flexion or abduction without causing them to bleed, or without tearing the surface and augmenting his sufferings. He became very weak, slept badly at night, lost his appetite. He was growing thin each day ; from time to time he suffered from diarrhœa.

We prescribed mercurial treatment internally, with washings of carbon powder and quinine. Hospital diet, *i. e.*, wine, chops, etc.

At the end of four months the patient went home and followed a new treatment ; he entered afterwards the hospital of St. Bartholomew, where he spent four months; no improvement.

The patient went home again and remained many months. Upon the advice of a few friends he decided to come to France and enter the city hospital in Paris.

This urethral chancre, which had caused extensive destruction—respecting only the scrotum—of the penis, the groins, the pubis, the perineum throughout its length, the internal and superior portions of the thighs, was of ten days' incubation. The woman who inoculated him is a patient being treated for syphilis in a hospital at Liverpool.

Upon his entrance to the hospital the following condition existed :—

The perineum, throughout its length, here and there to the anus, was almost completely covered with a white cicatritial tissue, which was thick, wrinkled, hard, having drawn and contracted the neighboring skin. On the perineum we found two large circles at least the size of

a five franc piece. The surfaces were red, and gray in some points. The borders were elevated, pointed, slightly discolored. The urethra bled at the slightest touch when a sponge was used in cleansing the wound. The pubis was completely raw, and we saw four large wounds similar to the others. They were covered with a thick crust, brownish in color, which broke and was easily detached by the nail; below we found the base of the ulcer slightly depressed and of variable color at many points, grayish, light red; and at other points the surface was moist with a bloody serous fluid.

At the internal and superior portion of the thighs we found two wounds the size of a one franc piece, more or less covered by a crust. I have previously stated that these wounds were generally round; some absolutely formed a circle, others were oval and elliptical in shape. These ulcers, which always invaded the neighboring parts, became cicatrized at one part and hollow at another. They extend on the surface rather than in the deep parts. During the time of his stay at St. George's Hospital he had an adenoid tumor in the left inguinal region.

The 16th of October Dr. Demarquay took off the crusts which covered the wounds and washed the surfaces with an aromatic solution. He proceeded to dress them and prescribed the treatment. We applied strips of Vigo's plaster and covered it with absorbent cotton. The whole was kept together by a bandage.

As to diet, we prescribed wine of quinine, broths, rare meat, and Bordeaux wine. The dressing was re-applied at the end of five days and thus continued during nine weeks.

The 23d of October we made the patient inhale each morning twenty liters of the gaseous mixture in the fol-

lowing proportions : air one-fourth, oxygen three-fourths. That is to say, fifteen liters of pure oxygen. Here are the principal phenomena observed. The pulse, at first 76, rose to 80 and at times 84. This phenomenon is very variable, as we have seen in many individuals. The skin became slightly moist, the face dim pale, very little color, even of the lips. Was it due to the action of the oxygen upon the economy and the efforts which the patient made to conveniently inhale by means of this apparatus? There was no headache, no sensation in the nose or the frontal sinus, no constriction of the temples.

We have not noticed in the patient any physiological phenomena with the organs of sense, the sight or the hearing; no tingling of the ends of the fingers. We employed during eight days twenty to twenty-five liters of pure oxygen.

I recommended the patient to take deep inspirations, to hold the air a long time in the chest, so that the gas would remain a long time in contact with the dark blood, which gas could be easily exhaled after having had its effect. The pulse was elevated from four to twelve pulsations, the skin became moist, the patient experienced a pleasant feeling and was quite happy. These sensations disappeared after a few minutes. The patient was not dazed, no humming in the ears, no intoxication. At times in the frontal sinus the patient experienced slight trouble which lasted half an hour. From the 13th to the 19th of November we administered to the patient thirty liters of the gas, the same as previously stated. We observed the same phenomena but the patient did not experience constantly the reunion of these signs. Many times heat back of the sternum, principally on two sides of the chest, with moisture of the chest and hands,

were the only signs observed. There were increased pulsations but diminution in the fullness of the pulse.

Intoxication, the sort of gayety which is produced by a small quantity of alcohol, is not seen excepting in women and young patients; and under the influence of a large dose of pure oxygen, from fifteen to forty liters, these phenomena of intoxication, of happy feeling, the feeling of shock and vertigo, are very pronounced.

In terminating this case we will speak of the general results to the patient and upon the wounds. During the first few days nothing was noticed aside from the ulcer, which was phagedenic in character. The inhalation of oxygen simply produced redness in the wound; it was covered with an abundant sero-purulent liquid. The base of the wound was very red in color. A month after the commencement of the treatment the greater portions of the chancrous surfaces were covered with a thin pellicle of cicatritial tissue. In certain parts the wounds were completely cicatrized; at other portions the chancre was yet red and attacked the surrounding parts.

We cauterized many times these points with nitrate of mercury and nitrate of silver, afterwards we washed the wounds with an aromatic solution. We covered them with strips of Vigo plaster, a thick roll of wadding and a bandage outside. The 4th of October we definitely postponed the inhalation of oxygen. The general condition of the patient was much improved—his strength improved, the face had good color, and he had a devouring appetite which seemed to be never satisfied. The 28th of December cicatrization was almost complete at all points. In two places there was an ulcer the size of a one franc piece. We cauterized them, dressed them, and in a few days the patient was cured. Here was a young man

afflicted with long-standing venereal trouble; he entered the hospital in a debilitated condition and at the end of two months and some days he was cured.

While this patient was being treated, a young man twenty-eight years of age, of scrofulous constitution, entered my service to be treated for two enormous buboes followed by soft chancres. This young man, very intelligent, was a commission broker. He was very much debilitated, was troubled with insomnia, loss of appetite, and at the end of a few days the wounds resulting from the buboes became true phagedenic ulcers, invading the two groins. I gave him the following treatment: The wounds were washed with a lint dipped in glycerine and he was submitted to large doses of oxygen, twenty liters at night and morning. Under the influence of these inhalations he had an increase of appetite, he ate and digested the food of two men. At the end of a few days the progress of the ulcers was stopped and finally this young man was cured. One of the most striking things about this case was the large amount of food the young man partook of. I was obliged after a few days to diminish the dose of the oxygen. A complete cure took place.

PHAGEDENIC AND GANGRENOUS CHANCRE OF THE PENIS.—GRAVE HEMORRHAGE.—EMPLOYMENT OF OXYGEN.—OBSERVATIONS TAKEN BY MR. BARLEMONT.

Emmanuel C——, aged twenty-seven and one half years, commission merchant, entered the hospital the 3d of January, 1865, afflicted with gangrene of the penis. The patient informed us that towards the end of November, 1864, he noticed on a level with the prepuce a slight bunch which was indolent and slightly hard. He punct-

ured it and a little pus escaped ; after this it began to enlarge and get hollow. He could not state the color, but it was evidently an indurated chancre. There was no more attention paid to this button, as he called it, which began to cause extensive destruction, and finally at the end of December it had acquired great proportions ; it abundantly suppurated, there was considerable swelling of the penis, and a paraphimosis. The penis was tumefied, the gland became black, and finally a hemorrhage manifested itself below the swollen prepuce and on a level with the chancre. The patient entered the 3d of January. An application of lint dipped in perchloride of iron stopped the hemorrhage.

The patient, of a scrofulous constitution, presented the appearance of a man suffering from anæmia. He had no appetite. Aside from the genital organs we found a large swelling of the penis. The dark gland presented the appearance of gangrene. An abundant amount of pus escaped under the prepuce from the base of the gland. The corpus cavernosum was destroyed to this level and the gland was just held to the penis by the urethral integuments situated below the canal.

The 5th of January Dr. Demarquay proceeded to reduce the paraphimosis by an incision of the integuments of the dorsal surface of the penis. A slight ligature was necessary.

The 7th of January the gland became completely separated from the penis without causing any accident. Perchloride of iron was used to stop the hemorrhage produced by the corpus cavernosum laid bare by the falling off of the gland.

January 8th. His sufferings, which were great each day, now became almost intolerable. The wound pre-

sented a grayish aspect and a disagreeable odor. General condition was not very good.

The 9th the penis commenced to diminish slightly, the fever, which was great the first few days, commenced to diminish. During the night of the 10th or 11th the patient had a great hemorrhage from each side of the canal from the corpus cavernosum. An application of the perchloride of iron did not have any effect and this threatening hemorrhage continued. A slight compression on the two corpora cavernosa with a slight application of ice stopped it for a few hours. The next morning, however, the hemorrhage re-appeared and Dr. Demarquay decided to cauterize it. For this effect an incision was made upon the dorsal surface of the penis, which was yet tumefied, and by this means the bloody extremity of the corpus cavernosum was laid bare. Many cauterizations were made on the wounds and the hemorrhage was thus stopped.

The 12th. The patient passed a good night; the wound commenced to suppurate. (Glycerine dressings.) The patient, rendered weak by considerable loss of blood, had a thread-like pulse and slightly frequent, 90 pulsations. We made the patient inhale this day and the two following, twenty liters of oxygen.

The 15th. The patient had a good appetite. The wound was oval shaped, the large extremity of which turned toward the base. The smaller one extended to the length of a centimeter on the verge of the penis. The new meatus urinarius, the center of which was formed by two folds, was obliquely reunited below, and formed by the corpus cavernosum. The prepuce, situated at the inferior extremity, was oval shaped, tumefied, and extending slightly over fifteen millimeters. The patient, who had

retained his appetite, saw the wound, which was red in appearance, become grayish and it had a very bad odor. The oxygen had been stopped for a few days.

The 23d. Inhalations were commenced again; the wound began to be rose-colored, swelling diminished, good appetite, general condition of the patient was improved; pulse became full, and the face, which was thin and pale, became filled out and had good color. The 3d of February we ceased the oxygen. Good appetite continued. The wound continued to present a good appearance. The new meatus urinarius disengaged itself from the head, which formed the two corpora cavernosa and presented in the middle an oval surface.

Following the example of Beddcës, I have given with success oxygen for the cure of scrofulous ulcers. I have now in my service a patient aged twenty-nine years, suffering from two scrofulous ulcers in the groins, following two large abscesses of the same nature. Six weeks of ordinary treatment did not produce any change in the parts. At the end of a few days after inhalation of oxygen the wounds changed their appearance, the appetite and strength began to return. Aside from this these facts are not very thrilling. It is only in consequence of the physiological action of oxygen. Knowing the properties of the gas it was natural to apply it in treatment to diseases of the bones and articulations. Dr. Thornton, in a letter to Dr. Beddcës, cites the case of a white swelling treated and cured by oxygen. I have not been so fortunate as the disciple of Beddcës. In the case of chronic arthritis of the knee joint, after having advantageously modified the general condition, I saw the articular pains increased. I believe from a therapeutical and pathological standpoint it is important to distinguish

these cases of chronic arthritis ; some being produced by rheumatic conditions or gout, others being the result of a traumatic lesion, and others nothing but manifestations of a scrofulous condition. Perhaps in the latter case only could we derive any benefit from the oxygen. I have not had sufficient experience to say positively, but we know very well that if we produce in a patient a good appetite and power of assimilation we shall profoundly modify a diseased organism and that we finally put it in a condition so that a cure may be finally effected. It is also necessary to ask one's self if the organic forces thus being established, the patient would not assimilate better the agents to which we submit him. In fact it is not only necessary to give nourishment to a patient to make him live, but we must procure digestion and assimilation so that elements not intended to build up the organism may be excreted. It is the same also in giving treatment. It is necessary that it should be absorbed, that it should be submitted to a special assimilation, in order to produce the benefit for which it is given. We know of no better agent to bring about this result than the oxygen. Here is a curious case which Hill tells us of and in which we hear spoken the names of two prominent surgeons.

WHITE SWELLING OF THE KNEE.—OBSERVATIONS BY DR. HILL.

Mr. Richard George was afflicted in May, 1787, in the thirtieth year of his age, with a rheumatic fever, which was harsh and of short duration. Toward the end of the following month he was taken with remittent fever, and Dr. Warren was called and took care of him for three months, during which time the patient suffered violent pain. The two knee joints were very much inflamed,

painful and swollen, especially the right one, which had received some months before a slight contusion. After having been profoundly debilitated by pain, fever, and the continual confinement in bed, Mr. George went to Buxton upon the advice of Dr. Warren. The waters of Buxton brought about the resolution as far as stiffness of the joints was concerned, and toward the end of October the joints had recuperated some of their vigor. The right joint, however, remained feeble ; upon the slightest exercise or a slight chase it always became painful, swollen, and he was obliged to keep it in an absolute rest for a few days. Similar renewed attacks occurred, the result of which was a fluctuation in the joint. In 1789 Mr. John Hunter was consulted. He prescribed slight cathartics and sea baths, but the effect was negative. Up to 1794 the disease did not improve any. About this time Mr. Cruickshank was called in consultation and he made an incision from which a yellow and glairy liquid escaped. The wound rapidly closed and the result was negative. In June, 1795, the knee was again affected, there was intense fever, great suffering, and it was very much swollen. These symptoms continued during many weeks during which the articular region was very much swollen. The constitution of the patient was seriously affected. Another surgeon was called and, after having found thickening of the tissues, swelling and alteration in the structure of the patella and bony extremities, he gave a very unfavorable prognosis. After many modes of treatment without any good results, two blisters were applied, the knee was twice cauterized, this kind of treatment being continued for a year. At this time, upon the recommendation of Dr. Beddoës, I was consulted. The surgeon, who was a friend, had told the patient that an amputation

was necessary. Mr. George, having been placed under my care, was submitted to the use of oxygen and after a few weeks the improvement was such that we really hoped for a cure. Mr. George, who could hardly go up stairs even with the aid of crutches, could at the end of six weeks, with the aid of a cane alone, walk a mile without fatigue, no stiffness of the joint, no pain, although from time to time there were slight painful attacks. This improvement continued and six months afterwards Mr. George's health was completely re-established, the knee being so improved that he could take long walks of three or four miles without any inconvenience. He continued to enjoy good health during three years.

CARIES OF THE BONES OF THE LEFT FOOT.—PROFOUND ANÆMIA.—INHALATIONS OF OXYGEN.—RAPID IMPROVEMENT.

John F—— entered the hospital the 18th of March, 1864. This man never had, to his knowledge, any serious disease. Eight months ago he was kicked by a horse upon the left leg, which spot was followed by general swelling, with heat and fever, which obliged him to keep the bed fifteen days. The patient, however, recovered very rapidly. Eight days ago he was taken with a general feeling of illness, headache, fever, and was obliged to stop work and go to bed. A pain, which was at first slight, commenced to increase in intensity, localized itself on a level with the external border of the dorsal surface of the left foot. This part began to tumefy rapidly and a physician was consulted, who, believing that there was a collection of fluid there, punctured it, but nothing escaped excepting blood and serum. The patient was

not eased. The fever increased each day, no improvement in the foot, so the patient decided to enter the hospital. This man when we examined him was pale and emaciated and his appearance indicated misery and suffering. The swelling of the foot was very manifest, yet there was no fluctuation. Pulse frequent and feeble; loss of sleep and appetite. Wine of Bordeaux, wine of quinine, etc., were prescribed. Compression by the aid of a roller bandage.

March 22d. Intolerable pain in the foot, slight redness of the skin, profound fluctuation. Incision by means of a bistoury, two cupfuls of pus mixed with blood escaped. We commenced to administer oxygen in doses of eighteen liters mixed with air. The inhalations did not vary the pulse. No trouble with the sight, no coloration of the lips, no humming of the ears. The wound of the foot did not change its color during oxygenation.

24th. We gave twenty-five liters of oxygen at a dose. Patient became slightly dazed.

25th. Mr. F—— experienced that night intense pain in the foot and very little sleep. Complexion was fair, patient seemed lively, and appetite was better.

26th. The pulse, which was at first 80, rose to 84 immediately after taking the gas. The appetite increased and the patient ate with pleasure.

April 1st. Appetite still good. He ate four times a day. Since we put the foot in a dextrine bandage he suffered less. Comfortable nights; however, he slept little, three or four hours a night at the most. This man had a pale yellow appearance, but he said this was his natural complexion when in a state of health. There were no murmurs found in the carotid arteries nor the heart. We made him inhale in the morning

twenty-five liters of oxygen. The pulse before inhalation was 84 per minute, after 93. Otherwise nothing particular. No tingling sensations in the hands or feet, no sense of constriction in the head, no trouble with the sight. The mucous membranes of the lips, however, were more colored immediately after than before inhalation.

April 2d. Pulse was 76 before inhalation. Patient inhaled but fifteen liters of oxygen to-day. Pulse was 84 immediately afterward. Although the patient inhaled thirty liters yesterday his appetite was not increased. Otherwise nothing particular.

April 5th. The patient experienced during the last two days increased pains in the foot. They were particularly increased towards evening and at night they were so intense as to prevent him from sleeping. Appetite, however, was good, color good, eye reacts well. We gave him fifteen liters of oxygen. Pulse 80 before taking, 88 immediately after.

April 6th. We took off the dextrine bandage. Respiration of eighteen liters. Pulse before 76, immediately after 80. Otherwise nothing particular.

April 7th. We replaced the dextrine bandage. Inhalation of fifteen liters.

April 10th. Patient's appetite very good. Even wakes up in the night and wants food. Complexion good. Strength fair. His general condition is, in a word, very satisfactory.

April 12th. He gains strength daily. Appetite is very much developed. He not only eats four times a day but partakes of food given him by his friends. Sleep, good. Patient sleeps all night. He suffers slightly yet with his foot. Under the influence of twenty liters of oxygen he

experiences no sense of constriction, no numbness in the limbs, no trouble with the sight.

April 18th. General condition very satisfactory. We ceased the use of oxygen.

With the properties which we know to be attributed to oxygen, it is natural to apply it to patients afflicted with cancer. I have very often done this with success, but not with the idea of effecting a cure. I have with many patients improved the digestive functions and enabled them to take substantial nourishment, and every one knows how often patients afflicted with cancer have a repulsion for animal food. My first patient was an old lady of sixty-nine years afflicted with an ulcerated cancer of the breast. She was anæmic and very feeble. Oxygen brought about a good appetite, so much so that she was impatient for meal-time. Soon afterwards complexion was good and her strength was good. The patient left my care and I was unable to follow her.

The beautiful sister of one of our most distinguished internes was afflicted with an enormous cancer of the breast. It was impossible to operate, but, thanks to the oxygen, her strength was so improved that she was enabled to enjoy social life during a period of one year in spite of her deplorable condition. That which I say concerning cancer of the breast I would also say of cancer of the womb. In these cases where oxygen is used I repeat that it strengthens the patient. I must also add that I have not cured anybody afflicted with cancer.

INDURATION OF THE UTERUS. — CHRONIC METRITIS. — CHLORO-ANÆMIA FOLLOWING.—GENERAL DEBILITY.— TONIC TREATMENT AND INSPIRATION OF OXYGEN GAS MIXED WITH VARIABLE PROPORTION OF AIR, AND FINALLY INHALATION OF OXYGEN PURE.—OBSERVATIONS TAKEN BY MR. LAVAYSSE, EXTERNE.

Mrs. Bertha J——, widow, Hungarian, aged thirty-two, entered the hospital the 6th of October. For many months this woman has complained of strong pains in the lumbar region, in the abdomen, and in the superior portion of the thighs. She experienced twitching sensations in the groins and a feeling of weight in the pelvis. She was habitually constipated, the menses for four months had been very irregular, sometimes very abundant, sometimes almost nothing, just soiling the linen in twenty-four hours. At this period the pains were intense. She was obliged to keep the bed. There was headache for many hours. On vaginal examination by use of the speculum, Dr. Demarquay found the neck of the uterus was enlarged, hard, and engorged. With the finger we could with difficulty make the circumference of the neck. The uterus had increased in weight, was indurated, and heavy to raise up. No leuchorrhœa excepting probably two days before the menstrual period. We did not employ rectal touch. By external palpation through the walls of the abdomen we could very easily feel the uterus in the pelvis. This pressure was very painful. Vaginal examination did not show anything the matter with the ovaries, or the broad ligaments, or the surrounding cellular tissue.

The patient presented a pale yellow appearance, no

strength or appetite. Dr. Demarquay prescribed wine of quinine, baths, poultices, rest in bed, and inhalations of oxygen. From the 11th to the 23d of October this woman inhaled fifteen liters of the gaseous mixture (oxygen with one-third air), then twenty liters, finally thirty and thirty-five liters. The proportions of oxygen were increased each day. This woman had an enormous lung capacity. She inhaled from two to three liters, while the smallest amount was half a liter, at an ordinary inspiration. Here are the phenomena observed and noted each day in this patient.

The first day fifteen liters of the gaseous mixture were inhaled in two minutes and ten seconds. The pulse rose from 68 to 76. The skin of the chest and forearms and hands was very moist; a slight sensation of heat was felt in the chest; no headache, no intoxication, no constriction of the temples, no tingling in the tips of the fingers.

October 20th. We increased the dose to twenty liters, of which fifteen liters were pure. The pulse rose eight pulsations; the skin was moist; the heat previously experienced in the chest was now generalized. Above the nasal margin in the frontal sinus and in the temples, there was a sensation of constriction which the patient described the same as occurring in preceding coryza.

23d. We gave twenty-five liters; the patient saw with pleasure that her appetite had increased each day. She experienced for twenty minutes at a time after inhalations a happy feeling, a mild heat in the chest, a false strength which disappeared very rapidly. We suspended the inhalation of gas during three days, for the patient stated that if she had experienced the slightest improvement in her condition the pains in her kidneys and in-

ferior extremities were intense and troubled her principally at night.

The 27th we again administered oxygen ; the dose was twenty-five liters, and it was brought up to thirty-five at the end of twelve days. There were in these twenty-five liters of mixture about twenty liters of pure oxygen. The pulse varies many times ; from 68, 70, 72, it rose to 80 and 84. This was the maximum. Her appetite increased almost every day ; her strength returned rapidly ; her complexion was better ; the lips and conjunctiva, at first pale, became rose-colored. This good feeling attained its maximum during three inhalations when the patient took twenty-five liters of oxygen pure. In the chest, throughout the back of the sternum, strong heat, which disappeared at the end of two hours and which was followed by more easy respiration.

From the 8th to the 16th of November the patient inhaled from thirty to thirty-five liters of oxygen, mixed with one-fifth of air. We saw the same phenomena produced with greater intensity. Three times we had noticed slight intoxication, also a tendency to gay ideas and laughing spells ; a slight numbness and dazed condition ; slight buzzing in the ears at times ; slight tinglings in the tips of the fingers. The skin became moist ; the pulse became thin, but increased from eight to twelve pulsations. Never had any headache, excepting just this sense of constriction, which disappeared rapidly. The last two inhalations took place the 15th and 16th of November. The amount of gas inhaled was from thirty-five to thirty-eight liters of pure oxygen. We noticed these same phenomena with perhaps greater intensity for the following reason :—

After the indications of Dr. Demarquay before these

experiments had taken place, I had advised the patient to take long inspirations in order to retain the gas as long as possible in the lungs. In these two experiences the patient held the gas in the chest from ten to thirty seconds; that is to say she made from six to three respiratory movements, the normal being eighteen per minute. In this way the oxygen could be very easily disseminated in the blood and kept a long time in contact with it. Here is a short synopsis of the phenomena :—

Sensation of strong heat but not disagreeable in the chest; pulse accelerated, also the respiratory movements. The skin became moist; the heat was most intense in the hands; there was numbness in the hands, slight intoxication; buzzing in the ears; in a word and to conclude, after having been subjected for six weeks to the inhalations of oxygen, she obtained her normal color, good appetite, and strength. She was much improved when she left the hospital the 20th of November, 1863.

I could enumerate many affections of the uterus in which the use of oxygen was very beneficial, but in these cases the gas was always administered to overcome the dyspepsia and anæmia which are often morbid elements complicating these chronic affections of the uterus and upon which Dr. Beau has many and many times insisted. I terminate this summary of surgical diseases in which oxygen has appeared beneficial by publishing a fact written by Dr. Beddoës. In the common troubles arising with menstruation I have never prescribed oxygen gas.

CHLORO-ANÆMIA, DYSMENORRHŒA, SUPPLEMENTARY HEMORRHAGES, ETC.—TREATMENT BY OXYGEN.—CURE.

The subject of this case is a young lady who constantly presents symptoms of chlorosis. The menses

come in small quantity and serous in character. She is married and has been many times pregnant but her labors have been always unfortunate. A few years ago a herpes made its appearance upon the face, and sanguinous effusions into the cellular tissue with engorgement of the capillaries. These bloody effusions gave place to hemorrhages so frequent that the patient as near as I can learn lost each week about thirty ounces of blood, rarely less than six or seven. I considered this due to insufficient menstruation and administered many uterine stimulants but without obtaining any good results. The iron gave a general feeling of vigor but proportionally increased the hemorrhage of the capillaries of the face. The treatment by mercury and other drugs the same with applications of astringents and the strongest stimulants did not produce any result. Having a similar case and seeing the hemorrhages become more frequent and abundant, I commenced to administer the oxygen according to the usual way. Soon afterwards the symptoms of chloro-anæmia disappeared; the feeling of dyspnœa, and dropsy of the legs, which had persisted to a remarkable degree, had almost completely disappeared and the sleep became more refreshing. At the end of a month's treatment, during which we administered three times a day three-fourths of oxygen, the skin received its normal color, which was indicative of better health, and the vascularization and lividity of the parts where those sanguinous effusions took place had completely disappeared. The hemorrhage was somewhat diminished, so much so that I believed it necessary to take other means to obviate any accidents which might come from abrupt cessation from so abundant loss of blood which had become habitual; this was the only additional treatment which I gave

the patient. The decided improvement could not be attributed to this precaution, for I did not prescribe it until the convalescence was fully established. This same means had been prescribed previously without producing any result. We continued the administration of the same quantity of oxygen during three months with wonderful improvement but without completely controlling the hemorrhage. We then stopped the treatment with the hope that this habitual circumstance, which rendered it necessary for her to continually receive treatment, might improve. The health did not become impaired in any way by stopping the oxygen and the disease gradually disappeared.

Here are the particular conclusions which we may derive from this case :—

Under the influence of oxygen the pulse became stronger, more frequent, the temperature of the body was increased, but not the hemorrhage, as was the case when iron was prescribed with exercise and good nourishment. To explain the effects of oxygen we have adopted the opinions of Dr. Hunter, after which the action and the force are essentially different and that the oxygen is one of these rare stimulants which give this improvement time and again. We can also think, as have recent physiologists, that oxygen communicates to the economy a certain irritation and thus brings about stimulation. This opinion seems to be confirmed by the fact that oxygen renders the body more sensible to the action of other stimulants, such as purgatives, for example, as I have assured myself in certain cases.

THOMAS CREASER.

PREPARATION AND ADMINISTRATION.

CHAPTER VI.

All that has been said, in the foregoing pages, of oxygen-treatment has been said not of the atmosphere nor of any combinations or condensations of atmospheric air, but of oxygen artificially prepared. The earlier experiments with oxygen in disease were not only many of them made in a bad way, so far as administration goes, but made with "vital airs" that were far from being what they should have been. Considering the nature of these "airs" and the way in which they were administered, the good results reached were surprising. Even so late as 1869 Edward Mackey got his results with inhalations which were from $\frac{5}{8}$ to $\frac{9}{10}$ atmospheric air, and until more recent years all experimenters, with a single exception or two, with oxygen gas in diseases where they did not give pure gas, made their compounds with atmospheric air, and since where atmospheric air has not been used still the chemical formulas have not always been the best. It would seem from a standpoint of pure science that the mere addition of oxygen to the atmosphere, no matter what per cent. above what is normally in it, but especially if the per cent. be small, is likely to be in a therapeutic sense insufficient. Even small doses of artificially prepared oxygen will as a rule bring about better results than larger ones, yea, than very large ones, in which the compound is made with atmospheric air. The first thing, then,

to do in treating diseases with oxygen is to have that oxygen artificially prepared and prepared in the best way; prepared and administered not so much with an idea of quantity as of getting the value of the active oxygen principle. Indeed, the "active principle," as a theory of power against the old theory of quantity, is very much the notion now of all schools of advanced medicine, though oxygen-treatment is not technically a medication but rather a vitalization.

In its relation to the "vital dynamics" lies the secret of its power. There can be no doubt of the greater value of oxygen artificially made as compared with atmospheric air under conditions of compound. It has been demonstrated time and again that small doses of non-atmospheric oxygen, pure or diluted, have a therapeutical power not lodged in much larger doses of atmospheric oxygen. There must, of course, be a reason for this. Dr. Birch, considering this, applied what he calls the "practically significant but scientifically rather loose term, quasi-nascent," and perhaps this as well expresses it as any phrase could. Artificially prepared oxygen may not be when used actually "nascent," but it has, if properly preserved, some special activity of the oxygen-atoms. In this, perchance, may be found the ground-work of the superior therapeutic value of non-atmospheric oxygen.

Admitted that after all we understand but partially the modifications of atmospheric oxygen, yet that there is a marked difference in the action of it and artificially prepared oxygen, only those ignorant of the facts will venture to deny. If we may rely upon the researches of Schonbein, Sobet, Clausius, Daubeney, Odling, Andrews, Tait, Brodie, Meissner, and Richardson, then the truth of

this difference is only that made necessary by scientific differentiation.

The atoms in artificially prepared oxygen as compared with atmospheric oxygen would seem to have a more direct and powerful polarization and a greater heat carrying power. In this may lie the secret of its greater vital efficiency and its consequent superior therapeutical action.

Oxygen may, of course, be made in many ways, and yet some ways are better than others. Mercuric oxide and manganic dioxide readily yield it when exposed to high temperature. It can also be obtained in large quantity and very pure from potassic chlorate. Two hundred grains, or fourteen grammes, of the salt is placed in a glass flask fitted tightly with a cork, containing a glass tube bent so as to dip under the shelf of a pneumatic trough; when the flask is heated the chlorate will give more than a third of its weight of gas. The salt consists of potassium chlorine and oxygen and in the change the whole of the oxygen is disengaged, potassic chloride remaining behind. No matter what formula is used nor by what process the gas is prepared, it should be thoroughly prepared and every way fitted for the purposes of inhalation.

COMPOUND OXYGEN.

Of this preparation an eminent physician, who has for years used in his practice various oxygens and who himself manufactures oxygen for his own use, says:—

"Upon a careful consideration of the composition of the United States Compound Oxygen and a watchful testing of it in a variety of cases, I have arrived at the conclusion, after eight years of experiment with different oxygens, that, all things considered, for general use it is preferable to any other kind within my knowledge."

Dr. Birch gained his experience of the value of oxygen in disease by office administration from what was then known as the Barth apparatus, an inhaling apparatus, with the gas condensed in "iron bottles." These bottles were rather crude, they were liable to get out of order and not easily conveyed on short notice. They had the further disadvantage of holding only fifteen gallons of gas, and that was not under very heavy pressure. And yet Dr. Birch records it as his experience that up to that time in England there was nothing known for administering oxygen equal to this apparatus. The United States Compound Oxygen Co., Springfield, Mass., put up their gas in small iron cylinders, nickel plated. These cylinders are twelve inches in length and less than three inches in diameter, and into each cylinder the company put sixty-four gallons of gas. The gas is drawn directly without heating or vaporization from the cylinder and is taken by inhalation. All "bottle treatments" of oxygen, or any compound of it, have to be heated. So if you want oxygen in the night you must have a fire, or if in a hot July day you must have a fire. There are, everything considered,—fineness of apparatus, convenience of use, degrée of condensation, and possible therapeutic value,—no home-treatments of oxygen gas like those furnished by the United States Compound Oxygen Company.

CONDENSED OXYGEN.

A word should be said of artificially prepared oxygen, under conditions of condensation, and of its especial value as compared with non-compressed atmospheric air, or the same oxygen at its normal expansion, having never been compressed, or having been a long time relieved of that

compression. In the first place there are, as before intimated, in oxygen artificially prepared, certain marked polar conditions. These may perchance have no special character of permanence, and yet a certain active possibility may thereby be set up which will, under certain conditions of motion and combination, show itself. In his interesting work on the "Action of Oxygen in Disease," Dr. Birch declares it as his opinion that artificially prepared oxygen is, in a therapeutical sense, more valuable than atmospheric air. The reason of this opinion is that oxygen thus made is in a nascent allotropic or actinic state, and hence in its degree of activity quite distinct from the inherent oxygen of the atmosphere. Dr. Birch says that in the preparation of oxygen "to insure its requisite energy in small quantities as a therapeutical agent, it should be either nascent or carefully subjected to the electric current immediately before employment, or *properly condensed*, so as to be available for release, measurement, and administration at a moment's notice." He well explains the scientific philosophy of this requisition when he says, "The necessary coöperation on the part of the positive forces associated with the blood-corpuscles appears to bear close relation to their more or less energetic polarization or capacity for immediate polarization under the influence of the negative force in the oxygen atom, and this converts the latent heat of the oxygen atom into active heat, with much greater rapidity in the case of oxygen just released from condensation or combination, when admitted into the lungs and thus brought within its proper sphere of action, than occurs in the case of oxygen in ordinary conditions of settled expansion." In his "Class Book of Chemistry" Prof. Edward L. Youmans, M.D.,

has a paragraph so completely setting forth this truth that we shall be pardoned for quoting it. "It is held," says Prof. Youmans, "that the molecules are always in motion and by virtue of their motions are centers of molecular energy. The molecular units are supposed to have three kinds of motion. In solids they maintain their relative places but vibrate at such varying rates as to emit all the colors of the spectrum. In liquids the molecules are loosened from their structural relations and circulate among each other so rapidly as to give rise to energetic liquid diffusion. When the vehemence of these motions is increased by heat the molecules are shot beyond cohesive restraint and assume the condition of gas. No longer influenced by mutual attractions they are now supposed to move with far greater energy, flying about in all directions in extremely short, straight paths, striking and repelling each other and giving rise to an expansive pressure known as gaseous tension."

It is now an established fact that this active inherency of artificial oxygen may be, by condensation, for a long time preserved. The greater the condensation of the gas, the greater when released from its confinement will be its possible active potency. This condensation and sudden expansion give to it what is scientifically called "the motion of the oxygen atom," that is, a certain isolation and individualization of the atoms, by reason of which they act upon the blood more powerfully and with greater therapeutic effect than they would otherwise have. We know that the action of the phosphate of lime upon animal charcoal is to isolate and individualize the carbon, and this makes the carbon-particles specially and powerfully active. Thus it follows that oxygen which has never been condensed from its normal ex-

pansion, or having been thus condensed has been relieved of that condensation and left for considerable time expanded, has not in the one case the therapeutic value of oxygen that has been condensed, and in the other has, by standing *in expanso*, lost much of its value. Thus inhalations of oxygen gas when taken of gas that has never been condensed, that is gas made and delivered into a gasometer and taken from it, cannot have the possible therapeutic power that smaller inhalations would have of condensed oxygen. So, too, oxygen drawn from a condensed state into any receptacle, a gasometer or a bag, and kept there for any great length of time, loses very much of its therapeutical power. For this reason oxygen-treatments carried out from physicians' offices in bags and administered to patients in their homes, several hours thereafter, are far from being what they should be. The oxygen in the bag has become inactive. It is very much like dead air or stagnant water. Of course this "bagged" oxygen could be by electrization relieved of its inertia. The oxygen atoms could be thus set in motion, but this is never done, simply because it is practically impossible.

So, too, a physician who makes his own oxygen and lets it stand in quantity in a gasometer holding many gallons, and who draws from day to day doses from this gasometer, does not get for oxygen-treatment the best conditions for permanent therapeutical results. He loses the value of the "motion of the oxygen atom." There is a difference in the effect of breathing such inactive oxygen and oxygen in motion like the difference in breathing the stirring air of a winter's morning crisp and cold and the stifling air of a midsummer's day, when a dead quiet reigns in the air and not a leaf of the

millions upon the trees perceptibly stirs. According to Faraday oxygen is the most magnetic of all the gases. Its magnetic power as compared with air is as five to one, as compared with nitrogen as forty to one. The magnetism of oxygen like that of iron is destroyed by heat. Unlike iron, however, the magnetism of oxygen overcome by heat can, because it is a gas, be by cooling processes recovered. This doubtless explains the sensations we have, all the way from partial suffocation to high exhilaration, in breathing atmospheres of different temperatures. Condensed oxygen at a low temperature would often have the greatest magnetic power.

Because of all this,—the superior value of artificially prepared oxygen, the greater value of highly condensed oxygen and the practical value of a reliable compound such as that made by the United States Compound Oxygen Company,—their cylinders, with accompanying apparatus, are the best known for office use, as they are unquestionably the best for self-administered home-treatment.

ADMINISTRATION.

Twenty years ago, in England, Dr. Birch, appreciating the value of oxygen as an auxiliary medicinal agent and advising its use, said to his professional brethren: "The use of oxygen will give some personal trouble and cause loss of time to the practitioner, especially in his first essays, but I am sure few members of our profession would permit these considerations to influence them were they really aware of its value both as a primary and auxiliary medicinal agent." These were well considered words, and with the lapse of a score of years they have lost none of their force. Indeed, time and the advance of knowledge only give them an added significance.

But with the use of oxygen there comes the large question of its administration. Though, as a therapeutic, oxygen is a remedy *sui generis*, yet its administration must not be carried on merely as a medicinal mechanism. There must always be a wise consideration of differences of physiological temperament and peculiarities of conditions of disease; in short, the special "pathological state" of each individual patient must not be overlooked. The gas must not be taken either as regards quantity or manner of inhaling with a "dead level" uniformity. In pulmonary inhalations, the power of the gas to do its work of aeration in contact with the "delicate membrane of the air cells," and the ultimate good results, will depend very much upon the wisdom with which it is taken. For the want of judicious inhalation, it would be, unfortunately, possible to void otherwise good results. The administration of oxygen in disease must have, as its basis, a correct idea of the modification of non-atmospheric oxygen, a clear sense of the constitutional predisposition of the patient, a correct knowledge of the general physiology of the patient, together with due attention to certain medicinal accessory treatment. A thorough experimenter with oxygen in disease makes much of what he calls "individual receptivity." This, of course, depends upon several things, but chiefly upon the constitution of the patient and the nature and conditions of his disease. When these are taken into account, as they should be, there is a proper standpoint from which to proceed in the administration of the gas.

Very many things have been, by experiments upon animals, or upon healthy persons, learned in a general way of the value of oxygen in various physiological conditions, but such experiments should not, as *criteria* for

its administration to the victims of disease, be made too much of. A single notion, unfortunately quite prevalent among the common people, should be gotten rid of, the notion that the therapeutical value of oxygen is measured and determined by the quantity taken. Certainly not if there be any truth in the relations of physiology to disease and to the treatment of disease. The fact is, this physiological differentiation is a fundamental truth and must always be considered in any and every department of the pathology of disease. In the administration of oxygen what would be a *minimum* dose for one patient would be for another a *maximum* dose, and *vice versa*. This philosophy of the varying power of "individual receptivity" may be said to constitute the physiological basis of the therapy of oxygen-treatment. And not only is it important "in a practical point of view," but especially important in its suggestive relations in regard to the *modus operandi* of administration. No tests made with oxygen upon lower animals or upon man under healthy conditions can be relied on as indicating under diseased conditions its possible value. The reason is apparent and it is one of strict science. It is this: in inorganic substances the relations of the electro-negative principle of the oxygen atom with the polarization of the associated atomic elements is, on the whole, well defined and clearly understood. In the lower orders of organic existence there is much reliable knowledge to go by. But, to use the language of another:—

"In the infinitely varied organic conditions of animal life, especially in man, we must have an equally infinite variation in the reception of the negative force associated with the oxygen atom by the positive force associated with the blood-corpuscles. As physiologists, we can

scarcely, if at all, meet with two persons who can be absolutely asserted not to differ in the smallest degree in constitutional power of generating heat, musculo-nerve force, and blood-corpuscles, and consequently in the power of appropriating for strength and vitality the negative principle in the oxygen atom. So great is the inherent vital power in some individuals, so quick and vigorous the assimilation of alimentary matters, that they can live in excellent health, from their interior motility, assisted by a comparatively limited amount of food, air, and exercise. Contrast these with those who can scarcely "keep their blood in circulation" and nutrition in tolerable activity for comfortable existence without a large and regular supply of food, air, and exercise. It is true that each of these extremes and their intermediates so long as they can and do maintain a *mens sana in corpore sano*, each receiving the requisite amount of atmospheric oxygen according to the natural demands of the organism, are often not very sensibly affected, some not at all, by the inhalation of large quantities of pure oxygen, although notwithstanding many even of these may be made to feel the influence of a small percentage inhaled under carefully detailed directions. Some few constitutions it should be noted here are very sensitive to the influence of the gas under any circumstances."

Huseman noticed that inhalations of oxygen gas produced a most delightful exhilaration even to a perceptible warmth diffused through the whole body, together with a feeling of increased invigoration and a kind of electrical tingling to the very fingers' ends. This, in the average administration of the treatment, is a frequent experience. There may be, as Prof. Phillips says, "some giddiness," and some effect upon the pulse, "probably

from extra effort in breathing." In his own case, improved "appetite, improved motor power, and sleep followed" the taking of the gas. He corroborates similar observations recorded by Dr. Demarquay and others.

There should always be a just distinction made between the immediate sensation experienced under the inhalation and those effects which are only, as they show themselves in improved physiological conditions, perceptible.

Sometimes the effects are exhibited in the improved condition of the patient very much as the results of sunlight or moisture show themselves upon vegetation whose growth has been impeded by overmuch heat or cold. As a plant withering under a long continued drouth, or dying for want of light and heat, would slowly revive, as, under a sufficient shower or a protracted rain, the dry earth should be wet to the very roots, and the roots be refreshed and invigorated by the moisture, or as it might be exposed to the sunlight and slowly warmed into revivification, so sometimes the physiological dryness and deadness must needs be overcome, and the very hidden roots of physical animation reached and invigorated ere any improvement will be apparent. As the rain-drops must have time to wet the parched earth clear down to the plant's roots, and as the sunbeams must have time to pour themselves down until the surrounding atmosphere and earth are thoroughly warmed and the conditions of the environment changed, ere what is visible of the plant above the surface will show signs of renewed life, so sometimes the effects of the oxygen-treatment are conditioned largely, almost solely, upon the time-element. It must have time to "wet" to the very roots of the vital organism, and time to change the

conditions of the physiological environment. It is folly to think of oxygen-treatment for only a dose or two or for a few doses, but give it time and it will, in those cases where it is indicated, do its work as surely, though perhaps as slowly, as the sunshine or the rain revives the withered plant. Indeed, it not unfrequently happens that long after treatment has been discontinued, even weeks and months, a steady improvement goes on, and the patient finds himself saying, "How much better I am feeling." He may not at the time think of the cause, namely, the fact that the roots of his impaired vital force were, months before, by the oxygen-treatment, "soaked" and "warmed" into life.

Thus it will be seen that suitable care should be exercised in oxygen inhalation, whether professionally administered or self administered. Some attention should be paid to the method of such inhalation. This is highly important. There are many things that should be thought of as factors regulating the character of the inhalations. In some cases deep and vigorous inspirations will be indicated, and, if the best results are reached, demanded. In other cases it will be important, and especially in commencing the treatment, that the inhalations be short and comparatively languid. Then, too, some attention must be given to the time of each daily sitting. The duration of it will vary according to the same law of variance in other things. Sometimes the patient should inhale in a sitting or recumbent posture, sometimes standing, and it may be desirable that the same patient, in the course of regular treatment, should inhale in all of these positions. There should be, as a rule, a short interval between the inhalations. Sometimes, however, they should, without such interval, be kept up until the whole dose is taken, that is, with an un-

interrupted succession of inspirations approximating as nearly as possible in breathing, to continuity.

It has come to be accepted, among professionals in the use of oxygen in disease, as a rule, that it should not be taken immediately, say an hour, after eating. Following the authorities doubtless of the old medicinal empiricism, this rule has obtained and, as has been supposed, according to principles of sound physiology. But the rule should not be made arbitrary. It must have not a few notable exceptions, exceptions made for the best of reasons.

So eminent a physiologist as M. Claude Bernard thinks the rule on the whole a mistake. If oxygen inhaled tends to promote digestion, then, even though during the digestive process the resistance to oxygen is the greatest, there is, or there may be in given cases, all the more need of it; and the indication for the employment immediately upon eating may be very pronounced. Though just at that time the blood may be specially transfused with hepatine and so may not readily absorb oxygen, *ergo* the oxygen may be specially beneficial in resisting the undue influence of the saccharoid hepatism. Doubtless in some cases of indigestion inhalations of oxygen immediately upon eating would, by promoting gastric activity, help to the best results. This would be likely to be the case in not a few instances of dyspepsia. We have administered it to several patients, as soon after eating as they could get to the office, and with uniformly satisfactory results—results for which they had before striven in vain. Patients who are generally debilitated and anæmic should, as a rule, be careful in beginning oxygen-treatment not to attempt too deep or strong inhalations, and especially on an empty stomach. Proper ingestion and digestion are physiological conditions imperative in oxygen-

treatment to the best results. Oxygen-treatment wants food and the assimilation of food—the system well fueled and the escapes of the combustion clear and sufficient; and here is one of the therapeutic beauties of the treatment; on the one hand, wanting food for its work, it tends to give a normal appetite, and on the other, wanting the digestive organs in good condition and the excretive sluice-ways free and open, it tends to bring about this result.

The following directions may serve in the administration of oxygen as a reliable guide :—

1. Take it as a rule once a day, as nearly as may be at the same hour of the day, and when the body is active. Exceptionally it may be taken twice or more times each day. In cases of obstinate insomnia it may be taken on going to bed. In aggravations of dyspnœa or asthma during the day or night it may be taken immediately to subdue the aggravations.

2. The ideal position for inhaling is the standing position. Sometimes, however, the patient should sit, and sometimes the best posture is that of entire recumbency, as on a lounge or in a bed.

3. Resist all temptation or inclination, for want of time or other reason, to hurry the inhalation. Be leisurely about it. When done inhaling remain for some minutes in an easy posture and rest.

4. Eat of wholesome food and drink liberally of good water.

5. Keep the excretory channels open. The treatment, where there are tendencies to indigestion or where there is actual and aggravated constipation, will be likely to do this. But should it not, resort to some mild cathartic.

6. Do not undertake a treatment when out of breath or when heated. Rest first and cool off.

CLINICAL EXHIBITS.

CHAPTER VII.—PART I.

By S. B. Birch, M.D.

The following clinical exhibits, illustrative of the curative power of oxygen after the failure of other remedial treatment, or in connection with it, are from the records of eminent practitioners in this country and on the Continent.

Exhibit No. 1.

DERANGEMENT OF THE LIVER AND SPLEEN.

The following is worth recording as an extreme case of the rapid effects of oxygen inhalation.

In 1856, Lieutenant E——, aged 30, stated that he had been unfit for duty for several years in consequence of an abscess, etc., of the liver, resulting from repeated attacks of fever and dysentery. It had discharged itself externally on several occasions, and the opening had been for some months healed. No sooner did this take place than dysenteric diarrhœa recommenced with hepatic and intestinal pain, only relieved by continual use of opiates. Having returned to England, he consulted some of the most eminent authorities, was advised to carry opium always in his pockets, became worse and more emaciated, daily felt scarcely able to stand upright; and, as a last resource, requested my opinion about oxygen in his case. After three days, the sanguino-mucous and watery evacuations gave place to perfectly black,

and then dark bilious ones, at first very profuse, then moderate in quantity. In the course of ten days he began to feel less weakness, slept better, did almost without opium, and even ventured to dine out. Some days afterwards he informed me that he had walked eight miles on the previous day, felt no worse, and thought himself quite equal to join, on the Continent, the family of friends who had long been hoping to see him. Whether he completely recovered, notwithstanding his imprudence, I am unable to say, but *verbum sat sapienti.*

Exhibit No. 2.

FEMALE CONGESTION AND WEAKNESS.

Organs of sense paralyzed, general paralysis threatening. A married lady, aged 51, was persuaded to place herself under my care. For some years she had experienced great mental anxiety with general derangement of the liver. During the previous winter and spring her debility had increased. Constipation, which for fifteen years had necessitated the frequent use of aperients, gave place to a rather relaxed, uncomfortable state of the bowels, with very troublesome flatulence; formerly robust, she became much attenuated, for the digestive and other organs were so weak that the system could only appropriate a very small quantity of the food taken. A very annoying eruption of a leprous character about the ears and temples had troubled her for several years. A few months since she had caught a bad cold, which, owing to the debilitated state of her vital powers, remained unsubdued, and degenerated into a severe chronic bronchitis. Her eyes became very dim, her hearing much impaired, the sense of taste and smell entirely lost. There was a constant feeling of chilliness and feverishness even

in the warmest apartment; and although formerly an excellent walker, she became unable to take the slightest exercise without great fatigue and pain in the back, the lower extremities almost refusing to support the weight of the body. She felt, in her own language, as if all her senses were going, and thought that she could not last long. Catamenia, formerly of a natural character, ceased last year.

May 12th, 1856. This lady could just walk up to my consulting room. Her countenance presented an anxious appearance; she could not read even very large print; with great difficulty could she be made to hear the questions put to her. She had no sense of taste or smell whatever, even when substances of the most powerfully bitter and odoriferous nature were applied to the respective organs of those senses. The head felt oppressed with a constant weight and tension. The back of the neck was very stiff and painful when moved; the face was drawn to one side, and, upon being requested to show her tongue, she involuntarily protruded it toward the right side. She experienced much weakness and pain in the loins and iliac regions (ovarian congestion), complained of always being chilly and cold; moreover she suffered from constantly recurring paroxysms of a distressing and spasmodic cough accompanied with copious mucous discharge from the bronchi. Abundant evidence was afforded that she was in the very jaws of what might have been, under the circumstances, a fatal attack of paralysis.

Strong doses of oxygen were immediately administered, and I had the surprise and satisfaction of finding that in ten minutes all the oppression about the head had left her. Suddenly she exclaimed, "Why, I can hear

everything you say perfectly!" In a few minutes she felt so much invigorated that she walked around the room quite astonished at her rapid acquisition of strength. In half an hour after she entered the room, just as she was taking leave, she abruptly turned to a book on the table, and almost screamed, "I declare, I can see every word!" To which I rejoined, "Only the large print, I suppose." "Oh no, I can read the very small print," and taking up the book she proved that she could. After four days' inhaling daily, my patient gradually progressed in strength, but I was not quite satisfied with one point; namely, the persistent chilliness. The oxygen was then pushed further. The first very large dose had at once the desired effect of creating a feeling of genial warmth throughout the system, which continued for the whole day; but, there being in the evening some slight return of coldness and shaking, a second dose similar in strength was taken. After this, the natural warmth was permanently re-established. Oxygen was continued daily in smaller doses for a period of six weeks. In three weeks after the first inhalation the senses of taste and smell were completely restored. In one month the severe cough had quite disappeared, and before the termination of six weeks' treatment my patient was able to walk many miles without the slightest inconvenience. The complexion, which for some time had been muddy yellowish and much wrinkled, soon assumed so fair and pink an appearance as to elicit various congratulatory remarks from her friends. From the very commencement of the inhalation, the troublesome flatulent distention of the bowels disappeared, and the evacuations regained their healthy appearance. Subsequently I was informed that in the course of the following year the

catamenia again made their appearance after many months' cessation, and that the pain in the back and loins was quite relieved.

Exhibit No. 3.

FATTY DEGENERATION OF THE HEART WITH PASSIVE CONGESTION OF THAT ORGAN, AS WELL AS LIVER, SPLEEN, AND WOMB.

Mrs. M——, aged 62, placed herself under my care July 16th, 1864. Has for many years, especially since "change of life," been subject to frequent attacks of palpitation of the heart, bilious attacks with piles, as well as winter cough and occasional attacks of bronchitis. Presents a puffy, congested, apoplectic appearance, with intermuscular and general deposit of loose fat, the more marked from the possession of a short neck and rotund figure. Heart's action extremely weak and irregular, with occasional brief intervals of irritative reaction; pulse intermitting every three or four beats, and very compressible; appetite bad, tongue flabby and thickly coated; no cough of any moment; no present or recent cold which would temporarily exacerbate symptoms. Severe headaches frequent; constant giddiness and liability to fall down; an inability to make the slightest exertion calculated to excite the heart's action without these symptoms; a difficulty of breathing; cardiac dyspnœa.

As a special point, the normal extent of cardiac dullness on percussion indicates a moiety of increase equally diffused, and systole and diastole are scarcely appreciable to the ear. Much flatulent distention of the intestinal canal, especially the transverse colon; some irregularity of the bowels and hemorrhoids, which were frequently

troublesome. These symptoms, conjoined with a naturally excitable nervous and vascular system, caused spasmodic attacks of irritability followed by urgently dangerous depression of the heart's action after meals and upon lying down at night. For some weeks these attacks have been nightly, sometimes continuing more or less throughout the night. Placed herself under my immediate care. Commenced with oxygen inhalation; both fatty degeneration and congestion with relaxation of the heart being the pathological condition indicative of its use. Prohibited *free* use of stimuli and sedatives, permitting for internal use only an occasional teaspoonful of brandy or gin with chloric ether and aconite in very small doses at night, and occasionally a dinner pill, and sedative embrocation externally.

Oxygen from the first dose began to evidence marked effects in improvement of all the distressing symptoms, and sensation of relief, causing the patient to contrast the singular difference between the primarily exciting and secondarily depressing feelings which she had always experienced when stimuli were pressed upon her as a necessity, and the soothing and quietly exhilarating influence of the oxygen followed by no secondary depression. The case being one so urgent and of long standing, it had many ups and downs during a four months' course of careful watching, with frequent variations of treatment, external as well as internal, oxygen affording the *point d'appui*. During the twelve months following I had a few letters from this lady, and found that the benefits had proved permanent.

Exhibit No. 4.

AMENORRHŒA WITH SEVERE GENERAL SYMPTOMS.

Miss J. W——, aged 18, consulted me March 23d, 1857. Bilio-nervous temperament; good health until 14 years of age, since which period she has never been well, and lately has suffered increasingly from ill-health. Pulse 80; very weak; face leaden color and puffed; eyes hollow and dull with want of action in the iris, and surrounded by dark areolæ; tongue furred, with red tip; some pain in the epigastrium upon pressure, and always after eating; ascending transverse colon much distended; once in two or three months has suffered from dysmenorrhœa with very slight appearance, but for several months has had complete amenorrhœa; restless and easily fatigued; extremities always cold; frequently experiences much uneasiness in the spleen. I at once employed oxygen. In about a week or ten days the catamenia appeared for the first time of a natural character, and without pain; a course of gas (no other medicine) lasted but a little over a fortnight, and then my patient, from a belief that she was completely put aright, discontinued it. I feared that the very short period of treatment would prove anything but satisfactory, but was gratified to find two months later that she felt herself in perfect health, having had no recurrence of her former symptoms.

Exhibit No. 5.

LONG CONTINUED DERANGEMENT OF THE WOMB AND OVARIES.—IMMINENT APOPLEXY.

Mrs. H. B. G——, aged 57. Ten years ago had inflammation and fissure of the neck of the womb, with very offensive discharge, for which she was treated successfully

(so far as local affection) by one of our most noted specialists. Notwithstanding this, has not enjoyed "one day's feeling of real comfort and health"; during the ten years has been almost continually under medical treatment, having given lengthened trials to many eminent physicians. Has all the symptoms of venous hyperæmia, with enlarged liver and spleen; internal piles; congestion of the brain and spine. Suddenly fails in strength when attempting to walk, and drops without support; constant bearing down of the womb; tongue glazed and fissured, very red anteriorly, thickly furred posteriorly; pulse very slow and so weak as to be felt with difficulty; tendency to constipation. Resorted to oxygen and stopped all stimuli except very diluted wine and water. The first dose of oxygen conferred an immediate sense of relief from oppression such as had not been experienced for years, and next day I found her quite a different person, her nervousness having disappeared. Took one daily dose, occasionally two, for two months, during which time all her principal derangements of constitution gradually succumbed to the careful but simple management with the valuable aid of oxygen. Six months afterwards she was perfectly well, and able to enjoy her long walks.

Exhibit No. 6.

CHRONIC CONGESTION, RELAXATION, AND IRRITABILITY OF THE WOMB, WITH EXTREME SPINAL WEAKNESS.

Mrs. M. R. J——, aged 32. Married early; had a rapid family during the seven years following; afterwards no increase for some years, during which she suffered much from inflammation, congestion, and irritability of the womb, for which lithates and caustics were from time to time applied to the os uteri, and plentiful supplies of

quinine, speculum practice, galvanism, mineral acids, etc. No good results following, but decidedly the reverse, with steadily increasing weakness of the back and spine, she had avoided all but the most simple remedies for some time before she sought my advice. I found an extreme weakness and irritability of the entire spine, especially the lumbar region, even a moderate carriage drive causing a lengthened attack of aching pain ; tendency to piles ; congestion and relaxation of the uterus, with frequent leucorrhœa at the monthly periods, as might be expected from the quasi-spongy condition ; undue losses slowly but surely undermining a naturally good constitution. I enjoined a system of alternate rest and exercise, with elastic supports, and carriage to be specially padded. For a tonic, I depended upon a course of oxygen for a few successive weeks, this being repeated on two occasions during the succeeding twelve months ; and for occasional assistance to a relaxed and congested and frequently irritable womb, as circumstances required, Ac. Sulph. Dil., Bellad., Sec. Cornutum, with lotions from time to time containing morphia, glycerine, and astringents. The result was in every way satisfactory ; twelve months afterwards she became pregnant, enjoyed unusually good health and spirits during the gravid period, and had a most satisfactory accouchement. The oxygen in this case, on each occasion, never exceeded 6 pints diluted with about 50 pints of atmospheric air, and the immediate benefit of each inhalation was well marked even with four pints.

Exhibit No. 7.

APOPLEXY.

Mr. W. R. R——, aged 41 ; unmarried ; temperament bilio-nervous ; habits regular ; in consequence of his un-

fortunate malady, compelled throughout life to exercise the greatest caution as to diet, etc. Apoplectic at 7 years of age ; has suffered from paroxysms, more or less, every two or three weeks ; unable to follow any regular occupation. Better when taking plenty of outdoor exercise in the country ; cannot bear much cold, compelled to sleep with window open every night ; frequently experiences much oppression of the vertex of the head, especially when anything has chanced to disagree with his stomach; before attacks, the whole of the right half of the body feels very cold and chilly. Face thin and sallow ; eyes sunken with deep, dark areolæ around the eyelids ; tongue pale and slightly furred ; appetite moderate ; liver rather torpid ; pulse small and feeble ; tendency to piles and to constipation. Irritable and soon excited with passion, especially just before attacks. Has tried every mode of treatment that appeared to offer a remote chance of cure. I determined to give a fair trial to a judicious and carefully watched course of oxygen. The effects were most remarkable and exceeded my most sanguine expectations ; for, from the commencement to the termination of the treatment, a period of three months, he suffered no paroxysm whatever ; his general health gradually became stronger, his eyes fuller and brighter, his mental powers increased, and at length he entirely lost his former extreme irritability and became cheerful and happy. More than a year afterwards this patient had experienced no return of the apoplectic attacks.

Exhibit No. 8.

CARBUNCULAR BOILS.

A. B——, policeman, aged 36. Skillful medical treatment for three months ; advised that medicine could do

no more for him, and that he must get immediately into the country and try what change of air could effect. Covered with twenty or thirty large boils, or rather carbuncles, and his health much undermined from acute suffering. Offered gratuitous treatment under oxygen. Commenced a daily inhalation, and so rapid was his progress that in from ten days to a fortnight the eruptions had entirely disappeared and the unhealthy constitutional condition was so completely overcome as to render the cure permanent. Not one dose of any other medicine was employed.

Exhibit No. 9.

STRUMOUS MESENTERIA.

Miss A. B——, aged 5 years; very transparent skin and flaxen hair; never very strong, but at length became much debilitated; abdomen hard and much enlarged; breath very fetid; face wan; bowels irregular, with small, frequently offensive evacuations. Hectic fever with other urgent symptoms supervening, it was advised as a last resort to send her for residence to the seaside. At this critical period, the use of oxygen was suggested, and it was determined at once to give it a trial. Under the influence of this powerful remedy, conjoined with general careful management and well regulated diet, the child gradually began to improve, and in a few months was quite restored to health. She afterwards greatly improved in constitutional strength, and became a fine healthy young lady, although delicate and sensitive of organism.

Exhibit No. 10.

CONGESTION OF THE LIVER AND BRAIN WITH PARTIAL PARALYSIS.

Colonel R——, aged 61. Constitution naturally strong; habits always regular; formerly saw much service in tropical climates; underwent severe hardships which would have "killed most men." Result: he has been for many years subject to liver derangement, for the relief of which hydropathic treatment has been of great advantage. Forbidden by his medical attendant to perform his customary ablutions with cold water, owing "to rush of blood toward his head"; with vertigo whenever he attempts to raise his arm to his head; sensitive to the effects of cold weather; memory failed so much that he feels great difficulty in remembering anything. Countenance presents a bluish, congested appearance; coats of eyes, especially the conjunctivæ, are much injected; tongue relaxed and foul and covered with a thick yellowish white fur; pulse slow, labored, and subject to frequent intermissions; head dull and heavy; aching pain in the right shoulder and between the scapulæ; considerable uneasiness in the hypochondria, especially the right; liver a good deal enlarged; colon much distended with flatus; bowels rather sluggish; urine loaded with lithates; partial paralysis of one side, several fingers being paralyzed and drawn in tightly by the flexor muscles.

Recommended a course of oxygen gas. A carefully regulated dose was inhaled twice a day and the effects closely observed. Improvement immediately commences; in four or five days he lost the most of his oppressive headache; expressed himself as finding his memory wonderfully better in so short a time. Treatment stead-

ily continued for between a fortnight and three weeks; and although his natural energy, when he felt himself so much benefited, led him for the first few days to do much more than I approved of, yet he rapidly progressed. Soon after he commenced inhalations I permitted him to perform his cold ablutions daily, and this he did without difficulty; the only adjunct measures that I adopted were an occasional *very* gentle laxative and strict attention to diet.

Exhibit No. 11.

SYPHILITIC ULCERATION.

Mr. S. B——, aged 33. Unmarried, temperate habits. Nervo-sanguinous constitution. Subject of secondary syphilis for seven years; had undergone a variety of fruitless treatment. Consulted me. Found him extremely weak and anæmic; his formerly powerful and muscular frame completely relaxed and attenuated. The skin throughout the body was quite blanched, and so transparent as to show deeply beneath the surface much dark congestion with scattered spots of purpura. Some caries of one superior maxillary bone existed. Suffered much from irritation of the brain, with eyes suffused and intolerant of light, and chronic iritis; pulse from 100 to 110, very small and almost imperceptible; tongue white and fissured; impossible to generate a sufficiency of animal heat to keep him alive; extremities cold and clammy. In fact, universal prostration and torpidity of function prevailed. In addition he had a suspicious short hacking cough, which had existed for some months, with profuse night perspirations; but no well marked or *physical* signs of tubercular deposit. Upon examination of his legs, a very large ulcer was seen on one calf, a smaller

one on the other ; larger one commenced in a *little spot* about a fortnight previously ; had been for some days spreading rapidly, causing severe pain and constitutional irritation. Now presents the peculiar appearance of a sloughing mercurio-syphilitic ulcer, exactly circular, about two inches in depth, considerably excavated ; the whole circumference for the distance of an inch and a half or two inches from the edges is hard, red, and extremely sensitive. There is a discharge of dirty looking sloughy matter, an acrid, sanious fluid, sloughing ulcers rapidly extending.

Opportunity offered to thoroughly test the power of oxygen, and, knowing what this therapeutic agent could effect in analogous non-syphilitic ulcers, and in cases of extreme debilitated and languid circulations, I at once determined to energetically bring it into action. The same afternoon I administered a large dose of the gas, which had the effect of making him feel more comfortable ; the next morning superintended the administration of the largest quantity that could be borne ; and ordered a moderate inhalation in the evening ; ulceration spread no further, and, by daily watching my patient during the succeeding fortnight, I had the satisfaction of witnessing the separation of the dead portions, the perfect cleansing of the whole surface, and the gradual filling up of the excavation with granulations ; while, at the same time, the appetite returned and the capillary circulation and the entire nervous system began to regain tone. Small doses of iodide of potassium were now ordered three times a day, nutritious diet with porter ; cod liver oil was rubbed into the chest twice a day, a tepid daily sponge of the whole body was enjoined ; in five weeks he was able to walk about, and in seven weeks entire healing of the

large and deep excavation resulting from the ulceration had taken place. Afterwards, having walked rather too much, and otherwise irritating the place on the other leg where the small point of ulceration had apparently healed under the influence of oxygen without sloughing, and having got a severe cold, his cough, which had never left him, with profuse perspiration at night, disturbed him much. I gave him strict directions as to quiet for his leg; largely increased the quantity of oxygen at each inhalation, night and morning, and continued his other constitutional treatment. Progress very satisfactory, and was soon enjoying his favorite pedestrian exercises; continuing treatment, he, toward the middle of September, lost his consumptive cough, and fully regained his nervous tone, recovered his flesh, and suffered no longer from a languid circulation. The dirty, congested appearance between the cuticle had quite disappeared, and the general cerebral irritation with iritis ceased to show itself.

With this interesting case in mind, it is clear that there exists no remedy at all comparable with oxygen as a "purifier of the blood." My own experience particularly points to its well marked energetic action upon the capillary circulation, and upon the skin; in suitable cases it powerfully promotes the healthy secretion of the latter, and assists it in throwing off morbid poisonous matter, and, unlike all other medicines, while performing this duty it produces no weakness or other untoward effects; on the contrary, simultaneously acts as a general tonic to the entire constitution. It will be observed that I ordered as an essential adjunct to the treatment tepid sponging of the whole body; the poisonous *débris* cast off with the aid of the gas and accumulating on the skin obviously necessitating such sponging. It also merits a

passing notice how quickly oxygen demonstrates its power as a therapeutic agent in cutting short and arresting the progress of the rapidly spreading ulceration.

Exhibit No. 12.

CERVICAL CURVATURE.

Rev. T. A. W——, educated for the medical profession, but compelled from ill-health to give it up. Disease of the cervical vertebræ, with slight curvature, considerable swelling, and hardness of the parts, with occasionally much pain. Swelling confined to the right side ; considerable pain and burning sensation on the left side. Confined to bed for upwards of three months. Used blisters and taken the bichloride of mercury until the gums were affected. Since that, several quarts of cod liver oil, besides a deal of quinine and iron, but with little alleviation of the complaint. Could not sit erect for more than a few minutes at a time. Numbness of the fingers of both hands, and occasionally slight pain in the arms. Pain in the right side ; seems sometimes to be more deep-seated than at others ; as though it were sticking into the spinal marrow. Extensive tumefaction, hardening and thickening of the cervical vertebræ and of all the adjoining superincumbent tissues from the base of the brain to the seventh vertebra ; neck perfectly fixed and stiff ; head turned on left side ; tongue foul ; pulse quick and irritable ; much numbness of the extremities, but no paralysis of motion. Oxygen inhalations at once commenced ; belladonna fomentations prescribed as a frequent local application. Result : in a few weeks he improved so much as to be permitted a considerable amount of walking exercise ; the general constitutional irritation gradually subsided, with the swelling much diminished.

Feared retrogression upon stopping oxygen-treatment, but agreeably disappointed, being, as he said afterward, "up to anything." Tumefaction and induration had almost disappeared; no pain whatever remained; a perfect cure was effected. Oxygen gas merits a primary position as a remedy in such diseases, especially in those characterized by the scrofulous diathesis.

Exhibit No. 13.

NERVO-CONGESTIVE HEADACHE.

Mr. G——, aged 50; merchant; nervo-bilious temperament; regular habits. Had suffered severely for years from frequent headaches produced by every noise and excitement; had experienced occasional attacks of hepatic derangement for which a good deal of mercury had been administered: these attacks were becoming more frequent and distressing from slight causes, and of longer duration. Determined to take a course of oxygen. Found him suffering from the usual symptoms attending torpor and general derangement of the liver, stomach, and spleen; much depressed; his face presented a sallow, worn appearance, with yellow conjunctivæ; head symptoms very bad. First dose of oxygen completely removed the pain, and made him "feel quite a different man." With one dose daily, he kept light and well, with excellent appetite. Six months afterwards there had been no return whatever of the headaches, and he was in the enjoyment of perfectly good health.

In most cases of nervo-congestive headaches, oxygen ought to have a fair trial where all ordinary means have failed. The writer himself was formerly subject to this description of cephalalgia, and has had ample experience in his own person of the beneficial effects of the gas.

Exhibit No. 14.

CEREBRO-SPINAL DEBILITY, WITH EPILEPSY.

Mr. John M——, aged 27. Up to the age of 21 had enjoyed good health, but then began to be troubled with pain in the loins and back, with frequent and distressing discharges *per urethram;* epileptic fits of a severe character with exacerbations of most of his previous symptoms. Weakness increasing, the seaside was advised and tried for some time, but he returned rather "worse than better." Called on me; presented an appearance of extreme debility; face pallid, with hollow cheeks; whole of the body anæmic and much attenuated; complained of constant pain in the back and hypochondria. Had attacks so severe as almost to incapacitate him for any work; pulse feeble, almost imperceptible; extremities always cold. Strict regulations given as to diet and other general measures, and placed under a course of oxygen inhalation. Within a few days (as he expressed himself), he felt as he "had not done for years before," as though he had "suddenly received a new supply of health and strength." Continued the treatment for six weeks, and though he had some trouble with the digestive and assimilating organs he felt himself at the end of that time fully equal to his occupation—pianoforte manufacturing. All his distressing symptoms had disappeared, and he had almost regained his pristine vigor of mind and body. There was afterwards no relapse.

Exhibit No. 15.

CHRONIC INDIGESTION.—HYPOCHONDRIASIS, ETC.

Mr. W. L. K——, schoolmaster, aged 47; regular habits; nervo-bilious, excitable temperament; never been

very strong ; always energetic and active in mind and body ; married at 32 ; now a widower. Has from childhood been the subject of incontinence of urine, with great weakness of the muscular coat of the bladder. Two years ago began frequently to pass much blood from his bladder. Suffered since from extreme nervousness ; frequent inability to sleep at night from morbid fear of being alone or of dying suddenly, with other hypochondriacal symptoms of an unpleasant character. Presented an anxious, careworn aspect ; mouth slightly drawn down on one side ; eyes lachrymose with yellow and congested conjunctivæ ; complained of much cephalalgia, especially in the occiput and nape of the neck. Frequent passage of blood in the urine ; constant aching pain in the loins ; constipated bowels with much flatulence, and extreme depression and weakness mentally and bodily, alternating with fits of morbid excitement. Percussion evidenced considerable gaseous distention of the transverse colon ; no appetite ; much thirst. Commenced oxygen inhalations at once. The first day inhaled 15 pints, until it produced slightly unpleasant head symptoms followed in the course of ten minutes by a feeling of cheerfulness and general vigor of mind and body, to which he had long been a stranger. Next day wonderfully improved in appearance ; had felt "such an appetite," "such a flow of spirits" ever since the previous day that he could hardly realize the "astonishing effects." At the end of three weeks completely restored in general health ; distressing pain and other symptoms had disappeared ; countenance and the whole skin presented a perfectly healthy aspect ; clear and of normal color ; and his mind had fully regained its natural tone and equilibrium.

Exhibit No. 16.

PERIODIC HEADACHE.

Mrs. W——, aged 46. Nervo-sanguinous constitution. Subject from five years of age to frequent attacks of severe pain in the head, and excitement or irritability invariably produced headache; origin in childhood unknown. The catamenia appeared at 17 years of age, and then the cephalalgic attacks became regularly periodical. Married, and for two years following the head was much better, but subsequently neuralgic attacks became as severe as before; has four children, youngest three years of age. Medical treatment of every kind irrespective of expense tried without avail; twice subjected to severe course of mercurials. Present symptoms: neuralgic headaches occurring monthly of continued duration from two days preceding to two days after the cessation of the catamenia, of so extremely acute a character as to oblige her during the whole time to preserve the horizontal position in a darkened room. No pain in the uterine or ovarian regions, but some in the loins; with copious leucorrhœa; pulse 85, irritable and wiry, with strong pulsation in the carotids; digestion good; liver sluggish; countenance tolerably healthy. Began oxygen-treatment; inhalations of a small quantity caused a sense of fullness in the occiput, which sensation, however, presently passed off, and my patient felt more lively, with less weight about the head. The second dose on the following day had the effect of bringing on the period without any headache, a week before the ordinary time, and it continued rather longer than usual. Took a daily dose for about a week, and then, all her unpleasant symptoms having disappeared, and the periodical headache

not having shown itself, she ceased taking the gas, contrary to advice. Three weeks afterwards, fearing a return of her complaint at the approaching period, she had for a week on alternate days inhalations of oxygen ; none of her former sufferings reappeared, and she felt perfectly well. The process was repeated during the succeeding catamenial period as a prophylactic. The distressing affliction of this lady completely succumbed to the treatment.

Exhibit No. 17.

CEREBRO-SPINAL DEBILITY WITH PROFUSE SPERMATORRHŒA.

J. T——, aged 26 ; married for five years ; no family ; countenance sallow ; pulse weak and fluttering, with a somewhat prolonged intermission succeeding every six or eight beats ; skin moist, cold, and clammy ; great spinal weakness, and involuntary discharges *per urethram* nightly ; frequent vertigo and headache ; bowels very obstinate, with painful and distressing straining. Opposite indications : no physical or general signs of either cardiac or pulmonary affection ; can get through a tolerable amount of work, although soon used up and obliged to rest himself ; no stomach or hepatic derangement ; tongue perfectly clean ; appetite good. Before marriage, *se mori malo assaverat*—the origin, I doubt not, of his ill-health. Tried every mode of treatment that appeared to promise restoration ; came to me ; recommended a course of oxygen gas ; ordered spine to be rubbed with oil for half an hour every night ; ordered gas to be inhaled daily, at one sitting, two hours after a meal ; saw him six days afterwards, and to my surprise he told me that the treatment had had an extraordinarily beneficial effect, that he felt himself a "different man." I found his symptoms

mitigated, but the pulse extremely weak and intermittent ; his face, however, had lost all its anxiety and depression ; continued taking the gas daily. Within a month his pulse had lost its intermittent character ; the skin felt natural ; the bowels had become regular, although attended with some straining and mucus. Needed no further treatment, and it was discontinued.

Exhibit No. 18.

DIABETES MELLITUS.

Capt. N——, long a sufferer from diabetes mellitus ; had been for a lengthened period under the care of eminent physicians ; advised a trial of oxygen. In a few days, the harsh, dry, feverish condition of the skin was removed ; the thirst, as well as dryness of the mouth and fauces, much less distressing. The treatment continued scarcely three weeks ; most marked advantage derived from it ; great improvement in general health ; increase in weight and strength ; diminution in quantity of the urine. No opportunity of knowing the final outcome of this case.

Exhibit No. 19.

DYSPEPSIA.

A gentleman came to me laboring under extreme debility, with constant liability to profuse perspirations after slight exertion ; compelled from cutaneous relaxation, distressing chilliness, and icy cold extremities, to wrap up in a thick great-coat in warm weather. Had tried several of the principal hospitals, but without benefit. Appeared to have no special malady except dyspeptic symptoms and imperfect assimilation. The first dose of oxygen acted like a charm, and made him thor-

oughly warm from head to foot without perspiration. The next day I found that it had been no *transient* effect. He took a dose daily for one week; and then, feeling himself quite well, ceased the treatment.

Exhibit No. 20

PARAPLEGIA.

Mr. S——, 62 years of age; suffered for several years from paraplegia of the lower extremities from loins downward. In spite of treatment of every possible kind, the gradual diminution of motion and sensation continued. Determined to try a lengthened course of oxygen in small doses. From the first there was evidenced some gradual improvement. Improvement decided for the first two months, scarcely perceptible afterwards; yet, so firm of purpose and so patient was this gentleman, that he steadily persisted with extremely small doses (depending solely upon it) for two years, at the termination of which he had the satisfaction of finding himself *perfectly well.*

Exhibit No. 21.

ACUTE NEURALGIA OF TWENTY YEARS' STANDING.

Mr. T. C——, aged 70. Frequently recurring gastrodynia of a very intense character, which had necessitated the frequent use of opiates as the only means of partial relief for twenty years. This neuralgia had become more and more frequent, almost daily, lasting for some hours, and he had become reduced almost to a skeleton. Diagnosed the solar plexus to be the exciting cause of the attacks, and put him upon oxygen, one lengthened inhalation daily, and free inunction with olive oil over the entire abdomen and back. Two months afterward,

he reported that he had experienced *no pain* whatever for the three weeks following the commencement of the treatment. Expressed himself as highly gratified with the singularly quick and unexpected benefit.

Exhibit No. 22.

CHRONIC BRONCHITIS.

Major W——, liable for years to hepatic derangements, and to bronchial attacks ; recurrence of these attacks so frequent as to allow him an intermission of only a week or two. Subject to severe paroxysms of cough and wheezing, which continued until he discharged a large quantity of mucus. Purple appearance of face ; venous ramifications on the nose and cheeks ; yellow conjunctivæ; full laboring pulse ; hemorrhoids,—all evidenced general congestion specially localized and affecting the functions of the liver and lungs. Underwent a steady course of gas for a fortnight with such complete relief as to his symptoms and such pleasing change in his complexion that he determined to incur the expense of further treatment. At the end of a three weeks' course he was perfectly well ; the congestive and other distressing symptoms had quite disappeared. *Oxygen was the only agent employed in this case.*

Exhibit No. 23.

LUNG AND LIVER TROUBLE.

Mr. C. R. S——, aged 41 ; stomach and liver badly deranged ever since he had an accident when a boy. Pronounced to have incurable disease of the lungs and liver by several eminent medical practitioners. Suffered extreme distress from spasmodic cough, difficulty in breathing, and inability to sleep. Pulse feeble and inter-

mittent ; urgent dyspnœa. Incessant cough with expectoration of a dirty looking, fetid, ropy mucus, mixed with pus. Cannot sleep at night in *any position* for more than two or three minutes at a time, even with the aid of sedatives. Right side of chest motionless, with no respiratory murmur beyond the large bronchial ; on percussion feeling almost like a stone from apex to base of the lung. The left side of the chest also much duller than natural, with humid rhonchi ; puerile respiration in the upper half of that lung, while the respiratory murmur is least in the lower half. Considerable enlargement and projection of the liver, the anterior inferior margin reaching four inches below its normal position. Muddy, yellowish, congested countenance, and death seeming imminent. Put him on oxygen ; used Barth's apparatus with condensed oxygen. Considerable relief experienced from the first dose ; in two days palpable diminution of the congestion in the *left* lung. Respiration less hurried ; a little sound sleep, notwithstanding the distressing cough, which admitted of only short intervals of rest.

Feb. 12—five days after. Pulse almost lost its intermittent character, firmer, and only 70 immediately after the inhalation, instead of a variation of from 110 to 120 when not intermitting. Full inspiratory capability only sixty cubic inches on the 7th has now increased to one hundred and twenty cubic inches.

13th. Pulse improving ; respiration better ; congestion of the face diminished. Has expectorated large quantity of offensive mucus. After inhalation, pulse firmer, 75, slightly intermittent. Upper third of the *right* lung less dull on percussion. Can lie down much better at night, although still obliged to preserve the semi-recumbent position during rest.

16th. Passed a bad night with harassing cough and profuse expectoration. Pulse feeble and intermittent; skin cold and clammy. Effect of this day's inhalations surprisingly quick and well-marked; had two sittings on each occasion; all distressing symptoms except cough disappeared after two or three hours; the oxygen gave a glow to the whole capillary circulation, with hot skin and perspiration.

24th. Percussion and auscultation indicated less congestion; inspiratory murmur now heard over upper half of right lung; lower half of left lung less dull; smell of breath excessively offensive, pervading the entire room. Ordered to use inhalation of vapor of hot water charged with chlorine, and to continue strong opiate fomentations to the chest.

28th. Passed an awful night; constant spasmodic cough; no sleep; produced at least two pints of expectorated matters, which had nearly choked him, consisting of dirty brown pus and mucus, mixed with dark gangrenous shreds and lumps of pulmonary parenchyma. Feels exceeding weak and ill, yet relieved since the copious, awful discharge. Without the free use of chlorine, it would be impossible to restrain the nausea and sickness caused to the poor fellow by the fetor, or to sit in the room with him for more than a few minutes. Oxygen inhalation continued night and morning is evidently the only thing which keeps him alive.

March 16th. Various fluctuations up to this time; some days slightly improved; then at the point of death. Has had a terrible night; extremely depressed; quick, intermittent, and hardly perceptible pulse; cold and clammy sweat on face and forehead; described something as feeling "suddenly broken or given way," causing him

nearly to faint with pain and prostration ; immediately followed by the violent issue from the chest and mouth of a large quantity of fetid black discharge, mixed with blood, similar to that previously expectorated.

March 17th, 8 A. M. Very bad night with retching and coughing, with almost continual fetid expectoration from the sloughing cavity.

9 P. M. Feels much better; expectoration less copious ; cough at longer intervals. The diminution of the stone-like dullness on percussion, and of the tumefaction in the right hypochondrium, is very decided.

21st. Right side of the chest sounds more clear throughout, except from apex to base for about the breadth of three inches to the right of the sternum, where the stone-like dullness still exists. Respiration can be heard at the third inferior portion of the lung with cavernous rhonchus.

From this date, slow but steady improvement ; it would be superfluous to give further details of the progress week by week and month by month. Ultimately recovered ; has now for many years been a strong, active man.

Exhibit No. 24.

CONSUMPTION.

Miss F. P——, aged 21 ; sanguino-nervous constitution ; sensitive lungs ; liability to colds, in connection with catamenia, which have always been correct. Consulted me about the use of oxygen. Then present constant short cough, with frequent expectoration ; hectic flush ; frequently recurring febrile irritation; hot and red tongue; irritation of the stomach and bowels. Considerable loss of symmetry between the two sides of the chest. Right

flattened and presenting some concavity between the scapulæ to the extent of four and one-half inches from both downward. Auscultation, percussion, and microscopical examination confirmed the diagnosis as regards tubercular consolidation and central cavity. The remaining portion of the lung gave evidence of general congestion and loss of mobility, with jerking inspiration and the peculiar "click." The left side of the chest demands no special notice with the exception of compensatory respiration.

Oxygen inhalation at once commenced; cod liver oil discarded, and cream substituted as soon as the stomach could tolerate it. Dietetic and hygienic rules carefully observed, and due attention paid to the depraved secretions. From the very first dose of oxygen a diminution in the sensation of irritation and weakness of the chest felt by the patient; within a month, marked improvement, both in the lung and general health; at the termination of four or five months' steady treatment, with carefully directed inhalation of oxygen once daily, the flattening and concavity had given way to almost perfect symmetry, and the remaining dullness beneath the clavicle was so slight as to make the use of gas no longer necessary. Two years after the commencement of oxygen, she was quite well, and has ever since enjoyed good health.

Exhibit No. 25.

CONSUMPTION.

Mr. C. B. H——, aged 31. Subject to severe attacks of bronchitis, and pneumonia, which culminated in his present condition. Undergone a variety of treatment. Symptoms complicated, with cardiac weakness and irri-

tability and congestion of the pulmonary artery. Compelled for several hours every night to sit up in bed gasping for breath.

Principal symptoms now present: hurried and labored respiration, with loud wheezing and extensive physical prostration upon slight exertion; face and lips dark and congested; pulse flickering and scarcely appreciable to the touch of the finger, and varying in frequency every few minutes; semi-recumbent position at night essential even to a moderate amount of uneasy sleep. Tested the inspiratory capacity and found that he could barely accomplish more than fifty cubic inches. Auscultation and percussion evidenced congestion of both lungs, with diminished respiratory murmur; a few slight patches of emphysema; rhonchi varying in character in different portions of the lungs; no evidence of heart disease, but extreme feebleness in action; great congestion of the large pulmonary vessels. Much giddiness of the head; dull pain and weakness posteriorly; tottering gait, and legs suddenly giving way; liver, stomach, bowels, and digestion quite right, except so far as partaking of the general prostration. Cardiac feebleness following the gradual loss of nerve-power in the medulla oblongata and cerebellum.

Oxygen inhalation was unquestionably the *sine qua non* through which life was saved; its effects were immediate and well marked; and, although prior to the completion of the cure the oxygen was stopped and other remedial measures resorted to, yet it may be safely asserted that without the preliminary employment of the gas, all other treatment would have been fruitless. The patient has since enjoyed fair average health.

Exhibit No. 26.

VALVULAR DISEASE OF THE HEART.

Mrs. ——; daily occurrence for her to turn faint and giddy, and almost to fall when making any sudden movement from sitting to horizontal position or crossing the room. Slightly bluish lips and vascular network in a naturally clear and pink face; congested conjunctivæ, and sudden flushings from very slight movements; tongue paralyzed on one side—all of which symptoms point to an insufficiency in the cardiac, pulmonary, and cerebral circulation. Determined to try a course of oxygen. Great care necessary during the first week's daily inhalation. After this, improvement steady and progressive. Heart's action firmer; instead of the long intermission every two or three beats the intervals only occurred as a rule from ten to twelve beats. Systole with *bellows murmur*, as well as diastole, became appreciable. Pulse, instead of being hardly perceptible to the touch, felt with ease, though still feeble and slow; face regained healthy hue, and, before the termination of two months' treatment, so very well was the equilibrium of the heart's action and the general circulation restored that oxygen was no longer necessary. This patient has not thus far needed oxygen again; even the heart valves themselves appear to have undergone some gradual improvement.

Exhibit No. 27.

SENILE GANGRENE.

Mr. G. B——, aged 62. For many years a sufferer from rheumatic gout and incurable spinal disease; showed a tendency to break up altogether. Troublesome slow ulceration had attacked successively the roots of all the

toe nails, which had turned black and fallen off, leaving the dark surfaces indisposed to heal, with grumous discharge. For three weeks this morbid action had slowly increased, and had assumed the characteristics of senile gangrene, with large, nearly black, purpura patches upon the feet, ankles, and legs. No ordinary means appearing to have any influence in checking its progress, the patient (a relative of mine) placed himself under my care. I was much gratified and surprised with the result in his case. Without any particular change of diet the extending morbid process was suspended, and began to give place to healthy action within one week. This change steadily continued, and in the course of four or five weeks all traces of the disease had disappeared, new and healthy toe nails having begun to grow. For eleven years the patient, now 73 years old, has had no return of the foregoing symptoms.

PART II.

EXPLANATION.

In the following cases the inhalations were of various dilutions of oxygen gas, but the active therapeutical principle of all was oxygen.

Exhibit No. 1.

CAPILLARY BRONCHITIS.

Child two and one-half years old; at point of death from bronchitis intercurrent with measles. Respiration 80 accompanied with mucous râles audible at some distance from the bed. Pulse too frequent to be counted. Face

pale and dusky ; extremities cold. Within one hour after the continuous administration of oxygen was resorted to, pulse had fallen to about 160, respiration to 40. Within another hour the face had regained its color, and the râles were no longer audible unless the ear were applied to the chest. Inhalations continued without interruption for three hours, and irregularly for five hours longer, then wholly discontinued. The following day convalescence was *fully established.*

ANDREW H. SMITH, M.D.

Exhibit No. 2.

CROUP.

Severe case of croup ; administration of the usual medicaments without benefit ; immediate alleviation after oxygen had been inhaled.

Patient, a boy 21 months old ; hitherto perfectly healthy ; breathing noisy and whistling, short, some 50 respirations in a minute, irregular. Pulse small, very frequent, impossible to be counted. Countenance pale ; lips livid ; muscles active during breathing ; now and then agitated in the face. Frequently bent his head quite backwards ; seized his throat convulsively with his hands. Face moist and cold. Inhalations of oxygen were tried, other remedies having failed. Condition after the inhalation as follows : pulse perceptibly less frequent ; number of respirations about the same. Appearance of the child more quiet ; less anxious ; became more reactive to the impediment to respiration. Spasmodic movement of the muscles of the face, as well as of other regions of the body, ceased. Parents reported in the morning that the child had slept very quietly, and

that the spasms and anxiety had disappeared. They added that on no previous night were the suffocating seizures so alarming, and yet on no night was the patient so quiet. On the following morning the child was still better. The patient recovered entirely.

HERMANN BEIGEL, M.D.

Exhibit No. 3.

PNEUMONIA.

Mr. C——, aged 33, married. Suffered one year ago from severe attack of double pneumonia. Perfect resolution did not result, indurations remaining in both lungs; continued to have troublesome cough and dyspnœa. Commenced oxygen-treatment. Lung capacity 154 cubic inches. In two weeks, cough and dyspnœa much diminished; lung capacity 175 cubic inches. Took the treatment a month. Then thought his lungs as good as ever. Chest capacity increased to 210 cubic inches. The indurated areas almost cleared up, only a very slight dullness remaining. Continued improvement for six months; cough and other lung-symptoms cease to trouble him.

C. E. EHINGER, M.D.

Exhibit No. 4.

PHTHISIS.

Mrs. W——, aged 40. Phthisical for eight years; frequent hemorrhage; very much reduced in flesh and strength. Went to the country. While there had a succession of hemorrhages, which left little prospect of even a temporary rally. Improved some, however, and returned to the city. Passed the winter in extreme feeble-

ness. Decided to try oxygen, believing it would take the place of going out of town. Inhaled twice a day about four gallons; found her strength much improved. During summer two slight hemorrhages. Health, in the patient's opinion, better than the preceding year, notwithstanding the disadvantage of remaining in the city. Continued the use of the gas with occasional intermissions. Cannot omit it for more than a week without sensible retrogression. The summer, which has always been the most trying season for her, has been passed with great comfort. That this is due to oxygen is shown by the effects of occasionally omitting its use.

ANDREW H. SMITH, M.D.

Exhibit No. 5.

ANÆMIA.

Wilhelm N——, aged 28. More and more feeble and bloodless for four months, probably from the effects of syphilis. First saw him on the 23d of November. Very anæmic; conjunctivæ and nails white; hands cold; pulse 96, very feeble; no cardiac souffle. Absolute disgust for food; restless in his sleep.

Gave him at once four gallons of oxygen, inhaling about ten minutes. Following day pulse had fallen four beats, and there was a little appetite.

November 25th. Further decline of four beats; appetite improved.

November 26th. Pulse, 84; appetite good; complained of constipation and headache; ordered Ex. Senna Fi.

November 27th. Pulse, 96; bowels free, but headache continues.

November 28th. Pulse, 80; headache no better. To omit the iron.

November 29th. Pulse, 76; head still painful; ordered Potas. Bromide gr., Ex. Terdic.

November 30th. Head some better; pulse, 84; appetite good; nails pink; conjunctivæ still pale, but not so much so as at first.

December 1st. Head much better; strength greatly improved.

December 2d. No more headache; has an excellent appetite; from this time, steady improvement.

ANDREW H. SMITH, M.D.

Exhibit No. 6.

INTESTINAL CATARRH.

Case first.—Gentleman well up in the sixties. General debility and gastro-intestinal catarrh. Medication useless. Results—*oxygen inhalation a signal success.*

JOHN AULDE, M.D.

CATARRHAL PNEUMONIA.

Case second.—Widow, aged 35. Chronic catarrhal pneumonia; prognosis unfavorable. In the course of a month or two she was able to sit up in bed; followed the *oxygen-treatment* two months, and shortly after was married. The oxygen-treatment saved her life.

The above cases reported by S. H. Platt, A.M., M.D., in "Oxygen is Life."

Exhibit No. 7.

SEPTICÆMIA.

Septicæmia after parturition, caused by absorption of the products of decomposition. Ergot was given, and,

whether from that cause or from absorption of putrescent matter, gangrene of the feet was threatened. Pain in the feet agonizing; toes blue, and almost insensible, "and the line of demarkation began to be foreshadowed." The pulse, which had almost ceased in the extremities, was found to be but 80 in the carotids. Body covered with cold, clammy sweat. Ergot stopped, and quinine, beef-tea, and wine given, together with injections of carbolic acid, and hot applications to the feet. The next day inhalations of oxygen were begun, and the following day re-action set in, and convalescence was gradually established. How much was due, in this case, to oxygen, how much to the other treatment, and how much to the powers of nature, it is impossible to determine.

DR. FRAUENSTEIN.

Exhibit No. 8.

DIPHTHERIA.

Case first.—Advanced diphtheria. Child six years of age cured by the inhalation of oxygen gas, one gallon morning and evening, and the inhalation of the solution of the tincture of chloride of iron, ten minims to the fluid ounce of water. *Remarkable alteration in the patient's condition perceptible after the first inhalation of oxygen.*

Case second.—Severe case of diphtheria after small-pox. Exudation lining the whole pharynx. Laryngeal implication, suffocative paroxysms, etc. The administration of calomel for six days afforded no relief. Case treated by inhalations of a spray of hot water, afterward lime-water, and subsequently tannin; the oxygen administered to relieve suffocative attack, with complete suc-

cess; continued twice a day as long as requisite; combined treatment resulting in a cure.

HERMANN BEIGEL, M.D.

Exhibit No. 9.

PNEUMONIA.

Boy fifteen years old, sick with pneumonia. Sent for me in a hurry, messenger saying child could not breathe. Packed my office apparatus and took it with me—HOME TREATMENT apparatus of U. S. Compound Oxygen Co., Springfield, Mass. Found the lad suffering greatly; very much choked. Filled a bag with gas, and with great difficulty got him to inhale it. After he had taken about two-thirds of the bag, he breathed better, and a half hour later I left him feeling quite comfortable. The next morning he was better, and by next Sunday, one week, I think he will be out of bed.

R. KINGSMAN, M.D.

WASHINGTON, D. C.

APPENDIX.

OXYGEN ADMINISTERED IN DRINK UNDER THE FORM OF OXYGENATED WATER.

Last year the idea occurred to me to administer oxygenated water; but water, as we know, does not dissolve upon ordinary atmospheric pressure but one-twentieth of its entire volume. However, under a pressure of fifteen to eighteen atmospheres it can be made to dissolve three-quarters. My idea was that certain troubles of the stomach and intestines would find in the administration of this agent a convenient stimulant. I have therefore advised it in cases of dyspepsia and nervous women, and especially in women slightly hysterical, in whom flatulent dyspepsia is not rare. In the convalescence of certain affections many patients have found it very beneficial. I am disposed to follow this study (thanks to the kindness of one of my former pupils, Mr. Limousin, who prepared a certain number of bottles of oxygenated water), for I found in perusing the Encyclopedia Britannica (1799), a good work by d'Odier of Geneva, on this subject. In reading the work I was struck by the fact that this physician from Geneva was actuated by the same motives as myself. I cannot do better than give you a *resumé* of his knowledge on this subject.

"Oxygenated water," says d'Odier, "increases the appetite and strength, provokes micturition, calms cramps of the stomach, particularly when they are accompanied by hysterical symptoms, and prevents their return, espe-

cially if they are periodical. I saw the mother of a family, aged forty years, subject for many years to an affliction of the nerves, which upon the occurrence of any excitement produced violent pains. It commenced by cramp in the stomach accompanied with compression in the neck and suffocation to such an extent that she could neither lie in bed nor inhale easily. This condition was absolutely exempt from fever during its violence, which lasted about an hour, after which the symptoms disappeared, and left a general feeling of illness which lasted many hours. The next day she was perfectly well. But the following day the symptoms commenced to reappear and she was affected in like manner. It was during the third attack that I was called. I administered at first large doses of quinine during four consecutive days, without any success. I afterwards prescribed certain powders recommended for the first time by Sir George Baker, and which I saw produced good effects in nervous patients (Cardamine Pratensis, Linn.), the dose in this case being one ounce a day. Finally I employed oxygenated waters, a glassful in two hours, and before the first bottles were used the patient had revived. No recurrence of the attacks, and the patient has been well ever since.

"Another mother of a family, of the same age and having about the same constitution, was taken with bilious fever, during the course of which she had nervous attacks which had manifested themselves by cramps in the stomach, compression of the neck, and complete extinction of the voice, a sensation of suffocation and very uncomfortable feeling, involuntary crying, etc. These attacks at first were irregular. I prescribed oxygenated water, but it produced suppression of the urine at times and I was obliged to stop it. A few days after, this acci-

dent having ceased, and the attacks having become altogether periodical, occurring exactly every twenty-eight hours, and having resisted the most powerful antispasmodics, I again turned to the use of oxygenated waters, which produced decided improvement and prevented their return. The suppression of the urine which it had previously occasioned again manifested itself, but only after the patient was cured, and as she was merely taking the waters as a precaution so we might discontinue them without any inconvenience.

"I have seen many similar cases in which the oxygenated waters have been very beneficial. It appears to me that they might be able to take the place of a great many antispasmodics. I have seen good results in a case of profound melancholia from this treatment. I also know of a case of dropsy in which they have acted with astonishing success as a diuretic. 1798.

"Since that which precedes was written, June, 1798, we have continued to experience success from the use of these oxygenated waters; we have each day seen its good effects.

"1. In a case of spasms and hysterical cramps, particularly in the stomach and intestines, when these symptoms were really due to a debilitated condition rather than to an engorgement or to an irritating cause, oxygen has proved beneficial. I have cured by this means a Spanish girl, twenty-five years of age, who was every day subjected to violent spasms which had their origin in strong affections of the mind and were considerably increased following fatigue and continual vomiting which she had experienced during a sea-voyage. All the known antispasmodics had been employed without success; oxygen-water finally cured her very rapidly.

"2. In affections of the chest which partake of the nature of asthma rather than of phthisis. I saw a woman fifty-five years of age, subjected for many years to violent attacks of cough and suffocation, take these waters during many years and she experienced improvement which no other remedy had produced. I also saw a man about fifty years of age, feeble health, who, following an attack of inflammatory catarrhal fever, was affected for a long time with weakness of the chest to such an extent that the least effort of the voice fatigued him very much. The greatest incommodity which it caused him was that he was unable to teach, for he could neither speak nor read above a whisper without producing intense discomfort. He had continually a sensation of numbness, of cold, of feebleness of the legs and in the thighs. After having tried many other remedies, I finally employed oxygenated waters, which produced very beneficial results.

"3. It appears to me that we might have very good success in cases of debility and slow convalescence following febrile diseases, when the patients, without having any local affection, have great trouble in regaining their health, appetite, and ordinary gayety. I have taken the waters myself a few times in recovering from a very severe fever which left me in a very debilitated condition, and I experienced very beneficial results.

"4. Finally, in cases of dropsy, accompanied by oppression and lividity. One of my *confrères* saw a patient in this condition who had taken many other remedies without success, and the oxygenated waters had cured him as though by enchantment. This cure, which dates back many months, has been verified. When I commenced to make use of this treatment I saw

that it produced in some cases marked suppression of the urine. When such a condition existed I employed hydrogenated water to overcome this symptom."

"ODIER."

Encyclopedia Britannica, April, 1799.

FURTHER OBSERVATIONS ON THE USE OF OXYGEN IN THE TREATMENT OF PHTHISIS, BY ARTHUR RANSOME, M.D., F. R. S., CHRONICLE, MAY, 1889.

The following cases were admitted to treatment at the Manchester Hospital, for consumption, at Bowdon. The notes have been made in each instance by Mr. Burnett, the resident medical officer of the institution.

An approximation to the proportion of bacilli in the sputum is indicated by the signs BI., BII., and BIII. BI., when there are very few found ; BII., when an average number were found ; and BIII., when they were abundant. But no stress is laid upon these results of the bacillus search. It may be sufficient to repeat here that each cylinder fully represents seven liters of pure oxygen ozonized up to about nine per cent., and under a total pressure on the cylinder of six to eight kilogrammes.

I.—*Cases in the First Stage of Phthisis* (*males*).

Case first.—S. B——, aged 21 years. Admitted August 25th, 1888. Occupation, laborer. Family history, good. Previous history : Scarlet fever in 1881, typhoid two years ago. Before suffering from latter disease, patient had always been strong and healthy ; but since he has not been able to do more than three months' work without being laid up in bed for a time.

Present attack dates from convalescence from typhoid. Has gradually got weaker and lost flesh. Before the

fever weight was 12 stone, 4 pounds. Cough began early in May, 1888. Hæmoptysis (half pint) on two occasions at the end of May. Has had heavy night sweats.

Present condition: Weight 139½ pounds. Temperature 100°. Tendency to clubbing of fingers.

Respiratory system: Impaired resonance in right supra-clavicular, clavicular, and infra-clavicular regions as far as the second rib. In infra-clavicular region, the difference between two sides very slight. Posteriorly: Dullness in right supra-spinous fossa and in upper part of the inter-scapular region as far as the spine of the scapula. On auscultation the only difference is divided respiration and audible expiration in right supra-spinous fossa, right inter-scapular, and right supra-clavicular region, with slight harshness of both inspiration and expiration in right inter-scapular region, but no alteration of quality in other regions. No adventitious sounds. (About a week after above notes were taken moist sounds were heard, but they were only present for a short time.)

Sputum: Muco-purulent, containing BII.

September 11th. Began to take oxygen, one cylinder once a day.

September 13th. Takes two cylinders a day; no cough or irritation. Patient says it induces sleep.

September 20th. Two cylinders twice a day. Gradually gaining weight.

October 7th. Three cylinders three times a day.

On September 25th patient began to take Pil. Iodof.

October 12th. Four cylinders three times a day.

October 20th. BI. in sputum.

On two occasions patient took five cylinders, but each time the inhalation caused sharp pain in the side. Continues to take four cylinders.

November 27th. Slight hæmoptysis. Phlegm tinged. Oxygen stopped.

November 6th. BI.

December 19th. Since last note up to now sputum has been tinged with blood, and no oxygen given. Now resumed, four cylinders thrice daily. It causes, occasionally, slight cough, but no pain.

December 30th. BI. Expectoration slight. Moist sounds at apex again heard freely.

January 21st, 1889. Discharged. The disease remains confined to apex, and does not extend below second rib (i. e., limited to same regions as on admission). Moist sounds are, however, freely heard over dull area. No signs cavity. Expectoration slight. BI. Weight 151¼ pounds.

Weight,	August	28,	1888, ...	139½	pounds.
"	"	31,	"	141½	"
"	Sept.	7,	"	144½	"
"	"	14,	"	145½	"
"	"	21,	"	145¼	"
"	"	28,	"	147¾	"
"	Oct.	4,	"	148	"
"	"	12,	"	149¾	"
"	"	19,	"	150¼	"
"	"	26,	"	151¾	"
"	Nov.	23,	"	154¾	"
"	"	30,	"	153¾	"
"	Dec.	6,	"	153¾	"
"	"	13,	"	149	"
"	"	20,	"	153½	"
"	"	27,	"	153½	"
"	January	4,	1889, ...	152	"
"	"	11,	"	152	"
"	"	18,	"	151¼	"

Case second. — J. R——, aged 24 years. Admitted January 15th, 1889. Occupation, rubber-worker. Family history—no history of phthisis in family.

Present attack began five months ago with cough, and pain in lower part of right side of chest. Cough has persisted up to the present time. At the commencement, for four months, he brought up a large amount of phlegm, but during the last month the quantity expectorated has been much smaller. On two occasions during the last week has spit a little blood mixed with phlegm. No other hæmoptysis.

Present condition: Patient very sallow; not badly nourished. Pale appearance patient attributes to his having worked at glass cutting for many years, and not to the naphtha fumes to which he is exposed while following his present occupation.

Respiratory system: Slight flattening of right infra-clavicular region, impaired resonance in right supra-clavicular and also to a slight degree in right infra-clavicular, as far as second rib. Weak respiration in right supra-clavicular region not altered in quality. In right infra-clavicular region respiration rough, but expiration not affected. No moist sounds anteriorly. Posteriorly: Impaired resonance in right inter-scapular region and supra-spinous fossa. Over these regions respiration is weakened, but not altered in quality. Dry clicks are heard, especially on coughing. Bases clear, but just below spine of scapula on right side there is a patch of dullness extending downwards two inches, and over this the breath sounds are not much altered, but a number of dry crepitations are heard with every inspiration.

January 22d. Expectoration moderate in amount, containing bacilli, BI. The percussion signs remain the

same as on admission, but on auscultation small crepitations are now heard in right supra-clavicular region. Posteriorly the "clicks" have in part given place to decided moist sounds, especially at level of fifth dorsal spine, and crepitations are heard for a distance of two inches lower. Expiration behind is decidedly prolonged, and of an obscure bronchial quality (obscured by adventitious sounds).

February 5th, 1889. Began to take oxygen, one cylinder, three times a day. No bad signs.

February 12th. Now takes three cylinders three times a day.

February 16th. Expectoration moderate in amount, BII.

Weight, Jan.	18, . .	122½ lbs.		Weight, Feb.	15, . .	130 lbs.	
"	"	25, . .	126½ "	"	"	25, . .	132 "
"	Feb.	1, . .	127½ "	"	Mar.	1, . .	132¼ "
"	"	8, . .	127½ "	"	"	8, . .	133 "

Case in First Stage (*Female*).

A. R——, aged 21 years. Admitted May 24th, 1888. Occupation, office cleaner. Family history: Father living, 47, healthy; mother 45, healthy; one brother and one sister living, healthy; two died in infancy. No history of phthisis or struma in family. Previous history: Has always been ailing, but beyond diseases of childhood has not had any illness of moment. Present attack began eighteen months ago, with pain in left side and slight cough. Never any hæmoptysis. Night sweats sixteen months ago. Expectoration: Mucoid, slight.

Present condition: Slight dullness at left apex down to second rib. Breath sounds somewhat obscured, but

usually appear to be bronchial. Many bronchitis râles. Similar signs posteriorly. On right side respiratory murmurs harsh above clavicle.

May 28th. Began to take oxygen. Two cylinders. It does not cause irritation or induce cough. Expectoration scanty. No bacilli.

June 4th. Three cylinders. No bacilli.

June 14th. Four cylinders. BO. Expectoration varies from day to day in regard to quantity. When present it is always frothy and dilute.

June 21st. Weight increasing. No expectoration. Few moist sounds.

June 30th. Discharged at own wish.

Weight,	May 30, ...	116½	pounds.
"	June 6, ...	118	"
"	" 13, ...	120	"
"	" 20, ...	122	"
"	" 27, ...	122¾	"
"	Feb. 26, 1889, ...	124	"
"	Mar. 19, "	122	"

Since discharge, patient has several times been seen at Hardman street, and when last examined she continued well. There were then no moist sounds to be heard, and only impaired resonance at apex to be detected.

Case in Third Stage.

N. R——, aged 18 years. Occupation, servant. Admitted, March 18th, 1888. Notes on condition on admission lost. Beyond that patient had a cavity at apex of right lung and that bacilli were found in sputum, there is no history of case.

March 20th. Began to take oxygen, two cylinders daily.

April 2d. Three cylinders. No bad effects.

April 4th. Two specimens of sputum failed to show bacilli.

April 13th. Four cylinders now taken. Bacilli in sputum, BI.

April 20th. No bacilli. Expectoration lessened, muco-purulent.

May 2d. Few bacilli (BI.). Signs of cavity at right apex still present. No moist sounds.

May 14th. Discharged.

Weight, Mar.	8, . .	87¼ lbs.		Weight, April	13, . .	87½ lbs.	
" "	20, . .	88¾ "		" "	20, . .	87¼ "	
" April	2, . .	88 "		" May	2, . .	89½ "	
" "	4, . .	88 "		" "	14, . .	88¼ "	

For about three weeks after discharge, patient came to hospital each evening for oxygen. Cough gradually became more troublesome, and patient lost weight. About the middle of June patient went to live at Timperely, and on September 16th she came to hospital and was said to be doing well, cough having improved, shortness of breath less marked, and patient having gained ten pounds in weight.

Case in Third Stage.

R. B——, aged 46 years, domestic servant, residing at Dunham. Commenced oxygen inhalations in November, 1888. Family history: Father and mother and a brother and sister phthisical. Personal history: Enjoyed good health until sixteen years ago, when she had a severe attack of acute pleurisy, with effusion on the left side, which was slow in subsiding, and left the chest movements much impaired. Ten years ago she became thinner, and had a constant cough and short-

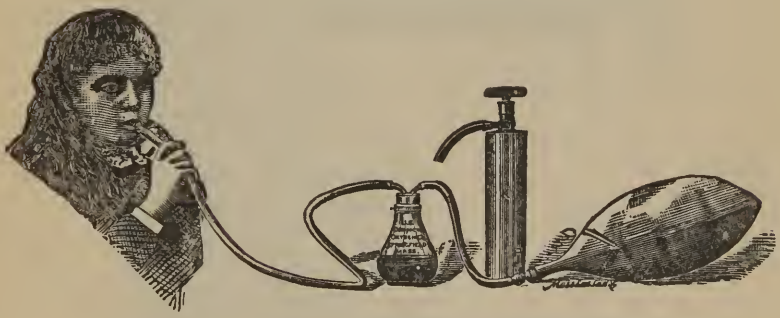
ness of breath, and it was found that she had bacilli in her sputum. Her condition on commencing the inhalations was: Weight, 116 pounds. On right side, supra-clavicular dullness on percussion, with bronchial breathing. Moist crepitation in the inter-scapular region. Puerile breathing at base. On left side, dullness on percussion to four inches front and back. Amphoric resonance and whispered pectoriloquy, with occasional gurgling. Crepitus above and under the clavicle in front. Dry crackle from two to four inches in front.

April, 1889. After six months' regular inhalations, no change in physical signs, but has gained weight to the extent of fourteen pounds.

Remarks.—The question to be laid before a jury of medical men is, whether in such a series of cases of phthisis as those described we could expect such favorable results from other modes of treatment. For my own part, I confess that although we have often had highly gratifying results from treatment at the Hospital at Bowdon, I do not remember any results quite so satisfactory as these now laid before you,—such continuous freedom from fever, absence of night sweats, diminution in the amount of expectoration, improvement in appetite and in sleeping power, and such consequent gain in weight.

But, on the other hand, it must be pointed out that the oxygen does not appear to have acted as a direct germicide, and that the control over the disease does not seem to have been due to its direct action upon the bacillus of tubercle. I greatly doubt whether we shall ever discover a means of reaching this organism in the

consolidated exudations of phthisis, impervious to air and even to the blood ; but I can well understand that oxygen may have a beneficial influence upon the general health of patients, and that it may enable the still healthy portions of the lungs to resist the noxious influence of the organism, and even ultimately to cause it to die out of the parts already attacked.



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