from her uterus and implanted in Holsteins, only one resulted in a live birth. If and when perfected, however, the embryo transfer technique could produce up to six or eight gaurs per year from a single mother, researchers assert, as opposed to the gaur's natural rate of one each year.

"Manhar," the infant ox whose name translates to "one who wins everyone's heart," boosted the hopes of zoo researchers around the world who worry about maintaining both numbers and genetic variety in animal species near extinction. As a burgeoning human community encroaches upon the specialized habitats of more and more animal species, zoos and animal preserves must assume a greater responsibility for maintaining healthy, representative populations of animals, says Richard Schultz, director of the St. Louis Zoological Park.

"I may sound pessimistic [about the preservation of endangered species in the wild], but I am very optimistic about the roles a zoo can play today," Schultz told SCIENCE NEWS. While the Bronx zoo focused on improving the reproductive success of a rare species with the embryo transfer technique, scientists at the St. Louis zoo concentrated on developing a reliable method of artificial insemination in a rare variety of antelope. A current recourse to inbred zoo populations is exchanging adult animals, Schultz says, a procedure that is costly, time consuming, and sometimes dangerous to both transported animals and their human handlers.

The accumulation of sperm banks, *in vitro* fertilization of ova, and intraspecific transfer of frozen embryos are other reproductive methods currently under research at various U.S. zoos. Although Bronx zoo researchers say they hope next to transplant embryos from the endangered Arabian oryx to the gemsbok, a more common antelope, further knowledge of the endocrinology and reproductive cycles of exotic species must be gained before cross-species transplants can come into common use.

"We're still learning a lot about just the basic reproductive physiology in these animals," says Janet Ott, a researcher specializing in reproduction in exotic animals at the Brookfield Zoo in Chicago. Before embryo transplants or artificial insemination can be useful reproductive tools, scientists need to understand each female's fluctuating hormonal cycles to be able to predict when fertilization and implantation are most likely to be successful. Conventional mapping of the cycles involves assaying the hormone levels in daily blood samples — a technique that is detrimentally stressful for most wild animals, Ott says. By developing a technique to measure the hormonal levels in urine samples instead, Ott can now unobtrusively map reproductive cycles of rare okapis, short-necked African relatives of the giraffe. She hopes to expand the technique's use to other species soon. □

Bell's theorem: Still not ringing true

It's difficult for many scientists to know just how to feel toward quantum mechanics. On the one hand, it has this reputation for predicting with unrivaled accuracy the outcome of experiments involving a comprehensive range of submolecular phenomena including elementary particles, atoms and electromagnetic radiation. On the other hand, it suggests, heretically to some, that our universe may be nondeterministic, that is to say, statistical in its basic structure. This seemingly is the concept being borne out by experiments done since 1972 and recently upheld by yet another similar experiment, noteworthy for its statistical significance.

Reported in the Aug. 17 PHYSICAL REVIEW LETTERS, this latest experiment, in some respects like others before it, employed visible photon pairs emitted by the energized calcium-40 isotope. In each such pair, the two photons emerge from the isotope with mutually opposite polarizations and in opposite directions. The ostensible object of this experiment was to record the number of coincidences, the number of occasions one detector was hit by a photon at the same time the opposite detector was hit by another photon, presumably the other member of the pair.

Experiments of this sort aim to test theoretical and philosophical developments that stem from a 1935 suggestion by Albert Einstein, Boris Podolsky and Nathan Rosen. They advocated the preservation of the determinism characteristic of classical physics and proposed a way to save it by introducing the notion of "hidden parameters." In short, they argued that the reason a particle's trajectory is ill-defined in quantum mechanics is not that it is ill-defined in reality, but because quantum mechanics does not take into account the existence of certain unobserved parameters that influence the particle's trajectory. Were we only to take account of these parameters, they argued, the uncertainty attached to the particle's movement would disappear.

In 1963, John S. Bell of the CERN laboratory in Geneva discovered that an empirically testable distinction exists between quantum mechanics and deterministic hypotheses, generally referred to as local realistic theories (these include, but are not limited to, the hidden-parameter theories). Specifically, this distinction relies on the discovery of a mathematical inequality, now named after Bell, that expresses a limitation on the number of coincidences that can be expected between correlated objects separated by a large distance, such as the calcium-40 photons, if any of these local realistic theories holds.

The recent experiment, carried out by A. Aspect, P. Grangier and G. Roger at the Optics Institute of the University of Paris, found that Bell's inequality was violated, and resoundingly so (the discrepancy exceeded 13 standard deviations), thus upholding quantum mechanics. The majority of previous experiments have come to the same conclusion, but this latest experiment further dispells lingering uncertainties by improving the statistics. □

Monoclonal antibodies tackle human cancer

A new immunotherapy against cancer is flexing its muscles: monoclonal antibodies — large batches of antibodies primed against a single enemy molecule (antigen). Last year monoclonal antibodies were used against tumors in animals and selectively targeted drugs against cancer cells. Now, for the first time, they have made cancer regress in humans, Richard Miller, Ronald Levy, James McKillop and David Maloney of Stanford University Medical Center in Stanford, Calif., report in the Aug. 1 LANCET and in the July BLOOD.

In 1975 George Köhler and Cesar Milstein of the Medical Research Council Laboratory of Molecular Biology in Cambridge, England, devised a means of mass-producing antibodies reactive against the same antigen (SN: 12/30/78, p. 444). They fused mouse cells making antibodies against a specific antigen to mouse tumor cells, creating new cells called hybridomas. The hybridomas inherited the quality of immortality from their cancer-cell progenitors and also the ability to produce antibodies from their antibody-producing cell ancestors. The hybridoma cells were then screened, and only those making antibody against the desired antigen were put into a test-tube to continue to multiply. The result: vast amounts of hybridomas making vast amounts of antibodies all directed against a desired antigen.

Miller and his co-workers then applied Köhler and Milstein's technique in order to make lots of mouse antibodies that react against a particular antigen that is much more plentiful on the surface of cancerous white blood cells than it is on the surface of healthy white blood cells. They injected the antibodies into six patients with leukemia or lymphoma (both white blood cell cancers) who had not responded to conventional cancer therapies. All six patients tolerated the antibodies without difficulty. The researchers had not been sure whether they would, since mouse antibodies are foreign proteins in the eyes of the human immune system, and the patients' immune systems could have triggered serious allergic reactions against the antibodies. The antibodies

produced significant cancer regression in three of the six patients. For instance, they shrank and healed white cell tumors present in the skin of one patient. However, they did not succeed in completely curing any of the patients.

So, "for the present," Miller and his colleagues conclude, "antibody therapy is no substitute for more traditional and proven methods of cancer treatment such as radiotherapy and chemotherapy. However, we hope that antibodies will prove an additional modality of treatment that can be combined with current methods." □

Fetus as patient: A new medical era

The human fetus, for centuries inaccessible to medical intervention, is at last becoming a patient. So say three of the scientists pioneering the new fetal therapy era — Michael R. Harrison, Mitchell S. Golbus and Roy A. Filly of the University of California at San Francisco — in the Aug. 14 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION.

Fetal therapeutic coups to date, achieved by Harrison, Golbus and Filly among others, include feeding large doses of vitamins to mothers of vitamin-deficient fetuses and inserting shunt catheters through the abdomens of mothers and on into fetuses with Rh incompatibility disease, with excess fluid in the brain, chest or abdomen, or with urethral blockage in order to infuse or withdraw corrective material (SN: 5/23/81, p. 326; 8/1/81, p. 70). Harrison, Golbus and Filly also foresee drugs, hormones or nutrients needed by fetuses being injected through the mother's abdomen into the womb so that the fetus can swallow or absorb the needed substance from the amniotic fluid. For instance, a growth-retarded fetus might be fed by such a method. The researchers point out that while surgically correcting fetal malformations is tougher than providing missing nutrients, hormones or drugs, it may be surgically possible to correct fetal diaphragmatic hernia, where viscera from the fetal chest compress the fetal lungs, killing the fetus. They have already demonstrated the feasibility of such surgery in fetal lambs. Still another plausible therapeutic ploy, they anticipate, is to correct certain fetal malformations by premature delivery of a fetus. An example of such a malformation is fetal growth retardation. Another is the amniotic band complex, where a fetal part is strangled by herniation through a defect in fetal membranes, resulting in amputation or deformity. Still another is gastroschisis, where the fetal bowel exposed to amniotic fluid becomes coated with a thick, fibrous inflammatory peel that may hinder repair or delay resumption of function.

Yet as with any new medical era, that of fetal therapy is bound to raise ethical issues. For instance, as the San Francisco fetologists point out, while it is relatively easy to weigh the risk of a treatment to a fetus against the possibility of the treatment correcting its disorder, assessing the risks and benefits for the fetus's mother may be more difficult — for instance, where a shunt catheter is placed through the abdomen. Another ethical problem, John C. Fletcher, a medical ethicist with the National Institutes of Health in Bethesda, Md., says, is the apparent inconsistency of encouraging fetal therapy on one hand and respecting parental choice about abortion on the other. Yet another ethical problem, he says, concerns the proper conditions for advancing fetal therapy research. He believes that a national ethical review board should oversee human fetal research involving more than minimal risk and reports that the Department of Health and Human Services is setting up such a board. Federal ethical guidelines for human fetal research of minimal risk already exist.

Ethical dilemmas aside, Fletcher is pleased by "alternatives to abortion for congenital defects, especially alternatives based on a rational approach to treatment." Harrison, Golbus and Filly agree:

"In considering the ethical problems raised by fetal therapy, one clearly positive aspect is that prenatal diagnosis of a fetal malformation may now lead to treatment rather than abortion." □

Six 'superluminal' quasars identified

Just a few months ago, only four quasars with components moving apart at apparent velocities faster than the speed of light had been identified. Now, report Marshall H. Cohen and S.C. Unwin of California Institute of Technology, there are six.

At the International Astronomical Union Symposium on Extragalactic Radio Sources, in Albuquerque, N.M., Cohen listed the six in order of increasing redshift, and therefore increasing distance from us: 3C 120 (redshift .033), 3C 273 (redshift .158), 3C 279 (redshift .538), 3C 345 (redshift .595), 3C 179 (redshift .846) and NRAO 140 (redshift 1.258). All six quasars have multiple components. Each of the six has at least one pair of components separating at velocities that, from our vantage point, appear to be faster than light. The apparent expansion velocities are all in the range of 3 to 10 times the speed of light, with the exact numbers depending upon which assumed value of the Hubble constant (which relates redshift to cosmological distance) is used.

The identification of quasar NRAO 140 as a superluminal source was so new that Cohen had heard of it only 50 hours before his talk. A.P. Marscher of the University of California at San Diego and J.J. Broderick of Virginia Polytechnic Institute and State University reported the details. It had attracted their interest because it is one of only three or four quasars seen in the X-ray part of the spectrum before the availability of the Einstein orbiting observatory. Unlike the other superluminal quasars, all of which have distinctly one-sided jets, NRAO 140 has two large, roughly equal-sized components moving apart at high speeds. Very long baseline interferometry shows the expansion to be superluminal, Marscher says, with separation velocities of from 3.0 to 10.0 times the speed of light, depending upon assumptions.

The other new superluminal source is quasar 3C 179. It, says Cohen, was the first source suspected of showing apparent superluminal expansion. New studies reported at the meeting by Richard W. Porcas of the Max Planck Institute for Radio Astronomy make it definite. Between October 1979 and December 1980, two of its components moved apart at an apparent superluminal velocity of about 7 times the speed of light, Porcas says.

When astronomers refer to "superluminal expansion," they don't necessarily mean the components involved actually are separating from each other at faster than the speed of light. Built into the phrase, as they use it, is the idea "apparent" — meaning "as it appears from earth." The leading explanation for these (apparent) superluminal expansions calls on a geometric situation in which a relativistic jet or beam (i.e., one moving at near the speed of light) from the quasar is moving out from the core at a small angle to our line of sight to the core. During any given period since light left the jet on its route toward us, the jet itself has moved almost the same distance toward us as well. The light from its second position therefore reaches us only a short time after the light from its first position. We interpret the total distance traveled by the jet as the small transverse distance we observe across the sky rather than seeing the actual much longer distance the jet has moved nearly along our line of sight, and so we get a false and much higher measurement of apparent velocity.

Most astronomers assume this to be what is responsible for these measurements of superluminal expansions, although there is plenty of uneasiness over the requirement of having the fairly special line-of-sight orientation. (In a random sample of quasars, the observer expects to have all possible orientations.) Cohen was asked how many quasars have been subjected to good enough VLBI observation to detect apparent superluminal expansion. His answer was twelve. So six of twelve, or half, the appropriately analyzed quasars have shown it, a troublingly high frequency. However, the twelve are not random samples, but highly selective samples, and that might help explain away that difficulty. □