Chimpanzees

Test Results That Don't Apply to Humans

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Some 1,500 chimpanzees are maintained in U.S. laboratories.[1] There are numerous problems with using chimpanzees as experimental subjects. One concern is their depleted status in the wild. Chimpanzees are considered a threatened species under the U.S. Endangered Species Act. Though importation of free-living chimpanzees from Africa is currently restricted, some fear that the restrictions will be lifted because of increasing demands by pharmaceutical industries, among others. This could present a serious threat to the survival of this species in the wild. For each captured chimp that reaches his or her overseas destination, it is estimated that ten others die en route.[2]

Another argument against their use is the extreme suffering imposed by the laboratory environment itself. In the wild, chimps are very active, traveling up to 7 or 8 miles daily[3], and spending up to 70% of the day foraging for food.[4] Chimps also have an extremely complex social structure, and spend large amounts of time socializing. These activities are denied to chimps who spend years confined in isolation cages. Chimps can live well into their fifties.

There are many physiologic and anatomical differences between chimpanzees and humans. These differences make them a poor "model" for humans. Data obtained on chimpanzees cannot be extrapolated safely to the human situation.

AIDS

Experimenters have been infecting chimps with the HIV virus since 1984. None have developed full-blown AIDS, in spite of being infected with several different strains of the virus, having their immune systems altered with drugs, having treatments designed to specifically destroy the cells which are thought to be most active in protecting the body from HIV infection, and being co-infected with other viruses which were presumed to help HIV gain a foothold. Experimenters have even injected human HIV-infected brain tissue directly into chimpanzee brains, but to no avail.[5]

HIV does not reproduce well in the infected chimp. This is apparently due to the higher baseline numbers[5] and greater proliferative response[6] of chimp T8 lymphocytes, as well as the lower ratio of T4 to T8 cells,[7] when compared to human blood cells. T4 cells are central actors in most immune responses, including both cell- and antibody-mediated defenses. T4 cells are preferentially attacked by HIV in infected human patients.[8] T8 cells are thought to suppress the replication of T4 cells.[5]

T lymphocytes play a crucial role in defending the body against disease organisms, through the cell-mediated immune response. While some individual chimps may demonstrate a reduction of T4 lymphocytes after HIV infection,[9] they do not show the dramatic depletion characteristic of the human infection.[10] This depletion may have an autoimmune cause in humans, since blood from HIV patients contains T lymphocytes which kill uninfected T4 lymphocytes in culture. These killer cells are not found in HIV-infected chimps.[11]

The antibody response to HIV is also more powerful in chimps. B lymphocytes in the HIV-infected chimp produce greater amounts of antibodies than in most human patients, destroying infected cells early in the course of disease. This antibody-mediated cell-killing ability is not found in HIV-infected humans at any stage of illness.[6] Also, humans show a drop in antibodies just before becoming clinically ill—this drop has not been seen in chimps.[12] Perhaps due to the chimp's immune system, HIV is found only in their blood cells, with very few exceptions,[5] whereas in humans, it is found free in the blood plasma.

The differences in the chimpanzee and the human immune system are dramatic, and highlight the impracticality of using these animals as a model for human AIDS. Also, above and beyond the intrinsic cellular differences, some authors have noted that the stresses associated with captivity can alter enzyme levels, thus invalidating experimental data.[13]

Another result of AIDS experiments is the growing number of AIDS-infected chimpanzees who are unwanted by experimenters due to their infected status, but who cannot be re-introduced into the wild. Large amounts of resources must be set aside to care for them over the remaining years of their lives. Estimates for the cost of lifetime care for one chimp range as high as $250,000.[14]

Hepatitis B

Chimps are also used in hepatitis experiments. Chimps become healthy carriers of the hepatitis B virus and show microscopic evidence of infection in their liver cells, but they do

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not typically suffer from the severe clinical illness which characterizes the human disease.[15] Chimps also do not show a male predominance of infection, as is found in the human patient population. Human carriers (those who carry the virus but are not clinically ill, and have little or no liver enzyme abnormalities) may progress to active hepatitis, but chimp carriers do not. Chimp hepatitis B carriers also keep producing virus, unlike human carriers.[16]

One type of liver enzyme is less variable in chimpanzees than it is in humans. Chimps show 17% less interindividual variability of GGT levels, which are used to determine the extent of liver damage in hepatitis. So studies to determine how GGT levels relate to liver disease are influenced by this variability more in humans than in chimps.[17]

Atherosclerosis

Numerous experiments have been done, attempting to produce blood vessel diseases associated with high blood cholesterol. Yet chimps fed a high-fat diet show increased levels of cholesterol in betalipoproteins only, whereas in humans, alpha-lipoproteins are also elevated.[18]

Orthopedics

The skeleton of the chimp is very different from that of humans, yet chimps are sometimes used to "model" the human anatomy and locomotion. The dorsal spines on the chimp neck vertebrae are much longer, and half of all chimps lack transverse foramina (side openings) in these vertebrae. Only 3% of humans have missing foramina. The sacrum of the chimp, which is the base of the spine, has a greater average number of segments and is narrower. The chimp pelvis is much longer, and the birth canal is much larger relative to the size of the newborn's head, as compared to humans.[19] The muscular and skeletal anatomy of the joints, such as the shoulder, differs between humans and chimps. Chimps are much stronger for their size than humans, and they commonly use their arms for locomotion, both on the ground and in trees, obviously unlike humans. The chimps scapula has larger depressions, or fossae, which allow the attachment of the large muscles used for climbing.[20]

The long bones also differ between the two species. Humans have much longer legs than chimps, thereby having femurs (thigh bones) which are much longer than the humeri (upper arm bones). These two bones are nearly the same length in the chimpanzee. The chimp radius is relatively longer, compared to the humerus, than it is in humans. Except for the radius and ulna, the arm bones are heavier in chimps, whereas their leg bones are more slender than human bones. The patella (kneecap) of the human is also relatively much larger, reflecting our upright posture.[19]

Dentition

Chimpanzees also vary in developmental sequences. They have a different order of tooth emergence.[21] In humans, the permanent teeth erupt at about the same time as the growth plates close. Chimps still have open growth plates after getting their permanent teeth, yet their skull sutures close up earlier than human sutures.[19] Chimps also have much larger canine teeth than humans.

Kidney Function

The kidney basement membrane of the chimp is not as thick as that of the human. This membrane forms part of the filtration barrier between the blood and the filtrate, which ultimately becomes the urine. The podocytes, cells which lie next to the basement membrane, may partially fuse together in normal chimpanzees. In humans, this fusion only occurs in disease states.[22] The kidney of the baby chimp does not grow as fast as the human baby's kidney, relative to body size.[23]

Reproduction

Chimps have a higher serum concentration of relaxin than humans (a hormone that may prepare the reproductive tract for birthing), both during pregnancy and during the second half (luteal phase) of the menstrual cycle. These differences might be related to the chimp's longer menstrual cycle (averaging 36 days, versus 28 for humans), which is due to a longer follicular stage.[24] Sexual receptivity in the chimp occurs only during estrus, which is absent in humans. The chimp's pregnancy is 225 days in length, compared to 280 for humans, and menarche occurs at 9 years of age.[25] Chimps experience a gradually reduced frequency of menses as they age, with complete cessation recorded in only one chimp. Menopause in chimps is therefore different than that of humans, who, by contrast, experience a rather abrupt cessation of menstrual periods.[26]

Hypertension

In chimps, there is no difference in blood pressure between the sexes. Human females, up until menopause, have lower blood pressures than human males.[27]

Other Differences

Normal chimpanzees can vary considerably in size. Adults can weigh anywhere from 20 to 80 kg. Their skin is also quite different from ours. Their sebaceous glands (which function to "waterproof" the skin) are not as well developed, and only rarely contain glycogen granules, which are abundant in all human sebaceous glands. Apocrine sweat glands, which are found only in the underarm and genital area of humans, are distributed over most of the body of chimps. Humans lack sinus hair follicles ("whiskers"), which are present in the brow, lips and chin of chimps.[28]

These dramatic differences highlight the problems with using chimpanzees as surrogates for human diseases. Not only is data from chimpanzees misleading, but their continued use aggravates their dwindling numbers.

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