AFTER THEIR KIND AND IN HIS IMAGE

JAMES E. STRICKLING*

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A central point in the foundation of Creation Science is the immutability of biological types; these types regarded to be natural species. Limits imposed by a lack of interfertility define a natural species; i.e., two different natural species cannot reproduce (except possibly to yield infertile hybrids). Although not defined in the Bible, "kind," as used in the first chapter of Genesis, is generally assumed to be equivalent to a natural species—capable of wide variation but only within fixed and frequently unknown limits. This assumption is based on the idea of reproduction "after its kind."

In addition to kinds, the Book of Genesis speaks of created groups such as cattle, fowl, etc. If fertility were not the criterion, one might ask whether kinds exist within the fowl group, for instance, or whether multiple fowl groups exist within a kind. However, this turns out to be somewhat academic since a close reading of the biblical text reveals that the accepted meaning of "kind" is unsubstantiated, and the true meaning is far from being clear—possibly even beyond our understanding.

Consider Genesis 1:25.

> And God made the beast of the earth after his kind, and everything that creepeth upon the earth after his kind . . .

The organisms were *created* after their kind. *Nothing* is said about their subsequently *propagating* after their kind.

The statement about plant life in Genesis 1:11 seems at first to uphold the traditional concept of "propagation after its kind."

> And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after its kind, whose seed is in itself . . .

Unlike the foregoing verse, the meaning seen in this verse is strongly influenced by the sentence structure and the punctuation (supplied by the translator). It must be read as follows for compatibility:

> . . . Let the earth bring forth grass, the herb, the seed-yielder, and the fruit tree, the fruit-yielder, after his kind, whose seed is in itself . . .

This reading finds further emphasis by its absence from Genesis 1:27.

> So God created man in his own image, in the image of God created he him; male and female created he them.

"Kind" (Hebrew: *min*) is therefore not a biological entity but a concept—a design—after which plants and animals were created. Plants and animals were created from a design in the mind of God: man was created in the image of God.

The Biblical biological (reproducing) entities as created are cattle, fowl, man, etc. This relaxes the presently perceived limits of variation but has no impact on the essence of creationist thought; i.e., the specific separate creation of fully developed life forms.

*Mr. James E. Strickling's address is 5707 DeKalb Lane, Norcross, Georgia 30093.

THE EFFECT OF ELEVATED ATMOSPHERIC PRESSURE ON LIVING THINGS

TERRANCE L. SMITH*

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The effects of increased pressure on the maximum voluntary ventilation, and the toxic or narcotic effects of individual atmospheric gases at sufficiently high partial pressures, are described. These matters could have been very important before the Flood if, as some believe, a vapor canopy then caused the atmospheric pressure to be considerably higher than it is now.

It has been pointed out that an antediluvian vapor canopy would result in a higher atmospheric pressure than we currently have.[5,13] This fact has been used to both curse and bless the concept of a vapor canopy. However, these discussions have generally failed to examine what real (if any) limits exist for life as we know it. It is the purpose of this paper to present some of what is known about the interaction of atmospheric pressure and life.

The present atmosphere is composed of 21% oxygen, 78% nitrogen, and 1% miscellaneous gases. At sea level, these gases exert a nominal pressure of 14.7 psi (pounds per square inch) which is the same as 1 ATA (atmosphere absolute). Each of the constituent gases contributes to the total pressure in proportion to its concentration. Thus the pO_2 (partial pressure of oxygen) equals 0.21 ATA, and the pN_2 is 0.78 ATA. Changing the pressure of a gas mixture proportionally changes the partial pressures of each of the constituent gases. Consequently, if air at 1 ATA were compressed to 2 ATA, the pO_2 would increase to 0.42 ATA.

Changing the atmospheric pressure effects living

*Terrance L. Smith, Ph.D., is a Research Associate in the Department of Microbiology and the Department of Food Science at the University of Illinois, Urbana, Illinois. He receives mail at 2716 East California, Urbana, Illinois 61801.

things in two ways. The pressure by itself has an effect and the change in the partial pressure of the constituent gases has a different effect.

Pressure

Life can exist at quite high pressures. In the deepest parts of the ocean where pressures of 1,000 ATA exist, life has been found which ranges from bacteria to fish.[10] Interestingly, these animals are so well designed for pressure that they usually cannot be brought alive to the surface. However, life at these pressures may only be possible to gill-breathing and lower life forms. Lung-breathing animals are much more limited.

As the pressure of a gas increases at constant temperature, Boyle's Law states that its volume must decrease, and as a consequence the density of the gas must increase. This increase in density causes an increase in the Reynold's number for the flow.

$$\text{Reynold's number} = \text{velocity} \times \text{diameter} \times \frac{\text{density}}{\text{viscosity}} \qquad (1)$$

Reynold's number is a dimensionless measure of the probability of turbulence in a flow system. As the Reynold's number increases, the probability of turbulence increases until a critical value is reached where turbulence is essentially assured.

From equation (1) it can be seen that since velocity and diameter in the lungs is fairly constant, and the viscosity of gases changes very little until very high pressures are reached, the Reynold's number is a direct function of the gas density. The increasing turbulence in the windpipe and lungs causes a decrease in the maximum voluntary ventilation (MVV). This is a measure of the ability of an individual to move air into and out of his lungs and has the unit of liters per minute. The decrease in MVV with pressure is shown in Figure 1. By 6ATA, the encroaching MVV line has all but eliminated the possibility of the unduly heavy class of work. A person simply cannot move the air into and out of his lungs fast enough to do this class of work at this pressure. At higher pressures, the capacity for work is decreased still more. It is partly for this very reason that deep sea divers use a mixture of helium and oxygen (He-O_2). The helium is a less dense gas than the nitrogen it replaces and so restores some of the MVV. However, the MVV is not restored indefinitely. A 99% He-1% O_2 mix at 40 ATA has the same limiting MVV as air at 6 ATA.[15]

The use of He-O_2 mixtures presents two more problems. First, since the gas is less dense, the vocal chords vibrate faster and the sounds made are shifted upwards in pitch. This causes the so called "Donald Duck Effect" which degrades vocal communication. The second problem is that helium has approximately a six-fold higher specific heat than nitrogen. As a result, body heat is rapidly carried away and people are constantly cold.

Partial Pressures

As the pressure of a mixed gas increases, the partial pressure of its constituent gases is likewise increased. The consequence of increasing the partial pressures of

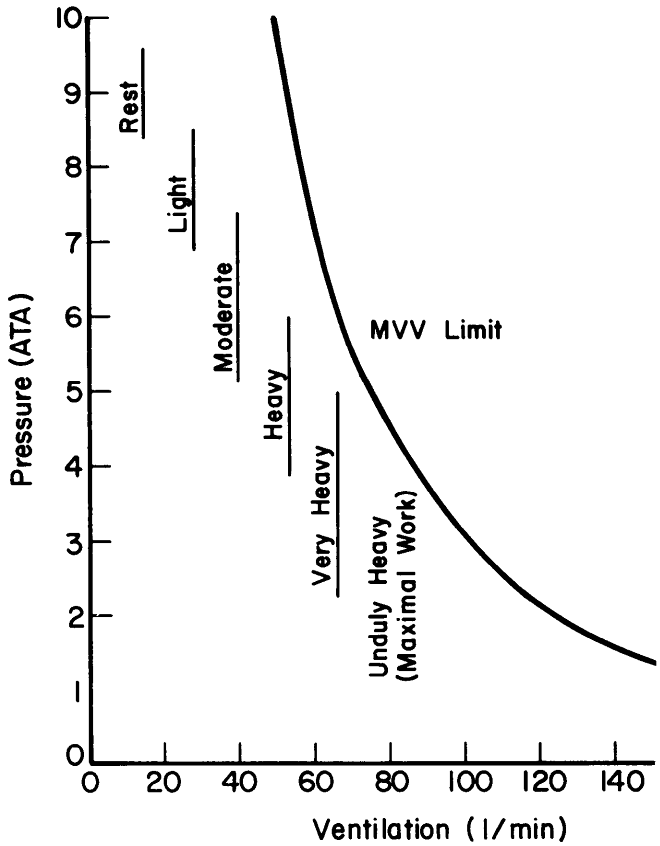

Figure 1. Limitation of MVV in air with increasing pressure. Work classifications are based on Christensen's classification of industrial work. Comparative examples of type of work are: desk work-lower light, cycling 5 MPH—upper light, Tennis—upper moderate, ditch digging—heavy, cycling 13 MPH—very heavy, chopping wood—lower unduly heavy. Adapted from Lanphier[15] and Pike and Brown.[22]

atmospheric gases is different for each gas. It is generally assumed that there is little interaction between the gases so that the effects of nitrogen, for example, are the same regardless of the oxygen partial pressure. It is the partial pressure of the gas in question which determines if there will be adverse effects. Thus, animals and men have lived at pressures ranging from 122 ATA with .17-.4% oxygen to 100% oxygen at pressures of less than one atmosphere.[6,12,17]

I. Nitrogen

With the advent of deep scuba diving, the clinical problems of excess nitrogen have become well-known even though the physiological basis is not well understood. The two problems with nitrogen are a decompression syndrome, popularly known as "the bends", and the intoxicating effects of nitrogen under pressure, referred to as nitrogen narcosis. The narcotic effects of nitrogen increase with pressure. Symptoms of euphoria and irresponsibility begin to show in divers and caisson workers at 130 feet (5 ATA) when breathing compressed air which has a nitrogen partial pressure of 4 ATA. At a partial pressure of 3.2 ATA, there is a measurable decrement in the performance of tasks.[3,16]

This narcotic effect of nitrogen is the second reason deep sea divers use He-O_2 mixtures, as helium is less toxic than nitrogen.

Hydrogen and neon are both present as trace gases in the atmosphere and are less toxic than nitrogen.[2] However, hydrogen is explosive; and neon has a greater density than nitrogen so the MVV problem is worse. Hydrogen and neon are, therefore, considered poor choices for reducing the narcotic effects at high pressures.

II. Oxygen

The toxic effects of oxygen are directed towards the central nervous system or the tissue depending on the partial pressure to which the individual is exposed. At pressures above 2-3 ATA of pure oxygen, there is a short and extremely variable latent period followed by convulsions.[1,14] This central nervous system effect rarely, if ever, occurs below 2-3 ATA oxygen. At lower oxygen pressures, there is the possibility of tissue damage, particularly to the lungs.[7,14] A number of studies have been summarized by Welch, *et al.*[25] on the oxygen tolerance of humans. Most of these studies measured the latent period as the time before the onset of substernal pain which is considered the earliest symptom of impending lung damage. As shown in Figure 2, there is a rapid increase in the latent period as the pressure of oxygen is reduced. However, the tolerance at any given oxygen pressure is also quite dependent on the individual. Welch, *et al.*[25] list one study where one of eight subjects showed toxic effects after nine days at 0.22 ATA oxygen. Yet, in this case, the oxygen pressure was barely above normal. The atmosphere used for space travel is 100% oxygen at 5 psi (0.34 ATA) and no toxic effects have been reported among the astronauts breathing this atmosphere for 2 weeks,[18,19] nor animals for eight months.[12] It has been shown that other tissues can also be affected by increased oxygen pressure. At oxygen pressures approaching 1 ATA, observations included a temporary decrease in metabolic rate in rats at 2 ATA O_2,[4] and an increase in blood urea in rats and humans.[11,24]

Most of the studies on oxygen toxicity have used adult humans or adult animals. There is, however, a very important effect of oxygen on the eyes of certain neonatal animals. It has been found that excess oxygen causes abnormal growth of the blood vessels in the retina causing detachment of the retina and consequent blindness (rectolental fibroplasia).[20] Work with newborn mice has shown that 0.4 ATA of oxygen causes blindness in 10% of the animals after 10 days. Keeping them at this pressure of oxygen until their eyes are developed at 14 days results in 21% blindness.[9,21] It is not known what the maximum oxygen pressure is that would allow the mice's eyes to develop without blindness.

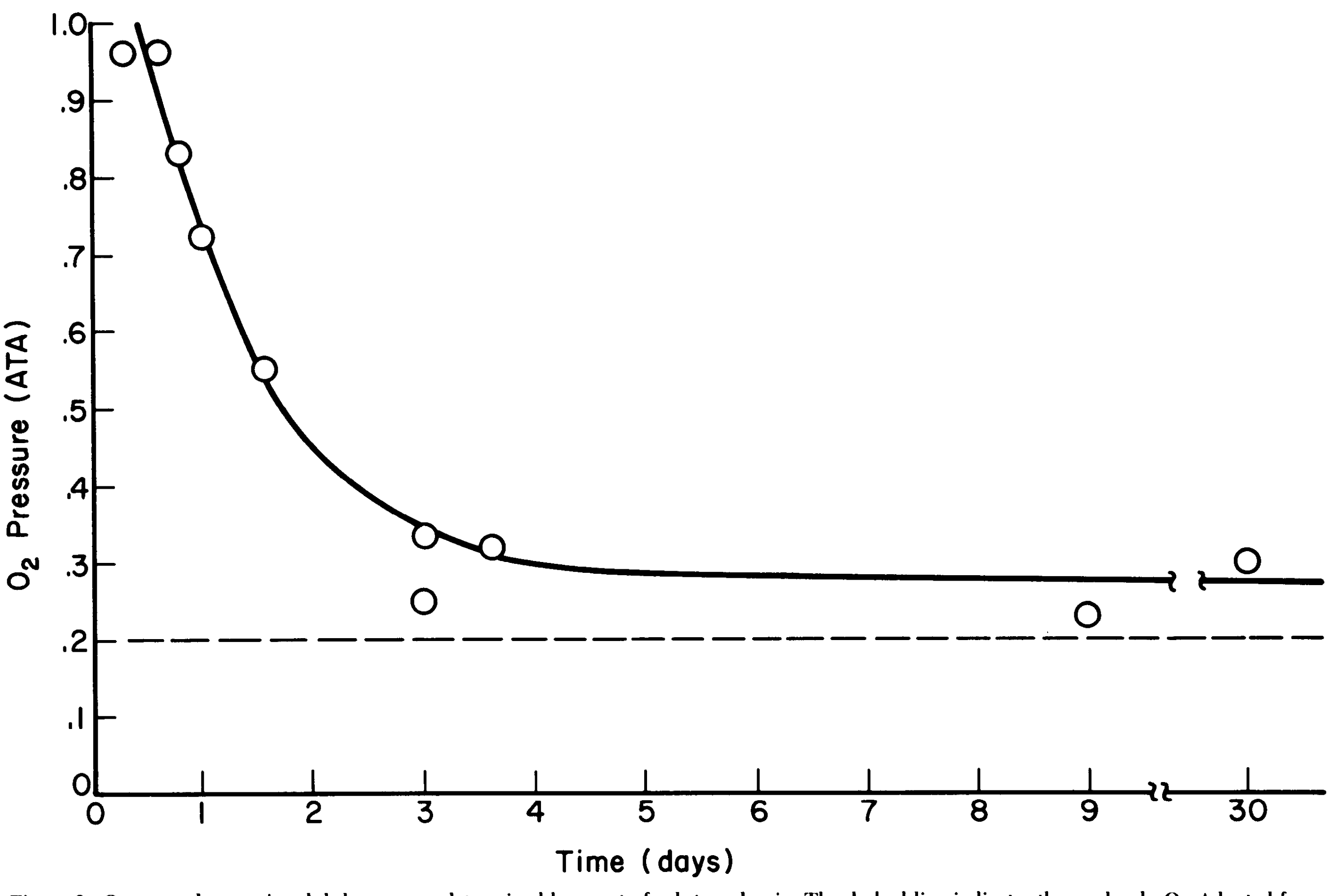

Figure 2. Oxygen tolerance in adult humans as determined by onset of substernal pain. The dashed line indicates the sea level pO_2. Adapted from Lambertsen[14] and Welch, et al..[25]

Toxic effects of oxygen have also been demonstrated in plants, insects, frog eggs, analids, bacteria, protozoa, and chick embryos.[8]

III. Carbon Dioxide

The level of carbon dioxide in our present atmosphere is about 0.04% (4×10^{-4} ATA). It has been reported that breathing up to 1.5% CO_2 (0.015 ATA) produces no adverse effects.[23] Above this level people become progressively more uncomfortable in breathing until about 0.1 ATA when mental effects similar to anoxia begin to show. In addition it has been observed that when the MVV is decreased there is a tendency to breathe shallowly (hypoventilate) and retain CO_2. This is termed 'hypercapnia' and is a great problem for divers as it can result in loss of consciousness.

IV. Conclusions

The most restrictive oxygen pressure is set by the incidence of blindness in some newborn animals. While the maximum partial pressure of oxygen that does not cause retrolental fibroplasia is not known, it is apparent that less than a doubling of the present atmospheric pressure would be allowed. It would be possible to increase the atmospheric pressure by holding the pO_2 at the maximum allowable and filling out the pressure with nitrogen or some other filler gas. In doing this, the narcotic effects of the filler gas, the MVV, and a mechanism to alter the composition of the atmosphere during the flood must be considered.

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Another Look at the Archaeopteryx

(Continued from page 87)

Up to the present time, a keel has not been found. The feathers were the same as those of modern birds.[1] The claws also are found on a modern bird: the Hoatzin of South America, at least on the young birds.[2] The toes were well adapted for perching on branches. The knee joint bent forward, as does that of the pigeon.

The vertebrae come up behind the head, and not somewhat under the head (as do a pigeon's). This characteristic is found also in the Pelican, Mute Swan, Heron, Flamingo, Egyptian Vulture, Gannet, Guillemot, Red-Throated Diver, and many other birds.

Many of the birds just mentioned, like those mentioned earlier in connection with the nasal passages, are sea or water birds. It is interesting to notice that the fossils found were in sediment, believed to have been laid down by a shallow sea which is said to have covered the region at one time. What connection there may be between this fact and the sea or water birds mentioned before I do not know.

In summary—it is clear that the *Archaeopteryx* needs more than a second look, before it is called the missing link between reptiles and birds.

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