what can wait, something textbooks can never communicate so effectively.

At least two other considerations apply to the choice of medical school. Schools differ in tradition, atmosphere, and attitude. Study the prospectus to try to get an idea of whether the personality of a school would fit with your own and discover the school’s admission policy concerning A level grades, resits, age, and previous experience. If in doubt it is wise to inquire specifically about your eligibility before risking wasting a choice. Write and ask to be shown around any school which seems attractive.

The second consideration applies after graduation and may therefore seem rather remote but it is important that two good house officer posts should be more or less assured for graduates immediately they have passed the final MB examination. These posts complete the requirements for full registration with the General Medical Council. All schools have a pool of posts large enough to provide for some if not all their graduates, usually with one post in the central teaching hospital or a nearby university hospital and one further afield to give a balance of emphasis and experience.

One last word: if you want to know about a school, or if you have particular questions concerning your own eligibility, find out for yourself. It is very hard to understand why young adults about to launch themselves on their own careers (or even sometimes prospective mature students) should have letters written by their parents. The first way to persuade a school that your decisions are your own is to speak for yourself.

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**Aviation Medicine**

Special forms of flight

III: Supersonic transport aircraft

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Two major advances were made in the history of aviation during the 1960s: the development of a supersonic transport aircraft and man’s conquest of space. These special forms of flight have posed medical problems, the solutions to some of which emphasise that aviation medicine is in the forefront of the practice of preventive medicine.

In 1963 at an early stage in the Concorde project the Anglo-French Concorde Aeromedical Group was formed to consider the aeromedical problems presented by such an advanced aircraft. The most important of these were created by Concorde’s high cruising altitude of 60,000 ft (18,288 m).

**Loss of cabin pressure**

Sudden decompression to altitudes exceeding 52,000 ft (15,850 m) results in unconsciousness within 15 seconds of exposure whether air or pure oxygen is breathed.1 Oxygen provides adequate protection for healthy subjects at an altitude of 40,000 ft (12,192 m); for passengers, such a supply is available from drop down emergency sets. Protection above this altitude is adequate only if the oxygen is supplied under pressure so that an alveolar oxygen tension greater than 60 mm Hg (78-96 kPa) is maintained.1 The flight crew of Concorde is, therefore, provided with a supply of oxygen delivered at a mask pressure not exceeding 30 mm Hg (3-99 kPa). The mask has been specially designed to meet the licensing authorities’ requirement that it can be put on within five seconds, which ensures that under the worst possible conditions of decompression the crew is sufficiently protected to start an emergency descent.

The main protection to Concorde’s occupants is, however, derived from its deliberately “overengineered” design. The engineering safeguards include a considerable reserve capacity to supply cabin air and the use of small (less than 15-2 cm) diameter windows. Thus if a window is lost at 65,000 ft (19,812 m) the maximum cabin altitude would reach only 36,000 ft (10,973 m) provided that an emergency descent was started within 30 seconds. Within 6-5 minutes cabin altitude would be restored to about 15,000 ft (4,572 m). The overall design is such that the cabin altitude will only exceed 25,000 ft (7,620 m) after an extremely remote failure (less than one in 107 flying hours).2 No decompression incidents have yet been reported during Concorde’s commercial service.

**Cosmic radiation**

We are all exposed to two types of extraterrestrial radiation. Galactic radiation originates from outside the solar system to produce a steady, reasonably predictable, low intensity flux of high energy particles.2 The earth’s magnetic field deflects the particles to give considerable protection in equatorial regions, but this effect declines to zero as the polar regions are approached. Further protection is also afforded by the solar interplanetary magnetic field and by the stratospheric absorption of low energy particles. The importance of the latter is that the background radiation dose increases with altitude so that at its cruising altitude Concorde is exposed to a galactic radiation dose of about twice that to which subsonic aircraft are exposed. Total
supersonic and subsonic exposure levels will, however, be very similar since for equivalent routes the former’s flight time is about half that of the latter.

The international committee on radiation protection recommends a maximum permissible dose of 5 milli-Sieverts (0.5 rem) a year for the general public. This would allow about 60 return trips a year by Concorde across the North Atlantic, 4 which is a dose likely to be exceeded only by aircrew. Even then 160 round trips would produce a total yearly dose of 13 milli-Sieverts (1.3 rem) which is still well below the maximum permissible dose of 50 milli-Sieverts (5 rem) a year recommended for radiation workers. 4

The second type of radiation is solar, the particles being released from the sun by solar flares. This radiation is of lower energy than galactic radiation, but its production may be intense. 5 Its most important feature is its unpredictability, and since adequate shielding would impose uneconomic weight penalties on Concorde the radiation dose is monitored by a detector mounted in the forward passenger cabin. A simple meter on the flight deck alerts the crew at levels of 0.1 milli-Sieverts per hour (10 mrem/h) and demands action—that is, descent—at 0.5 milli-Sieverts per hour (50 mrem/h). The latter level is half that originally recommended by the United Kingdom Medical Research Council and ensures that the risk of exposure to excessive radiation is minimised. The instrument also records accumulated dose: during 758 hours of flight on the Paris to Washington route in 1976, Air France recorded an entirely safe average dose of 0.015 milli-Sieverts per hour (1.4 mrem/h) and the alert level was never reached. 6

### Ozone

Ozone (O₃) is a strong oxidising agent produced by the action of ultraviolet light on oxygen (O₂). At ground level its concentration is about 0.03 parts per million by volume (ppmv), but this increases rapidly above 40 000 ft (12 192 m) to reach a maximum of about 10 ppmv at 100 000 ft (30 480 m). At Concorde’s normal cruising altitude the ozone concentration is about 4 ppmv, but this depends on latitude and season. 4

The toxic effects of ozone in humans are predominately respiratory. Acute exposure for two hours to low concentrations of between 0.6 and 0.8 ppm considerably reduces the diffusing capacity for carbon monoxide, probably by causing alveolar oedema, and slightly reduces vital capacity and forced expiratory volume (FEV). 7 In a long-term study of two groups exposed for three hours a day to either 0.2 ppm or 0.5 ppm no reduction in forced vital capacity (FVC) or FEV was observed during 12 weeks at the lower dose. Over the same period, however, the higher dose group showed a statistically significant fall in FEV but no change in FVC, indicating a degree of bronchiolar obstruction. 8 The FEV had returned to normal when re-measured six weeks after exposure ceased. Ozone also impairs night vision in man 9 and in human cell cultures can induce chromatid breakages that are apparently identical to those produced by x-rays. 10 This radiomimetic action of ozone has also been suggested by studies in rabbits and mice. 11

Fortunately, ozone is thermally unstable and its decomposition to oxygen is complete at 400°C, the temperature reached by Concorde’s air conditioning compressor circuit during climb and cruise phases. During these phases of flight the cabin concentration of ozone may be expected to remain below 0.1 ppmv—the concentration set as a maximum for industrial workers exposed to ozone for a five day, 40 hour week. On descent compressor temperature falls to about 300°C giving an ozone dissociation rate of about 90%, and the maximum exposure is then likely to be 0.25 ppmv for three minutes. Actual measurements in Concorde have indicated that at 50 000 ft (15 240 m) ozone could not be detected in the cabin despite an external ozone concentration of 1.5 ppm. On descent maximum values were 0.16 ppm, but a concentration of 0.1 ppm was exceeded for only four minutes. 12 Such figures compare favourably with values in subsonic aircraft 4 5 and give no cause for concern.

### Kinetic heating

At mach 2 some external aircraft structures may reach temperatures of 150°C. 6 To prevent unacceptable increases in the cabin temperature the cabin is double walled, and air is passed between the walls at high flow rates. Because the dynamic air is very hot at mach 2, however, it is first cooled by conventional heat exchangers and cold compressors and also by heat exchange with the aircraft’s fuel. The temperature of the air entering the cabin is then closely controlled to ensure a steady cabin temperature of 24°C (range 22–27°C).

### Noise

The noise levels inside Concorde are similar to those in subsonic aircraft because of Concorde’s extensive soundproofing. The major source of noise is external, although at subsonic speeds Concorde’s noise levels compare favourably with those of conventional jet aircraft such as the DC8: both produce noise levels of about 115 db on take off and approach. 4 The advent of quieter, new generation, subsonic jets—for example, the Airbus, which has an approach noise level of 102 db—means that Concorde will be one of the noisiest aircraft flying at the end of this decade.

Sonic boom and “super boom”13 have caused a great deal of annoyance, but their medical effects have been poorly defined. At present, Concorde does not fly supersonic over land, but a supersonic corridor was provided over the Middle East when British Airways operated a supersonic service to Bahrain.

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Next week’s article covers the medical aspects of space missions.

### References