FAUNA *of* AUSTRALIA

44. HOMINIDAE

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DEFINITION AND GENERAL DESCRIPTION

Within the order Primates, the family Hominidae is placed in the suborder Haplorhini to differentiate it from the lemurs and lorises (suborder Strepsirhini); within the Haplorhini, it is assigned to the infraorder Simiiformes to distinguish it from the tarsiers (Tarsiiformes). It is assigned to the section Catarrhini, distinct from the New World (South and Central American) monkeys (Platyrrhini), and within this section to the superfamily Hominoidea, separated from the Old World (Afro-Asian) monkeys (Cercopithecoidea). The only other extant family within the Hominoidea is the Hylobatidae, containing the Lesser Apes or Gibbons. The Hominidae contains the Great Apes (Orang Utan, Gorilla and Chimpanzee) and the sole Australian species, Homo sapiens, variously called Human, Man, People; collectively, Humanity, Mankind, Humankind.

The Hominidae may be described as follows. It is a family of Hominoidea that has short, robust canines, anterior lower premolars with metaconids, cheekteeth with broadened trigonid basins, a deep mandibular symphysis which is deeper than 75% of tooth-row length, and small incisive foramina. There are 17 or fewer thoraco-lumbar vertebrae. The wrist does not directly articulate with the ulna, but instead is separated from it by a meniscus. The big toe is controlled only by the long fibular, not by the long tibial, flexor muscle. In the mouth, the palatine ridges are irregular and the tongue has at least seven vallate papillae. At least in adults, valvulae conniventes are present in the small intestine, and the colon is short – less than 40% the length of the small intestine. The ovaries are large, more than 20 mm long. There is an axillary organ. Body hair is sparse, with less than 2 follicles per mm^2 on the back, less than 1 on the chest, and less than 4.5 on the scalp (Groves 1986).

In addition, the members of the Hominidae share a large number of karyotypic features and several unique amino acid sequences in globins, albumin, transferrins and other proteins. They also share important behavioural features such as the ability to manipulate objects to serve as tools, and to a degree, abstract reasoning and self-awareness.

HISTORY OF DISCOVERY

The earliest formal description, hence ‘discovery’, of the Human species was by Linnaeus (1758), whose diagnosis was simply Nosce te ipsum, ‘know thyself’.

MORPHOLOGY AND PHYSIOLOGY

External Characteristics

Human morphology varies enormously, both individually and geographically. Worldwide, the mean stature of adult males varies from 1430 mm (the Efe pygmies of the Ituri region in north-eastern Zaire, Africa) to 1850 mm (the Nuer tribe of the upper Nile, Sudan, Africa). Adult females are approximately 10% shorter than males, but within any population, there is considerable individual variation. The shortest Nuer, for example, will be no taller than the tallest Efe. The standard deviations are at most about 65 mm, giving a coefficient of variation of 3.5, which is about normal for a natural population. Within Australia, the mean stature of endemic (Aboriginal) adult males ranges from 1550 mm in the Atherton Tablelands tribes to 1710 mm in the Tiwi of Melville and Bathurst Islands, Northern Territory. In non-Aboriginal peoples, the mean height varies from 1740 mm for Northern Europeans to 1600 mm for South-east Asians and southern Chinese. Limb lengths also vary, especially those of the

legs. Relative sitting height, or trunk length as a percentage of stature, varies from 46% for the very long-legged Tiwi to 54% for the very short-legged Chinese. Weight varies from around 54–58 kg in male Aborigines and 45–46 kg in females, to 70 kg among North European males. Other physical features vary markedly, noticeably skin colour and hair form (see below), noseform (Aborigines are very broad-nosed, Europeans narrow, Asians intermediate) and eye shape (Chinese commonly have a fat-padded fold, the epicanthic fold, on the inner corner of the upper eyelid).

Apart from size differences, there is further obvious sexual dimorphism. Genitalia in males are conspicuous and the mammary glands in adult females are permanently enlarged. Males have longer, more heavily pigmented body and facial hair and the shoulders are generally broader than the hips, whereas in females the reverse is true. Muscular development of males is usually greater than in females who tend to lay down more subcutaneous fat. These differences are minimal until after puberty when they become much more accentuated.

With body wall hair so comparatively sparse over the body, skin colour differences are very obvious. Melanosomes, inside which the melanin is synthesised, migrate from the melanocytes to the stratum corneum; they are from 0.8–1.0μ long in dark skins, only 0.5μ in lighter skins. The number of melanocytes does not differ according to skin colour, they merely produce different amounts of melanin. In light skins, moreover, the melanosomes are clumped and in darker skins, more dispersed (Szabo et al. 1969). Since skin colour itself is susceptible to environmental influence (‘tanning’), measurement of the amount of light reflected is customarily taken on the inner arm, where tanning is least. Reflectance differences are greatest at wavelengths of 650–685 nm. At this wavelength, Arnhem Land Aborigines reflect on average only 19% of light whereas the Aranda, of the central desert, reflect 31%, Chinese individuals, 46% and white Australians 54% (Abbie 1975; Walsh 1963).

The body surface has no apocrine glands; all the sweat glands are eccrine. In the arm pits, a concentration of apocrine glands forms the axillary organ which produces a characteristically odoriferous secretion. In addition there are numerous, large sebaceous glands. The underside of the epidermis is strongly ridged, so it is not as loose as in many other mammals, and on the palms of the hands and on the soles of the feet, especially the tips of the digits, are characteristic systems of ridges (dermatoglyphics), that differ in their patterns from one individual to another.

Skin temperature can normally rise to 35–36°C. Because dark skins radiate less heat than light, at an air temperature of 30° or more, the skin of an Aborigine will be 1–3 degrees hotter than that of a European.

There are about 7 hair follicles per mm^2 on the face, only 0.5 to 0.7 on the rest of the body. On the scalp, Europeans have more than 3 follicles per mm2 and Aborigines probably the same; but the Chinese average only 1.3. Most of the apparent hairiness of Europeans is due to the greater length and pigmentation of body hair, but in some body regions, especially the chest, the hairlessness of the Chinese is real.

The hair on the head varies from straight, or nearly so, in many East Asians (ratio of free to stretched length of hair is 1); to wavy or curly in Europeans and Aborigines (ratio about 1.25); to ‘frizzy’ in Melanesian Torres Strait Islanders (ratio 2–2.5); to ‘woolly’ in Africans (ratio 3) (Hrdy 1973). The hairs are thick (90–105μ) and round in cross-section in Chinese people, thinner (70–85μ) and oval in cross-section in Europeans and Aborigines and flatter in cross-section in Africans. Head hairs are retained for some 2–4 years before being shed. They grow to varying lengths in different individuals, about 1 metre being reached in many Chinese if left uncut.

Musculature is specialised for an upright posture (there is great development of the back muscles such as quadratus lumborum and of the hip stabilisers such as the glutaeus group) and for bipedal locomotion (for example, the quadriceps femoris groups, mainly knee stabilisers, are well developed and the calf muscles, gastrocnemius and soleus, enormously so). A special plantar aponeurosis pulls the foot taut into its double-arched shape. A primitive calf muscle, plantaris, which is present only rarely in apes, is developed in humans, where it occurs in 90% of individuals.

Skeletal System

The skull (Figure 44.1) is strikingly orthognathous – the jaws hardly protrude in front of the plane of the orbits. The braincase is extraordinarily developed and sweeps up at an angle of 45° or more behind the orbits, with very little postorbital constriction. The teeth are small. The lower margin of the mandible is larger than the alveolar margin and so projects in front to form a chin. The cranium of the Australian Aborigine is more prognathous than others, reflecting the larger teeth. In this skull, the facial skeleton is low with often noticeable supraorbital ridges and a sloping forehead. The European skull is much more orthognathous, reflecting the very small teeth, the nasal skeleton is prominent and narrow and the supraorbital ridges tend to be smaller and the forehead less sloping. The East Asian (Chinese) is still more orthognathous, but the front teeth themselves often protrude. The facial skeleton is high, but flat and there are almost no supraorbital ridges, and the forehead is more nearly vertical.

The facial bones are lightened by the extensive development of sinuses: frontal, ethmoidal, sphenoidal and maxillary. Mastoid air spaces are also present.

A difference between human populations that received much attention in the older literature is relative skull breadth (the Cranial, or Cephalic, Index which is the breadth of the braincase expressed as a percentage of its length). In Australian populations this varies from 69 in some Aborigines to 92 in some Chinese.

The most noticeable feature of the human postcranial skeleton is the vertebral column, which, instead of being built like a suspension bridge as in quadrupeds, is double-curved to move the centre of gravity forwards in the upright posture. At birth, two primary curves, concave forwards in the cervico-thoracic and sacro-coccygeal regions, can be seen; from 2–3 months, two secondary curves, concave backwards, begin to develop in the cervical and lumbar regions. There are always seven cervical vertebrae, as in nearly all other mammals; 11 to 12 thoracics (mean 12), four to six lumbars (mean five), four to seven sacrals (mean five), and two to five coccygeals (mean four). The coccygeals, characteristic of the superfamily Hominoidea, are small remnant caudals, generally fused together to form a coccyx. The lumbar region accounts for 38% of the trunk length in humans – in no ape does it account for more than 30%. The sacrum, on the other hand, forms 20% of the spine – not more than 17% in apes.

Locomotion

To assist in bipedal stance and locomotion, the hallux (big toe) is aligned with the other toes and the metatarsal ligament extends to include it. The foot is arched both transversely and longitudinally. It touches the ground only with the heel, the head of the first metatarsal and the head of the fifth metatarsal, although the fleshy parts of the sole are, of course, in contact with wider areas around these three points. Inversion and eversion movements are well developed with very large inverter and plantar flexor muscles (such as tibialis posterior). The heel has a large backward extension, or talon, acting both as the point of the foot tripod and as the power arm of the calf muscles.

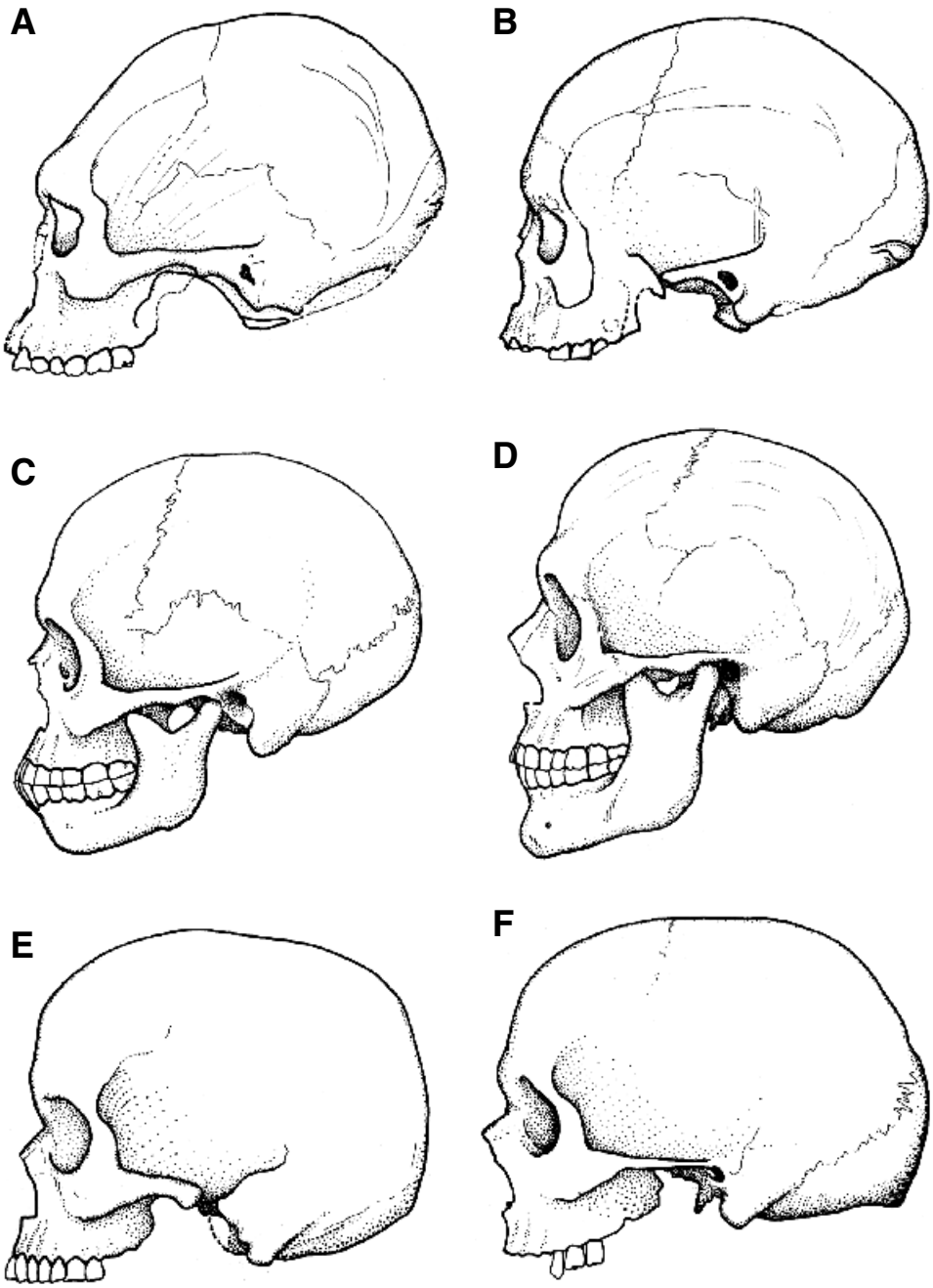

Figure 44.1 Lateral views of the crania of: **A**, prehistoric Australian Aborigine (robust type); **B**, prehistoric Australian Aborigine (gracile type); **C**, modern Australian Aborigine; **D**, European (gracile type); **E**, Chinese; **F**, European (robust type). (© ABRS) [M. Thompson]

In a biped that is not saltatorial, any locomotion involves a phase when the body is supported on one leg only. Each leg alternates between Stance Phase and Swing Phase. The hip stabilisers (glutaeus medius and glutaeus minimus in particular) are very powerful and the iliac crests (hip bones) of the pelvis flare out to the side to give these muscles a greater advantage.

Feeding and Digestive System

The dental formula is I 2/2 C 1/1 PM 2/2 M 3/3. Variations include: absence of third molars ('wisdom teeth') in 1% of Aborigines, about 20% of Europeans and 40% of Chinese (either epigenetic, not even a germ being developed, or

environmental, through having no room to erupt); occasional development of fourth molars in Aborigines; absence of lateral incisors; and very occasional absence or duplication of other teeth.

Shovel-shaped incisors (in which the edges are curled round, making the lingual surface concave (Figure 44.2)) are common in Pacific peoples. They occur in over 90% of south-east Asians, lower proportions of Aborigines and other Pacific peoples and only 30% of Europeans.

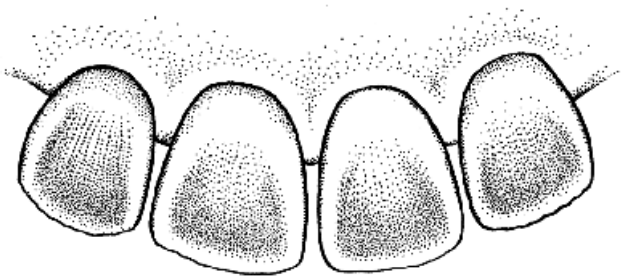

Figure 44.2 The 'shovel incisor' pattern seen most frequently in Chinese. The upper front teeth are shown as seen from the rear. (© ABRS)
[M. Thompson]

Humans have, unusually for primates, short canines that do not, or hardly, project above the level of the other teeth. Both upper and lower premolars are bicuspid. In most other primates, including all Catarrhini, they are unicuspid and act as honing mechanisms for the long upper canines.

The deciduous dentition usually begins to erupt at 6–9 months of age, beginning with the central incisors. The last deciduous teeth to erupt are the second deciduous molars at 2–2.5 years. At around 6 years the first permanent molars start to erupt, followed immediately by the central incisors. Replacement continues until about 11 years, after which the second permanent molars erupt. The third molars tend to erupt after 17 years or, as mentioned above, not at all.

The occlusal lines are not straight, but double-curved. The upwardly concave curve (when viewed from the side) from incisors to last molars is called the Curve of Spee. The upwardly convex curve, seen from the front, across the jaws, is called the Curve of Monson.

The tongue has a V-shaped arrangement of eight to 12 vallate papillae and the upper surface is dotted with fungiform papillae. Between two and eight irregular ridges, reaching back only to the premolar region are found on the palate. The parotid gland is very large and lobulated, lies below and in front of the ear, and opens level with the second molar. The main salivary glands, the sub-mandibular and sublinguals, are also very large. All four taste sensations (sweet, sour, salt, bitter) are very well developed.

The small intestine always has valvulae conniventes. In most populations, the enzyme lactase ceases to be secreted after the cessation of lactation. Lactose intolerance, resulting in the inability to digest milk properly, is usual in human populations, and is found in under 20% of North Europeans, around 50% of Aborigines and some South European populations, and over 90% of East Asians and Melanesians.

The caecum is small and little sacculated, and has, marked off from its end, a vermiform appendix—a uniquely hominoid lymphoid organ—that slightly exceeds it in length. The length of the alimentary canal varies slightly between different human populations, averaging some 10 times the straight mouth-to-anus distance. Humans have an unusually substantial, pyriform gall bladder.

Circulatory System

The heart weighs, on average, 285 g and continues increasing in size, especially in males, to quite an advanced age. The left auricle is higher than the right, opposite to that seen in apes.

The leucocyte count is higher than in apes: 10–12 000 per mm3 of blood. There are between four and five million erythrocytes per cubic millimetre in the adult circulation.

Blood pressure at maturity (say, 15–19 years) averages 118/80 in all known human populations. In urban-dwelling, European-derived populations it rises with age, reaching a mean of 168/90 at 70–80 years. In tribal Aborigines at a similar age it is only 122/90. In the San, of southern Africa, diastolic pressure actually falls with age. It is possible that in totally unacculturated Aborigines there might have been a similar fall.

At high altitudes, blood volume increases to as much as a third more than the volume at sea-level. Red cell volume increases by as much as 80%, total haemoglobin by 90% and thoracic volume by 20%.

Human populations are highly polymorphic for many blood systems: red cell antigens (blood groups), red cell enzymes, white cell antigens and serum proteins. About one dozen blood group systems are known, of which the ABO system is most familiar. The frequency of the gene for blood group B is low in Europe, but higher in East Asia and almost unknown among Aborigines except on Bentinck Island and the opposite mainland where the frequency is very high. A particular transferrin, TfD1, occurs only in Australia, New Guinea and Africa. A Group Specific component allele, Gc Aborigine, has a similar distribution. These two systems suggest, if only vaguely, a distant genetic connection between Australia/New Guinea and Africa. Abnormal haemoglobins, advantageous in a malarial environment, do not occur among Australian Aborigines, but are found in South-east Asians (Haemoglobin E), Mediterranean peoples (Thalassaemia) and Africans (Haemoglobin S, or Sickle-cell) (Kirk 1981).

Respiration

The trachea, 150 mm long, is held rigid by 20 U-shaped cartilages. In the larynx, besides the usual array of cartilages, there are very large vocal cords. The saccule, which may be very large in other primates, is, however, reduced in humans to a small midline air space. Some 50mm inside the chest, the trachea divides into two 50 mm-long bronchi, which subdivide in the lungs into progressively smaller and smaller bronchioles. The left lung has two lobes, the right lung three. The mean volume expelled in a breath (tidal volume) is about 500 ml.

Excretion

The kidneys measure some 100–120 x 50–60 x 30–40 mm with the right kidney lower down than the left. The bladder has a capacity of 500 ml. In females, the urethra is 40 mm long, but in males it is longer, since it traverses the penis.

Sense Organs and Nervous System

The brain weighs, on average, 1200–1300 g, about 2.5% of body weight – at birth, it weighs 325–350 g. The cerebral cortex varies in thickness in different parts, from 1.25–3 mm, the total cortical area is 1145 cm2, and contains an estimated 6900 million cortical neurons (Sholl 1956). The cerebrum and cerebellum are very much enlarged compared to these regions in other primates (and most other mammals), but the pyriform lobe and optic bulbs are reduced.

The eyeball is 24 mm in diameter, containing a lens 10 mm across and a retina containing seven million cones (capable of colour vision) as well as 125 million rods. In the centre of the retina lies the macula lutea, or yellow spot, the centre of visual acuity. In all mammals, the optic fibres, like all nerves, cross to the opposite side of the brain (at the optic chiasma). In primates a certain proportion remains uncrossed and in humans this is 40–50% of all fibres, namely those from the lateral part of the retina, including half of those from the macula.

If the anterior layers of the iris are unpigmented, the iris colour appears blue rather than the usual brown. Green and hazel tones are mosaics of light and dark.

The ear hears tones between 20 and 25 000 Hz and the greatest sensitivity is in the 1–5 KHz range.

Endocrine and Exocrine Systems

The pituitary weighs 0.5 grams. At 20–30 years, the thyroid is unusually well developed. The thymus weighs 13 g at birth, trebles in size up to puberty, then in many cases almost completely involutes.

The predominance of eccrine glands has already been mentioned. Humans can sweat, for short periods, up to 2 litres / hour and the body can support a loss of 1 litre / hour for 5–6 hours before salt depletion and dehydration set in. No other mammal sweats so much for a given heat stress (Newman 1970).

Reproduction

Both male and female genitalia are unusual among primates. The penis is, relatively, the longest found in the primates: its flaccid length is 90–100 mm in European men, and on average, shorter in East Asians and longer in Africans, but in all it averages 130–160 mm when erect. The scrotum is pendulous; testes weigh together some 30 g and the mean ejaculate volume is 4 ml (range, 1–11 ml) which contains 60 million sperm per ml. Average plasma testosterone in males is 598 ng/100 ml.

The female system is peculiar in the persistence throughout life of labia majora, which characterise only infants among the great apes. Ovaries each measure 45 x 15 x 15 mm. At birth, one million follicles are present. These gradually involute, so that by adulthood only 400 000 remain and, of these, only 1000 or fewer reach maturity. The early cycles after sexual maturity are anovulatory and even then not all cycles are accompanied by ovulation. In a German study, 60% of cycles in the 12–14 year old group were found to be anovulatory (the so-called adolescent sterility period), 45% in the 15–17 year old group, 25% in the 18–20 year old group, 5% in the late 20s (May 1978). Fecundability per cycle is about 20–30% for women in their mid-20s. Lactational amenorrhoea (Knodel 1977) lasts up to 2 years or longer for continuously nursing mothers. In the absence of breast-feeding, postpartum amenorrhoea lasts only 2 months.

Embryology and Development

The placenta is haemochorial, deciduate and unidiscoidal. The blastocyst attaches between 4.5 and 7 days after fertilisation and implantation may begin after day five. Gestation lasts 280 days on average. Birth weights vary greatly, both intra and interpopulationally. Among Aborigines, boys at birth weigh 2.8–3.3 kg and girls 2.7–3.0; Asian babies weigh slightly more and European male babies as much as 3.5 kg, although South Europeans may weigh rather less.

Growth is very rapid in the first year, after which is slows down and reachs a stable velocity until puberty, when there is a sudden, strong spurt that then declines to adulthood. The beginnings of genital maturation occur before the growth spurt; full sexual maturity, including menarche in girls, occurs after the

peak of the growth spurt. The timing is very variable: in northern Europe, menarche may be any time from 9–17 years old, but averages 12.1 years. Age at menarche has been getting less for at least a century, but now appears to have stopped at an irreducible minimum. In Aboriginal girls, menarche occurs on average at 14 years; to what extent this delay is genetic, and to what degree due to unfavourable environment, is unclear.

The brain initially grows very rapidly, achieving 97% of its adult size by 9 years of age. The reproductive organs grow very slowly; just before puberty they are still only 10–15% of adult size, then they grow rapidly. Lymphoid tissue doubles in size by 11 years of age, then regresses.

NATURAL HISTORY

Life History

In most populations the sex ratio at birth is about 105 males to 100 females, but about 95:100 in Africans. As male mortality is greater at almost all ages, the sex ratio declines, until at 45+ years of age there is a considerable preponderance of females. In a few societies, however, where childbirth mortality is exceptionally high, life expectancy is actually greater for males. Life expectancy at birth for males in England was 41.4 years in 1871; by 1950 it had increased to 66.5 years. Females recorded a similar increase. This, to only a limited extent, meant that old people were surviving longer, but was more an indication of a reduction in infant mortality. All contemporary communities with low life expectancy thus have high infant mortality and no particular deficiency of octogenarians.

The present (1989) overall population of Australia consists of the following age percentages: under 15, 24.4%; 15 to 65, 65.7%; over 65, 10.0%. These figures are not dissimilar to those for any industrialised country, such as the United Kingdom, where, however, the proportion of over 65s is 18% and that of working-age (15–65) is only 58%. These figures, in part at least, reflect the high percentage of immigrants (mostly young-adult) making up the Australian population.

The percentages for tribal Aboriginal populations, calculated from figures given by Rose (1960) and Tindale (1963), are: under 15, 43%; 15 to 65, 55%; over 65, 2%. These figures differ from those for totally unacculturated hunter-gatherer societies, such as the Kung San of southern Africa, in their higher proportion of children, and may reflect the ‘intermediate’ status of such mid-century Aboriginal societies, with birthrates higher than those known, or suspected, for pre-contact periods.

The population of Australia on 30th June 1984 was 15 543 600 (in 1996 it was 18 311 000; ed.). The net annual increase is 0.84%, of which just over a quarter is due to immigration, the rest to natural increase. Of the total population 14.1% was born overseas, half of this in the United Kingdom or Ireland. Populations across the world have undergone, or continue in a demographic transition. From high birth rate, high death rate patterns they have changed, or are changing, to patterns of low birth rate, low death rate, via an intermediate pattern where the birthrate remains high while death rates fall, and the population grows rapidly. Many European countries have completed the transition and their populations are now stationary. Australia has not yet reached this position. The crude birth rate in Australia is 15.8 per 1000, considerably higher than European rates; crude death rate is 7.2, with infant mortality 9.4. Both these mortality rates are comparable to European/North American levels.

The original Aboriginal population was estimated by Radcliffe-Brown (1930) to have been some 250 000 to 300 000, but Butlin (1983) has argued that this figure was probably applicable to New South Wales and Victoria alone, the total

figure for the whole continent being much higher. By 1850, after two smallpox epidemics, venereal disease and sundry genocidal acts by colonists, the south-eastern Aboriginal population had fallen to 10 000 to 15 000 (Butlin 1983). Today, it is once more on the increase. Although there are difficulties because of differing interpretations of the meaning of 'Aboriginal', it seems likely that the total Australian Aboriginal population is nearing 200 000.

In developing countries, as in Europe before the turn of the century, the chief causes of mortality were infectious diseases like tuberculosis. This was also the case in Australia, though perhaps not in the Aboriginal population (see below). In developed countries, such as Australia, the chief causes of death today are, in order: ischaemic heart disease, cancer, stroke and accidents.

Ecology

In presumptive traditional Aboriginal societies, weaning occurred at 3–4 years of age and there are records of it occurring as late as six. Prehistoric skeletal material demonstrates nutritional stress. Of the skulls of 3–5 year old children, 70% show cribra orbitalia, a defect of ossification in the thin orbital bone, that is indicative of anaemia. This falls to 1% in adult males and 19% in adult females, indicating the healing of the lesions in survivors (Webb 1981). Similarly, episodes of dental hypoplasia (failure of enamel formation on teeth, which does not heal over with age) can be traced in the main to the ages of 3.25–5 years (Green 1982). High parasite loads, recorded historically, seem to have characterised traditional Aboriginal populations, rather than epidemics, which could not be sustained in relatively sparse, nomadic populations such as existed everywhere but in the south-east.

Tooth wear was very rapid in Aboriginal populations, with marked reduction in tooth crown size even in a few quite young adults. A quarter of men, though only 4% of women, however, still had good gums at over 50 years of age. Abcesses occurred in one-fifth of adults (but three-quarters of the aged). Caries were absent in the young in pre-contact times, but shortly after initial contact as many as 40% of people in their twenties would have had caries due to alteration of diet (Campbell 1939).

Fractures were common in pre-contact communities, as shown by skeletal remains. Cases of deliberate amputation are known. Osteoarthritis is recorded, being especially common in the temporo-mandibular articulation. There was no tuberculosis or leprosy. It is disputed whether treponemal diseases, such as occur today (yaws in the wet tropics, treponarid in the arid zone) are indigenous (Kirk 1981).

Traditional foods included vegetable matter or (in coastal regions) shellfish, gathered by women, which formed over half to two-thirds of the diet, and game hunted by men. Meehan (1977) found that among the Anbarra of coastal Arnhem Land, 40% of the net diet is fish and store-bought food tended to have replaced gathered vegetable food. Traditional societies were not, on the whole, short of nourishment. Arnhem Land peoples were living in the 1940s at 74–116% of their calorific requirements, but obtained 172–544% of international requirements and were generally not short of vitamin C, calcium or iron (McArthur 1960). Both preferred vegetable foods and large game were encouraged by judicious periodic burning of the bush, referred to by Jones (1969) as fire-stick farming.

Behaviour

Wolff (1969) distinguished three types of cry made by the human newborn: (1) the basic, or hunger cry, a rhythmic 6 second cry followed by a whistle of inspired air then another such cry; (2) the angry cry, a more rasping version of

the first; and (3) the 'pain' cry, prolonged (up to 4 seconds), with a prolonged silence (7 seconds) of expiration, then further inspiration and more crying, becoming rhythmic. After 2 months these cries began to vary from their original stereotyped patterns.

Freeman (1976) showed averaged differences in aspects of behaviour between different populations of newborns. Aboriginal babies are well developed, often able to lift their heads within 24 hours; European and Chinese babies are much less developed at this age. Chinese babies tend to be more passive and often do not move their feet when 'walked' or show the Moro Reflex (throwing out the arms when jolted). Such behaviours are those most likely to have a strong genetic component, in that training has clearly not occurred prior to their display, although nutritional and other intrauterine effects cannot be excluded. Other behaviours likely to have a clear genetic basis are: (1) those that appear with stages of maturity and (2) those with a universal distribution.

J. Piaget (see especially Piaget & Inhelder 1969) has shown that there are distinct, and apparently universal, stages of behavioural development in human children. A stage of sensorimotor intelligence, when the child filters its experience and changes its mental structures to accommodate this, is succeeded after about 18 months by a semiotic or symbolic stage, when the child begins to use words, developmental images, pretends, plays and so on, first pre-operationally then (after about 7 years) operationally with the introduction of the well-known conservation of quantity concept. Adolescence ushers in the final, propositional stage.

The other type of behaviour pattern which seems difficult or impossible to modify environmentally is the human universal, such as the Eyebrow Flash, made in greeting the world over (Eibl-Eibesfeldt 1970). Clearly, such patterns are easiest to study in the culturally naive, namely children, and such authors as Bowlby (1969) and Burton-Jones (1967) have shown that there are many such patterns.

The variety of ways in which these patterns are put together into a socially homogeneous whole 'culture' is astounding. Australian Aborigines, despite, or perhaps because of, their relative lack of technological items, were able to evolve one of the most cohesive and complex cultural patterns known; one which, moreover, differed from place to place. Kinship was the organising principle in such societies, but did not by any means determine or circumscribe an individual's freedom of action. Again the forms in which these classificatory kinship systems operated differed from place to place, as did the form of preferred marriage (cross-cousin, cross-second-cousin and so on). Men would not marry until well into their twenties and women would often be betrothed at birth. Men were frequently polygynous and divorce was common. Land affiliation, religious association, food taboos and rights to painting styles were all related in part to kinship complexity. To a considerable extent these Aboriginal cultures have been torn apart by European ignorance in their dealings with Aboriginal societies, but a surprising amount remains and in many instances, the structure is basically more or less intact.

BIOGEOGRAPHY AND PHYLOGENY

Distribution

There are permanent human habitations on every continent, except Antarctica, in every type of environment. Even within Australia, pre-colonial populations were living in tropical rainforest, arid desert and within sight of ice-caps during the Pleistocene in Tasmania. There are no great altitudes available in Australia

(though Aborigines are known to have visited the Snowy Mountains, at least seasonally), but elsewhere permanent habitation goes up to 5000 metres in the Andes.

Affinities with other Groups

An outline of primate classification has been presented above. The family Hylobatidae, containing the Gibbons or Lesser Apes, are closest phylogenetically to the Hominidae.

Affinities within the Hominidae

The genus *Homo*, with its sole extant species H. sapiens, is close to Pan (*Chimpanzee*) and *Gorilla* (Gorilla). The three genera comprise a subfamily, Homininae, as separate from the Ponginae which contains (among extant genera) only *Pongo* (Orang Utan). Characters of the carpus, foot skeleton, skull, teeth and soft anatomy differentiate these two subfamilies.

Fossil Record

The genus *Homo* is variously defined, but probably all specialists would accept fossils as far back as 2 mybp as belonging to this genus. Different authorities deem *H. sapiens* to include different fossil representatives, dating back perhaps as much as 400 000 years. The earliest representatives of anatomically modern peoples may go back as far as some 100 000 years ago in parts of Africa.

Stone tools from Keilor seem to date from 36 000–45 000 ybp. In the well-known Willandra Lakes sites, human occupation certainly goes back to 35 600 ybp (+1800, -1500) on the Arumpo lunette (Flood 1983).

Human fossils from Australia seemed initially to fall into two broad groups: a ‘robust’ group, with large teeth, brow ridges and a flat sloping forehead, and a ‘gracile’ group, with smaller teeth, thin-walled skulls, small brow ridges and more rounded foreheads (Fig. 44.1). Recent studies have shown (Brown 1981) that at least some of the differences are a consequence of artificial cranial deformation, for example, head-moulding of the newborn. The robust crania come from Kow Swamp and Cohuna (Victoria), Talgai (Queensland) and Cossack (Western Australia). There is also an enigmatic, undated calvarium, WLH 50, from the Willandra series. The gracile crania come from Keilor (not the very old deposits) and Mungo in the Willandra system. Yet others, such as Nitchie (New South Wales), fall between the two types. There has been much debate about whether multiple invasions are necessary to account for the morphological diversity (such as remains after artificial deformation has been taken into account) or whether a single original immigrant group diversified in situ.

CLASSIFICATION

Family Hominidae

Subfamily Ponginae
Genus *Pongo**

Subfamily Homininae
Genus *Gorilla**
Genus *Pan**
Genus *Homo*
* not in Australia

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