Does Dibaryomania Start Here?

Where two or three are gathered together — that should be all, according to the current theory of particle physics. Two or three quarks, that is. The theory explains the properties and behavior of most kinds of subatomic particles by proposing that they are made up of two or three out of a small number of subparticles called quarks and antiquarks. (The small number was originally three quarks and three antiquarks, but in recent versions of the theory it can go as high as six of each.)

The "most naive" form of the theory, to quote the adjective used by physicist Charles Ward of Argonne National Laboratory, holds that three quarks are the maximum that can be bound together. At that point the force that binds them together "saturates," and no further quarks can be attracted to the group. Unfortunately for the naive form of the theory, a group of Argonne experimentalists has found a particle that appears to be made of six quarks bound together. The object is called a diproton resonance, because it seems to consist of two protons melded together into a single particle. The group that found it was led by Akihiko Yokosawa and included Ivan Auer, Andrew Beretvas, Eugene Colton, Howard Halpern, Daniel Hill, Kenneth Nield, Harold Spinka, George Theodosiu, David Underwood and Yasushi Watanabe. Their report was published recently in PHYSICS LETTERS B.

The discovery came in an experiment involving collisions of polarized protons, that is, experiments in which the spins of the projectile proton and the target proton are known. In proton experiments generally the spins of the protons are not known, and in the past it was expected that the interactions between the spins would have only a small effect on the total interaction of the two protons. This is at least the second recent result that indicates that spin effects can sometimes be very important. (For another, see SN: 9/24/77, p. 196.)

The diproton resonance forms only when the spins of the two protons are parallel and can add together to give the total spin that the resonance seems to require. The resonance does not form when the spins are antiparallel. The resonance lasts only a very fleeting time, even by modern particle physics standards, and then falls apart into two protons.

Probably next on the agenda is finding out whether the resonance can decay into other combinations, for example, a proton, a neutron and a pi meson. Another interesting question is whether other dibaryon resonances, resonances involving two other particles of the proton's class, are possible. Such experiments, however, will not be done at Argonne, because the Zero Gradient Synchrotron, Argonne's major accelerator, is funded only for polarized proton experiments and not for work with other particles.

If the naive version of the quark theory will not contain dibaryon resonances, modified versions may. A major type of modification deals with a puzzling paradox involving the force that holds quarks together. Inside a particle the quarks appear to be very loosely bound, yet it is impossible at present energies to knock a quark out of a particle. One way of resolving the paradox is to regard the particle as a kind of bag in which the quarks are kept. Inside the bag they can rattle around loosely, but for some reason they cannot get out of its confines. This bag theory seems to have room for combinations of more than three quarks, and it could be the modification chosen to explain the new results. □

National Medal of Science: Fifteen winners

The White House

Carter honors scientists and engineers and asks for increases in federally funded R&D.

President Jimmy Carter took the opportunity last week to reemphasize his interest in and his commitment to science. He did so at the presentation of this year's National Medal of Science Awards. Carter's brief remarks before the ceremony suggest that his support for science will be both symbolic and literal.

After mentioning that he "had some engineering background, some scientific background, in business, agriculture, politics," Carter went on to warn that "the quality of scientific equipment has fallen off rapidly in recent years. The number of top-ranked research centers has been falling off in recent years. The percentage of faculty members who are scientists and who are also young has been falling off rapidly in recent years. In 1968, about 45 percent of the faculty members were young men and women. Now that has dropped off to about only 25 percent, which shows that in the future we have a problem on our hands, unless we take strong action to correct these trends."

In response to this situation, Carter said that he would like to make sure that the climate for research and development in our country is enhanced "with my own imprimatur of approval and interest, with a broad-scale exhibition of interest on numerous occasions by the members of Congress and my own administration, with publicity accruing to those who have achieved notably in the scientific and engineering field, and also in direct budget allocations."

Speaking of the budget, Carter said that in many instances the heads of government agencies (cabinet members and others) have relegated scientific research and development to a fairly low position of priority. In order to remedy this, Carter has directed the Office of Management and Budget "to boost these research and development items much higher, and they will be funded accordingly."

On that note, Carter and his Science and Technology Adviser, Frank Press, went on to present the National Medal of Science Awards, the nation's highest honor for research in science and engineering.

In the biological sciences awards went to:

- Roger Guillemin of the Salk Institute for Biological Studies. Guillemin also shared in this year's Nobel Prize for Physiology and Medicine. He was honored for "demonstrating the presence of a new class of hormones made in the brain that regulate the function of the pituitary gland, thereby making possible improved diagnosis and treatment of many endocrine disorders."
- Keith R. Porter of the University of Colorado, "for his many contributions in the use of the electron microscope ... to give us a comprehensive and unified picture of the life of cells."
- Efraim Racker of Cornell University, "for major contributions to the understanding of the subcellular mechanisms

whereby oxidative and photosynthetic energy is transformed into the specific form of chemical energy used by living cells."

- Edward O. Wilson of Harvard University, "for his pioneering work on the organization of insect societies and the evolution of social behavior among insects and other animals."

In the engineering sciences awards went to:

- Morris Cohen of the Massachusetts Institute of Technology, "for original research in metallurgy, leading principally to better understanding of the properties of steel."
- Peter C. Goldmark, formerly of CBS, now with Goldmark Communication Corporation in Connecticut, "for contributions to the development of the communication sciences for education, entertainment, culture and human service." Carter remarked that he was particularly grateful to Goldmark for developing the long-playing record.
- Erwin Mueller (deceased May 17, 1977), "for his invention of the field-emission microscope, the field-ion microscope and the atom-probe microscope, which helped to resolve the atomic structures of solids."

In the mathematical sciences awards went to:

- Kurt O. Friedricks of New York University, "for bringing the power of modern mathematics to bear on problems in physical sciences."
- Hassler Whitney of the Institute for Advanced Studies in Princeton, N.J., "for founding and bringing to maturity the discipline of differential topology."

In the physical sciences awards went to:

- Samuel A. Goudsmit, emeritus deputy chairman from Brookhaven National Laboratory, now at the University of Nevada, "for the major discovery, together with George Uhlenbeck, of the electron spin as the source of a new quantum number."
- Herbert S. Gutowsky of the University of Illinois, Urbana, "in recognition of pioneering studies in the field of nuclear magnetic resonance spectroscopy."
- Frederick D. Rossini of Rice University, "for contributions to basic reference knowledge in chemical thermodynamics."
- Verner E. Suomi of the University of Wisconsin in Madison, "as a distinguished meteorologist, he has provided a new view of the dynamics of our atmosphere."
- Henry Taube of Stanford University, "in recognition of contributions to the understanding of reactivity and reaction mechanisms in inorganic chemistry."
- George E. Uhlenbeck of Rockefeller University, "for the major discovery, together with Goudsmit, of the electron spin as a source of a new quantum number."

At the end of the awards ceremony the president, himself, received a presentation. Medal recipient Goldmark gave Carter the first experimental pressing of a long-playing record. □

Look into my eyes: An infant's view

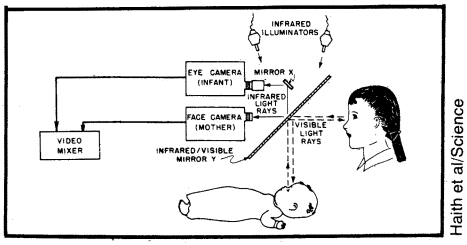
Newborns' visual behavior is both a marvel and a wonder to parents. But how interested are infants in what their parents look like? What elements in faces attract infants the most, and under what conditions?

Because eye movements are among the earliest of social behaviors as well as a crucial factor in the attachment of infant to parent, psychologists have studied them in detail. But past research has had several serious drawbacks. Face photographs, drawings and masks have often been used instead of real faces, and procedures have generally not allowed for precise identification of where on the face infants look. Marshall M. Haith of the University of Denver and Terry Bergman and Michael J. Moore of Harvard University have now explored infant eye movements in more detail. They report in the Nov. 25 SCIENCE that parental faces do not interest infants any more than strangers' faces do. However, the manner in which newborns look at human faces changes as they grow older. Three-to-five-week-olds focus mostly on the edges of faces, whereas 7-week-olds and 9-to-11-week-olds look a lot at the eyes, particularly when the faces are talking.

Twenty-four infants equally divided across three age groups—3 to 5, 7, and 9 to 11 weeks—participated in the study. Each infant lay prone under a mirror tilted to a 45-degree angle. From the position of either the adult or the infant, the other face appeared upright and directly in the line of sight. Behind the mirror were two television cameras mounted horizontally. The lower camera recorded the adult's face through the mirror, and the upper infrared camera recorded the image of the infant's right eye through the mirror by reflection from another small, front surface mirror. Two bulbs, located at either side of the infant's head, provided visual illumination.

The beams of the lights passed through specific points at the plane of the virtual image of the adult's face and converged on the infant's eye. Infrared filters and heat filters in front of the lamps transmitted invisible bands of light; the upper infrared television camera recorded the image of the eye with the reflections of these lights. Because the positions of these lights in the infant's visual field were known, fixation points could later be determined by measuring the distance of one of the lights from the center of the pupil.

Each infant was presented both the mother's and a stranger's face either while still, moving or talking to the infant. For half of the subjects in each age group, the stranger was a male, and for the other half a female. All possible presentation orders of conditions and faces were used within each age group. Each condition lasted 45 seconds. During the experiment, the outputs of two television cameras were alternately switched to a videotape recorder—one-half a second for the infant's eye and one-thirtieth for the adult's face.



Haith et al/Science

The infant's fixations on the adult's face were determined by first recording alternate eye and face frames from the videotape playback. The positions of hairline, eyes, nose, mouth, chin and ears on the adult's face were measured on 10 face frames. For each condition, the facial features were plotted with the sequence of the infant's fixations superimposed. The data were then analyzed.

As for the experimental results, none revealed a visual preference of infants for mother over stranger. The 3-to-5-week-olds spent more time looking at the edges of adults' faces than at their features. In contrast, 7-week-olds and 9-to-11-week-olds focused much more on adults' eyes than on other areas of their faces, especially while the adults were talking to the infants rather than just being still or moving. The researchers had expected just the opposite — that talking would distract the infants from the eyes.

How do these findings relate to early perceptual and social development? The attraction of 3-to-5-week-olds to facial edges supports earlier data showing newborns' attraction to contours, the investigators say. Clearly the previous suggestion that faces are seen as faces by newborns is not supported by these results. One interpretation of the dramatic shift in looking away from the edges of the face and toward the eyes (between 3 and 7 weeks of age) is that the face has changed its status from a mere collection of items to a meaningful entity.

But why do infants eventually zero in on adults' eyes rather than on other features? If the face were seen as a whole, the central location of the eyes as well as their symmetry would make them compelling components, the scientists conjecture. The eyes probably do not attract infant interest because of their movement, color or contrast since the researchers found that, if anything, the increase in lip movement and lip-tooth contrast associated with talking led to increased fixations on the eyes. Why does this happen? The researchers aren't sure.

In any event, they conclude that newborns' increasing interest in adults' faces, and particularly in their eyes, plays a crucial role in bonding between infant and caretaker. □