Effect of Oxygen upon Animal Life.

A. T. Kinsley.
Introducing
Oxygen
  Occurrence, quantity, etc.
  Function in life. Animal and plant.
  Action in putrefaction
  Former ideas of its effect upon animal life.
  J. F. W. Johnston.
  C. W. Rimini.
  T. H. Diversmore (experiment).

Plates and Photographs.

Experiments.
  Cat.
  Rabbit.
  Chickens.
  Human

Conclusion.
The writer is not the originator of this subject but one among the many that have written about it, and one among the few according to records, that have carried on experiments as proof of stated views.

The general statement that an oxygen atmosphere is destructive to animal life is thereby circulated, and believed to be true by many. There are professors in our institution that are of this opinion, and some of them laughed at me for repeating an experiment the result of which had been established for a century ago by the ablest scientists of that time.
However common oxygen is, there are many who would not, if they heard it spoken of, know what it is, where it is found, or what its use is. For this reason, a short account of it has been considered necessary.

Oxygen is the most abundant of all elements. Four-fifths of the air, right ninth of the water, and about two-fifths of the earth's solid crust is composed of it.

It is essential to life. The action on animal life is briefly as follow:- The air is taken into the lungs thru the bronchial tubes, then into the minute air chambers in the lungs which are separated from the blood vessels only by a very thin membrane and the carbon-dioxide exchange with respire out thru the separating membrane into the air chambers of the lungs, and the oxygen of the inspired air passes in thru the separating membrane and loosely combines with the red blood corpuscles of the blood thru forming oxyhaemoglobin. This oxygenized blood then goes thru the heart, and thence through the system, and the oxyhaemoglobin is partially reduced to haemoglobin in the capillaries, where the affinity of the corpuscles for oxygen is oxygen.
come by the affinity of the tissues of the body. That the oxygen combines with the haemoglobin has been for some time a question of considerable discussion, and the generally accepted proposition now is that the oxygen is loosely combined, because one hundred volumes of blood under ordinary conditions have the power of absorbing only one volume of oxygen from the air, while one hundred volumes of arterial blood in a normal condition contain from fifteen to twenty-five volumes of oxygen. Therefore it must be held otherwise than in simple solution. This is of vast importance, for if the haemoglobin did not have the power of combining with oxygen, we would require fifteen to twenty-five times the volume of blood we now have to carry the same amount of oxygen as the system. Bunge says: "The affinity of haemoglobin is shown by the fact that animals can live in an atmosphere where there is only one-third as much oxygen as in our present atmosphere. That is their arterial blood contains as much oxygen as it would in the common atmosphere. Then why cannot an animal thrive in an atmosphere of pure oxygen?"
Respiration also occurs in plants continuously. Oxygen being inspired, and carbon-dioxide expired, as in animal respiration. But there is, in plants, another process, 'Fixation of Carbon', in which carbon-dioxide is inspired and oxygen expired. This process only occurs in the presence of direct sunlight, and usually obscures respiration.

Oxygen is the chief agent in putrefaction and decay, both processes being accelerated by an increased percentage of it. Hence it is very important in arresting contagious diseases by rapidly oxidizing carcases. Thus it tends to rid the world of all inanimate bodies. It is becoming quite useful as a remedy or preventive of lung diseases.
The following is a sample of passages taken from scientific books of the present century, which are often quoted at the present time, both by authors and teachers.

J. F. W. Johnston, in his "Chemistry of Common Life," published 1869 says: "Animals breathe oxygen with an increase of pleasure, but it excites them, quickens their circulation, throws them into a state of fever and finally kills them by excess of excitement. They live too rapidly in pure oxygen gas and burn and dry up like the just flaring candle. Did the atmosphere consist of oxygen only, the lives of animals would be of most brief duration."

The above statement accompanied by no experimental proof neither is any quoted. It is evident that such statements should have some proof before being published. However, Mr. Johnston may have drawn from the statements by experiment and since it was generally accepted at the time, he thought it useless to publish it, which by the way is a very poor excuse.

C.H. Burnham, in his "Chemistry of Life and Health," published 1892, says: "The nerves..."
of nitrogen from the atmosphere would be as fatal as the removal of oxygen, and universal death would be accompanied by universal conflagration."

The first of the above statements was accorded in the comment on Johnston's statement. It seems hard to accept, and it is doubtful if "universal death would be accompanied by universal conflagration." No doubt combustion would be greatly accelerated if the nitrogen were removed from the atmosphere, but why should there be universal conflagration? Probably the kindling temperature would be lowered a very little, but before anything would burn it would first have to be raised to this kindling temperature.

I will admit that certain materials would burn in an atmosphere of oxygen that will not burn in our present atmosphere. But this only implies that some of our present mechanisms would have to be constructed from other materials, stone furnaces etc., which could be made of earthen-ware. But most common machinery could be made as usual for kindling.
temperature is never reached.

If a building or anything else should take fire, the flames could be suppressed with substances that were oxidized to a maximum, i.e., water would suppress flames by displacing the oxygen and thus from its cooling effect. Carbon dioxide (CO₂) would also prevent combustion.

Gray says, "The Creator has adapted the atmosphere to the support of life, as anything which destroys this relation thus established renders it deleterious to the animal constitution."

If the Creator did "Adapt the atmosphere to the support of life," why did he not adapt other things to their support? Plains, deserts, foreseen plants, etc. I should say from all sources of reliable information relating thereto, that the atmosphere seems to be a general result of the earth's gradual change from a molten mass to our present state.

Our relation to other planets may also have had an influence on our atmosphere.

F. H. Dimmick Jr. Textuel (1576) the effect of oxy gen upon animal life, is almost a very cruel
way. This experiment consisted in placing kittens and mice in large jars of oxygen without any inlet or outlet. This would not give satisfactory results because of the excreted (C0₂) carbon-dioxide and organic substances that are injurious to life also because of the dilution which would necessarily follow.

Benjamin Ward Richardson M.D. conducted some experiments in which he confined mice in two chambers, one containing wireless oxygen the other pure air. The results of the oxygen only will be given.

1st Experiment, temperature 65°F, mouse dead at the end of the fourth hour.

2nd Experiment, temperature 70°F mouse taken out at the end of the ninth hour in deep sleep.

3rd Experiment, temperature 60°F, mouse dead yet four hours and forty two minutes. These experiments appear quite satisfactory and they seem to reveal the fact that oxygen is destructive to animal life. However a mouse is very delicate, and the confinement may have been sufficient cause to bring about death. But to have a
fair test animals of average vitality should be used as subjects.

In my experiments, an airtight box was placed and fitted one cu. ft. capacity, with a glass front. These were holes thrown the top, through which food and water were given to the animals. The animal was put in the box through an opening in the top which was sealed during the experiment. The holes were also closed with rubber stoppers, so there was no means of air going into the top. The air in the box was gradually displaced by oxygen after the animal had been placed in it, by passing a current through a wash bottle, then by rubber tubing into the lower front corner. The exit tube being at the top, diagonally opposite this, a current was produced in the box and thus the expired carbon-dioxide and other substances that would dilute the oxygen were drawn out. There was also a pan partly filled with sodium-hydrosulphite (NaHS) and covered with screen wire placed in the bottom of the box, which would tend to absorb carbon-dioxide.

The oxygen was made from potassium.
Chlorate (KClO₃) and manganese dioxide (MnO₂) and stored in glasses as a week previous to the experiment.

First Experiment.

In this experiment a grown male cat was confined in the box (see plates and photograph) 5:30 P.M. April 15th. A record was made of all noticeable changes. The following Experiment closed 10:45 A.M. 40°. 16th.

<table>
<thead>
<tr>
<th>Time</th>
<th>Respiration</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00</td>
<td>24</td>
<td>Before putting in box.</td>
</tr>
<tr>
<td>6:30</td>
<td>24</td>
<td>Asleep.</td>
</tr>
<tr>
<td>6:00</td>
<td>29-30</td>
<td>Awake, lying still.</td>
</tr>
<tr>
<td>6:30</td>
<td>32</td>
<td>Asleep.</td>
</tr>
<tr>
<td>7:00</td>
<td>32-32</td>
<td>Awake, lying quiet.</td>
</tr>
<tr>
<td>8:00</td>
<td>31-32</td>
<td>Asleep.</td>
</tr>
<tr>
<td>9:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9:30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:00</td>
<td>32-33</td>
<td>Asleep.</td>
</tr>
<tr>
<td>12:00</td>
<td>32-33</td>
<td>Up, looking around.</td>
</tr>
<tr>
<td>a.m.</td>
<td></td>
<td>Asleep.</td>
</tr>
<tr>
<td>4:30</td>
<td></td>
<td>Moving around, breathing a little short.</td>
</tr>
<tr>
<td>6:00</td>
<td>34</td>
<td>Sitting up.</td>
</tr>
<tr>
<td>6:30</td>
<td>41-42</td>
<td>Breathing short and jerky.</td>
</tr>
<tr>
<td>7:30</td>
<td>38</td>
<td>Sitting up.</td>
</tr>
<tr>
<td>8:30</td>
<td>36</td>
<td>Lying on branches and sitting.</td>
</tr>
<tr>
<td>10:30</td>
<td>27</td>
<td>Looking around.</td>
</tr>
<tr>
<td>11:40</td>
<td></td>
<td>Ectoplasm.</td>
</tr>
</tbody>
</table>
The cause of the explosion is a mystery. It appears that there was some explosive gas formed in the top, for when a splinter
with a spark on it was held near the exit tube a flame immediately ran into the top—the explosion followed blowing off
the lid, breaking out the glass front, and singeing the cat a little. This was all the change noticeable in the cat except that
he was a little stiff due to the close confinement. It is true the cat's respiration increased, and probably oxygen was the
cause, yet it had diminished almost to the normal before the explosion occurred.

I believe if the explosion had not happened
the cat would have lived in the oxygen
indeﬁnitely without any apparent change
if some mixture had been employed to
supply the oxygen.

Second Experiment

A white rabbit was placed in the same box
and under the same conditions (emergent) that
the cat had been in, and a similar table
of results would have been given if there
had been any noticeable changes, but the
rabbit was taken out after fifty-three hours.
in just as good a condition, apparently as it was when the experiments began. Grass and clover were eaten heartily during the experiment.

Third Experiment.

In this experiment a fantail hen and a young chicken four weeks old, were placed under the same condition as the rabbit and cat, had been in. It was not a fair test on the young chicken, because the hen would occasionally sick and interfere with it. However they were both apparently in as good a condition as at the end of the experiment as in the beginning.

There was some effect, gasping and dumpyish actions, about three hours before the experiment closed. This was probably due to the expired air, as there did not seem to be a very strong current of oxygen passing thru the box, and hence there was nothing to drive the expired air out. When the peculiar gasping and dumpyish actions were noticed, but on turning on a full current these actions were no longer present. The hen became quite lively and began to chase the little chickens again and abused it severely and did this until the
Close of the experiment.

The experiment was continued for forty-four hours and will be repeated for a longer period.

Fourth Experiment.

The rabbit that was used in the second experiment was confined again for twenty hours. Then immediately dissected, and the only change noticeable from the normal was in the blood. It seemed to clot very rapidly when exposed to the air. And the arterial blood was of a brighter red, the seminal blood probably was also a very little changed in color.

Fifth Experiment.

In this experiment, two fowlers hens were placed in the box, under the same conditions as the chickens in Experiment third. They were kept in the box for five days and twenty-one hours and were not affected in the least. When they were taken out they were in just as good a condition as when they were put in.
An observer was present in the first experiment continually, and in the second one for the first nineteen hours, and it was never left alone more than four hours at any one time. The other three were continually watched.

It will be admitted that more experiments would be better to establish this fact. But in general it seems that oxygen is not destructive to animal life.

If some weak, frail animal was taken immediately from ordinary atmosphere and confined in an oxygen atmosphere, other things being equal, it would soon die as when some consumptive or unhealthy person goes immediately from an eastern city to a location where the conditions are most favorable to relieve consumption or improve health. Keeping all other conditions the same, he usually loses strength and soon wastes away.

But if the weak, frail animal is gradually accustomed to the change, other things equal, it would no doubt grow stronger and would soon thrive in an atmosphere of pure oxygen as when a consumptive or unhealthy person goes gradually to a location where things equal, where the
Conditions are favorable to suppress consumption or improve health, he usually grows stronger. This applies to either animals or men of average or strong vitality. But not so much as in the weaker ones.

Likewise a frail or delicate plant is usually killed by too sudden or too great a change, but if the change is gradual its vitality will be increased. This is also true of a strong plant.

The effect of oxygen was also tried on myself, but in a rather crude way. By placing the delivery tube into my mouth and closing my nose while breathing nothing but oxygen was inhaled. Expiration was done through the nose. This was continued for thirty minutes. The first time with no effect. The second time it was continued for an hour, and the only effect of any was a drop of about six per cent per minute. However this may have been caused, in part, at least, by remaining quiet. It was found, both in myself and in another person, that a full breath of oxygen would last about one third longer than common atmosphere.

It seems as the air world would be very similar to what it now is, if we live in atmosphere of 0.94 per.
There would probably be a decrease in respiration and probably a decrease in lung capacity. But it is hard to believe that there would be "universal death accompanied by universal conflagration."

From the experiments the following conclusions have been drawn.

First, that oxygen does not cause high life, fast living, etc.

Second, it does not cause any unnatural sleep or unconsciousness.

Third, it is not destructive to animal life.