

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

— the atlas's equivalent of 'you are here'.

Some features do not work so well. There is a valiant attempt to use a series of colourful strips with different scales to illustrate the locations of the wide range of orbits within a given planetary system, but the result is confusing. There are also the inevitable minor errors and inconsistencies associated with such an enormous enterprise. The most glaring mistake is that the relief map of the Neptunian moon Triton is labelled "Titania", the name of a much smaller and less interesting Uranian satellite; perhaps we can be generous and attribute this to the action of some mischievous spirit.

The sheer size of Greeley and Batson's finished product makes it difficult to lift, thereby reinforcing the impression that this is a reference work. There are inevitable comparisons with the lavish world atlases from previous centuries. Even the frequent blank areas on maps of satellites and planets — regions not imaged during brief spacecraft fly-bys — are reminiscent of the labelling by map-makers of large tracts of land in Earth's Southern Hemisphere as "Terra Incognita". While some might feel cheated by paying good money for empty space, such regions are a sobering reminder of our level of ignorance and the exciting task of exploration that lies ahead.

In a few decades, the blanks will be filled in by the next generation of explorers, both robot and human. Until then, this atlas will serve as the definitive guide to the Solar System and a fitting testimony to NASA's achievements in this field. □

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Custom-made beast of burden

The Nature of Horses: Exploring Equine Evolution, Intelligence and Behavior

by Stephen Budiansky
Free Press: 1997. Pp. 261. \$30

Horses Through Time

Edited by Sandra L. Olsen
Roberts Rinehart: 1996. Pp. 222. \$35.
Distributed in the UK by Airlift Books, £25

Marian Stamp Dawkins

It is definitely an exaggeration to claim, as the blurb to Stephen Budiansky's *The Nature of Horses* does, that the book contains "everything horse lovers, novice riders, and professional trainers alike need to know about one of our most beloved and fascinating animals". There are no instructions about how to train horses, for example, or what to feed them on, but there are nevertheless some fascinating facts and ideas. One

Not a horse chestnut, but *Mares by an Oak Tree* by George Stubbs.

of the most memorable is Budiansky's view that the horse, being a large mammal vulnerable to climate change, would have become extinct at the end of the Ice Age as many other species did, were it not for domestication by humans. North America, which had been the cradle of equid evolution for 55 million years, had no horses by 10,000 years ago; they were reintroduced by Christopher Columbus in 1494. The American Indians, who had never seen the animals before but subsequently of course made famous use of them, called them 'big dogs'.

The horse as we know it was probably domesticated in the Ukraine about 6,000 years ago. Budiansky argues that it was brought back, quite literally, from the brink of extinction by happy accidents of history that produced an animal preadapted for human use. The horse has a social system with rules of dominance and subordination that makes it particularly tractable for obeying humans; it is capable of carrying heavy burdens over long distances; it has a fortunate lack of horns or antlers; and it even possesses a convenient gap in its cheek teeth where humans can place a bit. Instead of becoming extinct, the animal made an explosive comeback by 4,000 years ago, so horse remains are common in archaeological sites from Asia to Britain.

The book contains some informative, if not particularly original, chapters on the animal's sensory system, and useful descriptions of gaits and the way the horse manages to be so large yet so fast. The horse-racing fraternity comes in for some criticism for its lack of understanding of genetics. The Jockey Club in America, for example, refuses to register horses that have been bred through artificial insemination or embryo transplants. Racing thoroughbreds are inbred anyway, so it is hardly surprising that attempts at breeding horses to race faster have not been very successful. In fact, speed records for the animals have remained virtually unchanged for the past 50 years, despite meticulous attention to stud books

and breeding. Budiansky recommends opening up horse-racing to all breeds, with the prediction that cross-bred horses would soon be leaving the thoroughbreds behind.

While Budiansky's book is well-written, full of useful information and certainly enjoyable, I found myself vaguely annoyed by two things.

One was the point already mentioned: that the book simply did not live up to its claim to cover everything one might want to know about horses. I would have thought, for example, that any book that dealt with human-horse relationships should have offered more on the different ways of training horses, from the time-honoured ways of subduing them to the newer ways which involve establishing a rapport with a social equal. Some of the claims that have been made for these new methods are spectacular (the Queen is said to be impressed with them). But do they work?

The second was that much of his writing draws upon the work of other people, and it is sometimes difficult to know whether the ideas are his own or not. This concern is particularly obvious if one reads Budiansky's book, as I did, soon after reading *Horses Through Time*, edited by Sandra Olsen. Budiansky not only draws heavily on the work of several of the authors in the latter book but even uses several of the same photographs, such as one of an Assyrian frieze and a particularly dramatic one of a horse-skin suspended on a pole.

Olsen's book has an altogether different flavour, even though it covers much of the same ground and is concerned with the evolution and domestication of the horse as well as its continuing relationship with humans. It contains ten different essays by nine different authors, giving it the inevitably slightly disjointed feel from which any multi-authored volume is liable to suffer.

There are some excellent and well illustrated chapters, including an authoritative description by Richard Hulbert of the horse's ancestry, and others on what is

known about how the horse was domesticated (surprisingly little). Juliet Clutton-Brock contributes an uplifting chapter on the horse in history, reminding us how important horses have been. Without the horse, Alexander the Great and Genghis Khan would probably not have been so successful, and the Spaniards could not have destroyed the Incas. The Roman Empire also depended largely on horses. Perhaps, she suggests, without raiding armies on horseback, many ancient civilizations would still be flourishing. At the very least, human history would have been different without the horse to accelerate the movement of people and their cultures and languages around the world.

The choice of subjects for the book, while interesting, does seem a little arbitrary. Why include a section on advanced techniques in horse medicine that have existed for only a short time, for example, but say very little about the animal's behaviour, which has been around for much longer?

Perhaps I am asking too much of books that both set out to describe the long history of human interaction with the horse and would not, despite their respective claims, have space to be truly comprehensive. But I could not help feeling disappointed that, although both described horses and their relationship to us in a fascinating way, neither addressed what is probably the hottest topic of all: the ethics of that relationship and what we do to horses. □

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A plague of weapons

The Eleventh Plague: The Politics of Biological and Chemical Warfare

by Leonard A. Cole

W.H. Freeman: 1996. Pp. 284. \$22.95, £24.95

Alastair Hay

Leonard Cole ranks chemical and biological warfare as the "eleventh plague". The first ten, described in the book of *Exodus*, were reputedly inflicted by God on the Egyptians for their failure to release the Jews from slavery. The arsenal available to the Almighty would appear to have been more limited than it is now for, say, the United States or Iraq. Today, the ubiquity of the chemical industry and the widespread use of fermentation processes offer endless opportunities for synthesizing chemicals in bulk or culturing pathogenic organisms.

If the technology is no barrier to producing agents of chemical and biological warfare, what are the constraints on their use? This is the principal question addressed by Cole in



Art transplant

The surgeon Sir Roy Calne performed the first liver transplant in Europe. But he is an artist too, and has painted transplant patients and fellow surgeons. Many of these paintings are reproduced in his book *Art, Surgery and*

Transplantation (William & Wilkins Europe, £45), along with other paintings about medicine by better-known artists. One such is *The Sick Child* by Edvard Munch (shown here), which hangs in the Tate Gallery in London.

this critical, well researched and eminently readable book. After reviewing the strengths and weaknesses of the various treaties proscribing chemical and biological warfare — deterrence and the huge costs required to maintain an adequate defence programme — Cole concludes, perhaps unsurprisingly, that a range of factors are required to deter use. These include verifiable treaties that allow inspections; defence programmes (justifiable both in cost and to the public they are meant to protect); good intelligence; and a much more outspoken position on the immorality of these weapons.

Three treaties prohibit the use of agents of chemical and biological warfare. Two of these, the 1925 Geneva Protocol and the 1972 Biological Weapons Convention, have no policing provisions and no sanctions. Apart from the exhortation to forswear the use of these agents, the treaties can do no more than create a climate hostile to their use. Cole points out that Iraq, even though a party to both treaties, developed a significant chemical and biological warfare capability, with the result that thousands of Iranians and Kurds were killed by Iraqi mustard and nerve gases.

This legacy has resulted in policing and inspection becoming two of the cornerstones of the 1993 Chemical Weapons Convention, which will become binding international law later this year. Many view it as the key to controlling chemical warfare, but two of the key signatories have still not ratified the treaty in their own parliaments and so are not bound by its provisions. The United States, which has more than 30,000 tonnes of chemical warfare

agents, and Russia, which has nearly 40,000 tonnes, are still outside the fold. Both countries were major participants in all the negotiations that led to the treaty; it is embarrassing for both, and very disquieting for everybody else, that they are not signed-up members.

The control of biological weapons will be influenced by the success of the convention. There is no doubt that a policing system is urgently required for biological warfare agents. As for a defence programme on biological warfare, Cole observes that, in the United States, "hundreds of millions of dollars have been spent" on it, and yet, in his opinion, the "US citizenry is no better protected from a biological attack now than when the army's research program began half a century ago". Cole believes any future improvements in defence will be only marginal.

Vast resources have been spent building chemical arsenals; far more will be required to dismantle them. Research on biological warfare agents has been less costly but significant in the United States, the former Soviet Union and Iraq. Information about activities in other countries is more scanty.

There is still time to rein in these activities and to persuade countries that their security is enhanced by being party to treaties that prohibit chemical and biological warfare. In agreeing to abide by these treaties, countries are also taking the moral high ground. Chemical and biological warfare is immoral, and there are many who would class it in the way Cole does, as a disease. □

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