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Quintessenz

Who, if not us?

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In this issue's editorial, we are not discussing aligner orthodontics, nor orthodontics in general. Our topic is one that will concern us most now and in the next decades: climate change, or rather the climate catastrophe. But why us, and why should we concern ourselves with it?

Since the Club of Rome was founded in 1968, the issue of climate change has been brought to the attention of a broad public. It has fully entered the minds of comparatively few people, however, and mostly those who no longer need convincing that the principle of sustainability should govern the lives of all individuals. We therefore need people who think in a fact-based way. As academics who have learned scientific thinking and factuality, we, among many others, are predisposed to convey truths. This is one of the reasons why Scientists for Future (S4F) was founded.

Let's take a look at some facts, taken from the book "Countdown" by Professor Mojib Latif[1], President of the Academy of Sciences in Hamburg, Germany.

The extent and particularly the speed of global warming over the last decades have been extraordinary compared to previous millennia. Humans have been the cause of the rapid rise in temperature since the beginning of industrialisation, due to anthropogenic greenhouse gas emissions. The mean annual CO_2 content of the atmosphere in 2021 was 416 ppm, which is a 50% increase compared to pre-industrial times (260 to 270 ppm). The CO_2 content had remained at a similar level for the previous 10,000 years. The CO_2 concentration in the atmosphere has now reached its highest level in at least a million years; this was announced recently by the US National Oceanic and Atmospheric Administration (NOAA) in relation to data for 2021. Critical levels of CO_2 will certainly be reached when the buffer capacity of the oceans for further CO_2 uptake is exhausted and the rate of CO_2 assimilation falls globally as a result of destruction of vegetation. The nine years between 2013 and 2021 were, with one exception, the warmest since temperature records began in 1880. The current rate of warming of about 1°C per century is accelerated by a factor of 25 with an increasing trend.

Compared to CO_2, methane and sulphur aerosols have a short residence time in the atmosphere. CO_2 persists for a very long time and sinks extremely slowly when there are no more anthropogenic emissions. A decline in the concentration of CO_2 takes centuries.

Water vapour plays a fundamental role as a feedback gas for global warming. The existing water vapour reacts to the change in air temperature. A warmer atmosphere can absorb more water vapour, and exponentially so. As an extremely potent greenhouse gas, water vapour amplifies global warming through anthropogenic greenhouse gas emissions by at least a factor of two. A doubling of the CO_2 content of the atmosphere leads to global warming of nearly 3°C. CO_2 alone would contribute 1°C to the temperature rise. Water vapour feedback causes an additional 1.6°C of warming.

More water vapour in the air means a higher energy content of the atmosphere. Thus, heavy precipitation will occur more frequently and intensively on a global scale. Sea

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levels will rise as a result of ice melting from glaciers on land and, above all, due to thermal expansion caused by the increase in water temperature.

The clearing of forests to grow feed to fuel the consumption of meat by humans, dogs and cats should be stopped as soon as possible. Neither the energy transition nor sustainable nutrition would be undue hardships. Healthy and less meat-based diets would also improve the health of the world's population, and scientific studies show that our food production currently far exceeds the ecological limits of the earth[2].

The effects of global warming and climate change on health concern the increase in respiratory, cardiovascular, renal and cognitive-psychological diseases. In Europe, a rise in infectious diseases can be observed[3]. Climate change is causing an increase in malaria, dengue fever, diarrhoeal diseases associated with qualitative and quantitative water shortages, malnutrition and, as a result of the decrease in stratospheric ozone, skin tumours, eye diseases and weakening of the immune system. Marginal tropical areas are more affected than temperate regions. Without technical assistance (heating, cooling systems), humans can only survive in the long term within a relatively narrow temperature range. Both high and low ambient temperatures can lead to increased mortality in the population. Immediately after heat stress, a period of increased mortality occurs, before mortality returns to baseline levels after a few days. One of the largest heatwaves occurred across Europe in 2003 and resulted in tens of thousands of deaths[4]. From 2018 to 2020, excess mortality due to heat occurred in Germany for 3 consecutive years for the first time since the start of the study period[5-7]. In 2018, there were 62,000 heat-related deaths in China and 31,000 in India. Globally, at least 356,000 people die as a result of heat each year[6].

There is no alternative to stopping the burning of fossil fuels. This is the only way to avoid exceeding the remaining CO_2 budget. For this to be achieved, the switch to renewable energy needs to be made as quickly as possible. Renewable energies can be consumed directly or stored temporarily as power-to-X. Power-to-gas technology is important, for example the production of hydrogen and methane. Hydrogen is easy to store and transport. In a second step, CO_2 can be added to the hydrogen. This produces methane, i.e., synthetic natural gas, which, as we know, is also easy to store and transport. It can be used for reverse power generation. Power-to-fuel, i.e., liquid fuel, can be produced using renewable energy. Power-to-heat is used to convert electricity into heat. Electricity from renewable energy is becoming increasingly cheap and is already cheaper than coal or nuclear power; the latter is by far the most expensive option. In addition, the production of nuclear electricity is dependent on water, which led to high production losses in France this year due to extreme water shortages.

The radicalisation of parts of the population is a great danger to society, which the right-wing extremists use for their own purposes. According to Hannah Arendt[8], fascism is a temporary alliance between the elite and the mob. Science is counterproductive to extremists; thus, they reject it. They do not accept the influence of anthropogenic climate change. If these tendencies continue to spread, factuality will become increasingly difficult to implement in politics and society. Solving global environmental problems in general and the climate problem in particular then becomes almost impossible.

As Dr Fredi Otto stated, quoted in an article by Damian Carrington[9]: "We are in the era of climate damage and we have been for decades. This is what we see strongly in the science, but it is not reflected in the politics." The impacts of climate change are so much more expensive than anything we could do to mitigate them[8].

Carrington[8], writing for the Guardian, continues: "Our editorial independence means we are free to write and publish journalism which prioritises the crisis. We can highlight the climate policy successes and failings of those who lead us in these challenging times. We have no shareholders and no billionaire owner, just the determination and passion to deliver high-impact global reporting, free from commercial or political influence." We too have a responsibility in this.

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