11. Air

Land animals can survive months without light, weeks without food, days without water but only minutes without air.

The atmosphere of the earth is life's most immediately precious asset. Aeration more or less defines the biosphere, from the depths of the soil to the outer reaches of the mesosphere. That covers a total depth of about 50 miles, which by comparison with the radius of the earth - about 4000 miles - looks very flimsy indeed.

The principal constituent of the atmosphere is nitrogen, which does not appear to have any direct part to play in our metabolism. It does however dilute the oxygen to about one fifth by volume, which prevents it from having toxic effects on some tissues.

This fraction is fairly recent. Up to 600 million years ago only about 3% of the atmosphere was oxygen, and varied very little. Any life at that time would have been centred on germs that thrive without oxygen, called anaerobic. But at that point plants began to succeed which could take carbon dioxide from the air and turn it into cellulose, the flesh of which plants are constructed. The exhaust from this process was oxygen, which made life difficult for the anaerobic germs. As a result of the steady increase in vegetation and decline in anaerobes, the level of oxygen in the atmosphere rose to about 35% by 300 million years ago.

By about this time air-breathing animals made things more complicated. They ate the vegetation, and in their version of metabolism turned oxygen back to carbon dioxide. By 250 million years ago this had reduced the oxygen to 15% of the atmosphere. At about that point some catastrophe reduced the population of animals and the oxygen climbed back slowly to 30% of the atmosphere by 100 million years ago. Since then it has fallen gradually and looks set to stabilise at about 22%. This figure has been achieved only very recently and is likely to fall further.

Meanwhile, however, in very recent times - the last two hundred years - human industrial development has added significantly to the carbon dioxide fraction, and renewed the decline in the oxygen fraction of the air. Combined with depletion of the ozone layer these changes have made the atmosphere behave more like a greenhouse, turning more ultraviolet and visible light into more infra-red heat. This has always warmed the lower atmosphere and soil but the more intense radiation is thought to explain why the global temperature appears to be rising. But we digress.

The Air We Breathe

Near the surface of the earth our atmosphere is affected very much by the terrain it lies above. Warmth from the soil or water causes turbulence and friction, creating cloud and static electrical charge. The rotation of the earth sets up trade winds that circle the globe, and the polar regions act as giant refrigerators, generating cold air at high pressure that meets warm air from equatorial regions at the polar fronts. Jet streams patrol these fronts at high level.

This is why we have weather - wind, cloud, fog, rain and the rest. We may moan, but without air blowing about we would not know what fresh air was. It contains not only plenty of oxygen, but is also charged electrically. The net charge of fresh air is negative, and makes it "wet" your lungs better. You breathe is this negative electricity along with the oxygen. Both are precious. Stripped of its charge (by repeated breathing, stagnation or chemical pollution) the air becomes stale and unrefreshing.

Your need for oxygen is urgent and demands intimate contact for swift access. The skin of your lung only just separates the blood from the air alongside it, with two flimsy layers of cells in between - one from blood vessel, one from lung. This contact takes place in small sack-shaped vessels called alveoli, which sprout at the very ends of all the bronchial tubes. If the surface of all your alveoli were joined together and spread out flat, it would cover a tennis court. Yet in lungs they are packed into about 5 litres of space in your chest.

This very efficient packaging maximises the rate at which you can refresh your tissues with oxygen and wash away the waste carbon dioxide, and that in turn sets a limit on the rate of chemical work you are capable of - known as metabolism. So the stakes are high.

But there is a price. The delicate membrane between air and blood is too specialised to include any sophisticated defences. The air represents the outside world, and your blood is your deep inner self. There is no customs house between, policing intrusion by other selves. If germs, dirt or chemical vapours can get to this membrane, they can easily get right into you.

Your defences against this start in your nose, which can detect a good deal of mischief as it enters, by smell or by irritation. Meanwhile the air is warmed and moistened to make it comfortable inside you.

There are mechanical means to expel trouble, such as sneezing and coughing. There are immune mechanisms, in which the lining skin of the

nose swells to create mucus containing white blood cells - the shock troops of the immune system. So a blocked nose that you have to blow repeatedly is not just a nuisance - it's your immune system working.

Anything which gets past your voice-box (protected by coughing) then faces mucus formation in the larger bronchial tubes. The cells lining these spaces each have small feet called cilia which sweep the mucus uphill, towards your voice-box, to be coughed out. And if that still does not clear up the threat, your medium-sized bronchial tubes are lined with muscle and can cringe, to keep toxic air from reaching your blood.

Any threat which beats all these defences and gets into your blood unmodified continues to behave like itself, not a part of you. So you react against it as best you can. Your attempts to reject it fail now, and can become a nuisance to you - the symptoms of constitutional intolerance. (I don't say allergy, notice - that's different, and occurs much more seldom. More on this in a later Chapter.)

The kind of reactions you try, to get rid of the intruder inside you, will include some that are more appropriate when it's still outside. If, for example, the irritant reaches the muscles surrounding your small bronchi via your blood, they react just the same as if it had been in the air, still "outside" you: they tighten.

Muscle spasm around your bronchi is a serious problem for you, since it makes breathing much more difficult. This problem is worse that the disease you were trying to rid yourself of, caused by the irritant intruder in your blood. If you make a habit of it, we call this asthma.

Most of us manage to tolerate intruders in our blood less irritably, and do not go into an asthmatic attack. Instead our blood defences keep the problem under sufficient control for normal breathing and normal Wellbeing.

Troublesome coughing, shortness of breath or wheezing, indicates a running battle with challenges to the integrity of your body and your person. They demand attention, preferably before they cause permanent destruction of lung tissue or chronic thickening of your bronchial passages.

The starting point is to breathe efficiently. Most people try to rely on their ribs for this, and lifting them like bucket handles does enlarge your chest cavity. But you can achieve much more by moving your diaphragm up and down. This is the sheet of muscle that separates you lungs and heart from the intestines (of which more later). This muscle is sucked up into your chest when relaxed, forming a dome. Working the muscle

flattens the dome and draws much more air into your lungs than you can manage by moving your ribs. It takes a little effort to learn how to do this but most people can stick their tummy out, like a pregnancy bump, and this results from flattening your diaphragm. If you really can't do it, enroll in a Hatha Yoga class for a term; good breathing is basic to yoga.

Efficient breathing includes using your nose. If it tends to block you may need to compromise when working hard, but persevere. You have no way of cleaning air that passes through your mouth.

Make a point every morning of taking a few deep breaths, preferably of fresh outdoor air. This is to aerate the alveoli that are furthest from your mouth. They tend to collapse when not in use, with their sides stuck to each other like an empty hot water bottle. Only a deep breath will snap them open and get air back in. Fail to do this, and a proportion of these alveoli will seal up and never again be available to you.

I examine the chests of a good many healthy people, and can often hear crackles as they take their first deep breath of the day for my benefit, and air replaces fluid in waterlogged alveoli close to the surface. This may be late morning or even early afternoon. Enough said.

Not many people realise the importance of electrical charge in the air. It gives mountains and coasts their healthful reputations, since the flow of air across the rugged landscape, and the fall of water in streams and waves, generate electricity that is not easy to come by in towns and cities. This charge cleans the air, by coagulating fine particles suspended in it, into crumbs of dust that fall harmlessly to a surface. They may even add fertility to the soil they fall on. When you breathe charged air your body hoovers up the charge, which contributes somehow to your Vitality. The only other way to get as much electricity is by dissolving vitamin C in purified water before you drink it (See later).

In urban or electronic environments the air tends to acquire a positive charge from computer monitors and air conditioning. This weakens concentration sufficiently that ambulance and air traffic control centres now attach negative ionisers to their air conditioning, to reverse this problem. The longer shifts and smaller staffing ratios this makes possible, justify the expense.

Among every-day situations, travel by car is the most troublesome from this point of view. The rubber tyres both insulate the body of the car from the earth, and generate static electricity as they roll. By now an ioniser should automatically be fitted to the air conditioning outlet to neutralise any positive charge that results, but many drivers still have to rely on a

portable ioniser run from batteries or the cigar socket.

Probably the best advice, however, is to use your lungs regularly during sustained vigorous exercise. Anything vigorous enough to make conversation difficult for at least 20 minutes, will do. This may be brisk walking, cycling some distance, jogging, dancing, horse-riding or swimming. Jogging and running may wear the joints of your legs faster than otherwise, so avoid these unless they really turn you on. Competitive sport is really only necessary to burn off warlike tendencies: for the peaceable, the risk of injury (acute or chronic) outweighs any benefit.

If you doubt that riding a horse exercises the rider, either try it, or take my word for it.

For me, a round of golf would spoil a slow saunter in the country. If you enjoy golf that's fine, but it's quite possible to complete a round without taking one really deep breath.