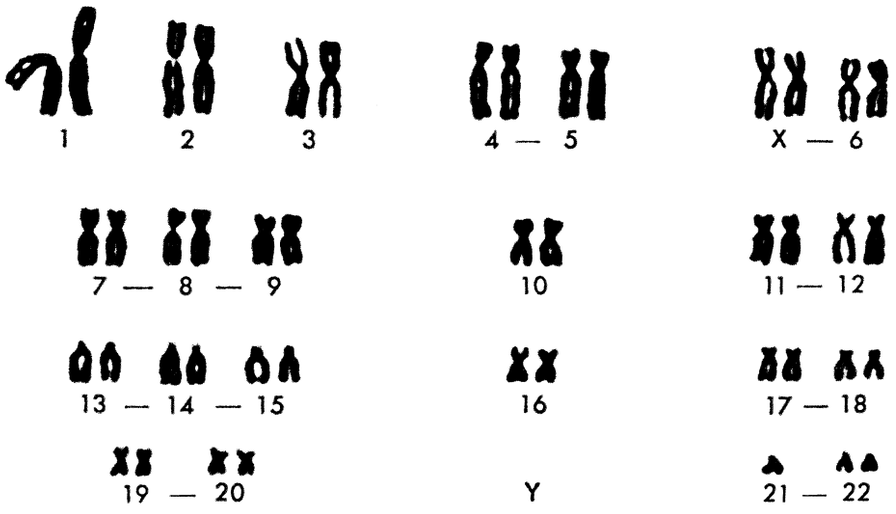

New England Journal of Medicine

Chromosomes of retarded girl: something missing in 21-22.

GENETIC ABERRATION

Survival despite autosome lack

A year ago, an Air Force technical sergeant and his wife, concerned over their three-and-a-half-year-old daughter's development, decided to seek help. The child could babble "ma-ma" and "da-da" but couldn't connect the sounds with her mother and father. She understood "no" but no other words.

The parents brought her to the Bethesda Naval Medical Center, where the National Institute of Child Health and Human Development maintains its Children's Diagnostic and Study Branch for the families of service men.

To the surprise of the researchers, as well as the parents, the cause of the girl's retarded behavior appears to be linked to a missing non-sex chromosome. The child is the first recorded case in medical literature to survive with this particular condition.

The specialists took the girl's complete history and performed tests including what is to them a routine chromosome analysis. She had only minor apparent physical abnormalities, and in most other clinics the tedious chromosome study would not have been undertaken.

Describing the child's appearance and characteristics in the Oct. 12 issue of THE NEW ENGLAND JOURNAL OF MEDICINE, the investigators say she had learned to play "pat-a-cake" at 18 months and would begin the game if the word was spoken—but only by imitation. Her usual play activity consists of sitting with her arms by her sides, rocking, or riding a hobby horse. She rocks her bed and bangs her head vigorously. Occasionally she will play with a toy car that has a siren, but not with more complicated toys.

The child's eyes are wide-set and downward-slanting, her mouth is small, her ears are low-set, and she has flared nostrils. She shows none of the characteristics of mongoloidism, caused by the presence of an extra chromosome.

Dr. Matti S. Al-Aish, who studies cellular genetics on the team that examined her, found that one of the child's autosomes—a non-sex chromosome—was missing. He believes it is probably chromosome 21, but he is not ready to commit himself further than to call it one of the Group 21-22.

The chromosome analysis was done by examining cultured blood, bone marrow and skin cells under the microscope until one cell was found in which the chromosomes were most clearly visible.

Chromosomes, which are present in all cells, contain the genes with the complete design for the living organism. One of the 23 pairs of chromosomes relate to sex; the other 22 pairs, the autosomes, determine other characteristics. Until this case was discovered it was believed that a missing autosome would cause death of the embryo in early stages of life.

Just what the missing autosome means in terms of missing characteristics is not yet known, and this unique case has aroused the interest of many geneticists. Dr. Al-Aish, with Drs. Felix de la Cruz, Lowell A. Goldsmith and Joseph Volpe made up the Institute team, assisted by Dr. J. C. Robinson, chief of the Pediatrics Outpatient Department of the Naval Medical Center.

Their report touches on possible causes of the child's condition, such as the parents' X-ray examinations without shielding and the mother's treatment for a cold while pregnant. The identity of the cold medicine is unknown, but during the last two months of the pregnancy she was given chlorothiazide for edema, or swelling, which often occurs in the ankles and feet at that time, though this is probably too late in the pregnancy to create the aberration.

"We believe," they say in conclusion, "this case illustrates the importance of cytogenetic studies, when they are feasible, in every retarded child." Studies now in progress could give further information about the missing chromosome's identity. ◈

24-HOUR DASH

Re-finding comets

Shortly after the beginning of the 18th century, astronomer Edmund Halley was comparing two dozen comet observations going back almost 400 years, when he noticed that the orbits of three comets—those of 1531, 1607 and 1682—were almost identical. The intervals between the sightings weren't quite the same, but the gravitational effects of Jupiter and Saturn could account for that. If they were indeed the same comet, Halley predicted, it ought to appear again in 1758. His guess was right on the nose: the comet, which now bears Halley's name, turned up, bright in the sky, as predicted.

If an astronomer is lucky, he may find a single new comet in his lifetime and have it named after him. A Japanese astronomer, Koichiro Tomita of the Tokyo Astrophysical Observatory, found a comet recently. In fact, he found so many—four—that he set a world's record for one evening's work.

Unfortunately, none of them will ever bear his name. They had all been found before. But Tomita is now apparently the champion comet re-finder of the world—at least for the 24-hour dash. (The lifetime record-holder is Dr. Elizabeth Roemer of the University of Arizona, whose 37 smother Tomita's 13.)

Relocating known periodic comets is a common procedure, valuable because the additional data from each new sighting makes it possible to predict the comet's next appearance more accurately. One of Tomita's rediscoveries, Comet Wolf, had been seen 10 times before since it was discovered by German astronomer Max Wolf in 1884. Tomita also made the fourth sighting of Comet Wirtanen, which was first seen in 1948; the third sighting of Comet Arend, known since 1951; and the eighth sighting of Comet Borelly, which was first found in 1905.

None of the four comets can be seen with the naked eye. The brightest of them is Wirtanen, which is of the 15th magnitude. The rest range down to magnitude 18, compared with Halley's comet, which is first magnitude and

will be easily visible to the eye when it makes its next appearance in 1986.

Astronomers knew 1967 would be a good year for comet-spotting. The Smithsonian Astrophysical Observatory in Cambridge, Mass., predicted that no fewer than 17 periodic comets would come to within good viewing range during the year (SN: 1/21). But Tomita has been making it a good year virtually single-handed.

Aided by Tokyo's 36-inch reflecting telescope, he has captured more than just the one-night record for comet re-finding. He re-found one on Jan. 3, another on Feb. 12, still another on June 15, a pair (as many as anyone else has ever re-found in a night) on Aug. 7 and a sixth the evening after that. Tomita's four-in-one-evening gives him a total of 10 re-findings so far in 1967, already a record for any one year. ◈

EXTRANUCLEAR GENETICS

Cytoplasmic RNA upsets theories

The idea of someday producing tailor-made genes for plants, animals, or even people has long-since passed from science fiction novels into the long-range predictions of the most sober-minded molecular biologists.

The job of any such genetic engineer of the future has now been made considerably more complicated with the announcement by two biologists at the California Institute of Technology of new chemical evidence suggesting that genetic messages are produced not only in the cell nucleus, but also in the cytoplasm outside the nucleus. A would-be gene mechanic would thus have to tinker with genetic material stored both in the nucleus and in the cytoplasm.

Until recently, biologists assumed that DNA, the nucleic acid that contains genetic information, was stored exclusively in the cell nucleus, as its name implies. From there, it directs protein synthesis by sending out coded directions in the form of messenger RNA. This RNA is exported to the cytoplasm, where factories called ribosomes follow its directions and produce the type of proteins ordered by the nucleus.

Such a total localization of genetic material in the nucleus would not explain the fact that certain structures in the cytoplasm seem to grow and divide without direction from the nucleus. The chloroplasts of plant cells, which are structures specially organized for carrying out photosynthesis, grow and divide independently of the rest of the cell and in general are so independent of nuclear direction that some scientists think they were originally independent organisms that joined up with the rest of what is now a plant cell when they were already well along in evolution.

The mitochondria of both plant and animal cells are also known to grow and divide independently of the rest of the cell. Mitochondria are cytoplasmic structures which contain the enzymes needed to perform the final steps in converting sugar into usable biological energy. When the cell divides, a process under the control of the nucleus, mitochondria passively become part of one or the other of the two daughter cells.

The first definitive link in the presumed chain of extranuclear inheritance was the isolation in 1964 of DNA from mitochondria taken from cells.

This DNA has an unusual closed circular structure with no free ends, and is unlike the straight helix of the Watson-Crick model.

It also can have superturns, like those of a figure eight twisted and folded on itself many times.

Although it is a small proportion of the weight of a mitochondrion, which is mostly membrane and enzyme protein, this DNA presumably contains the instructions needed to make at least the structural protein that holds the mitochondria together.

Evidence for a messenger RNA produced in the mitochondria has now been announced by Drs. Barbara and Giuseppi Attardi in the September 1967 issue of the PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES. Working at the California Institute of Technology in Pasadena, the Attardis found that radioactively labelled RNA showed up on the cytoplasm faster than did RNA that had first to be formed in the nucleus. This RNA was different in size and chemical composition from messenger RNA made in the nucleus. It was found in a special rough fraction of the endoplasmic reticulum, an intertwined subcellular membrane. The rough fraction is considered responsible for the synthesis of subcellular membrane components.

The new RNA fraction turned out to be similar in chemical composition to the unusual circular DNA extracted from mitochondria.

Its base sequence is complementary to that of the mitochondrial DNA over a significant portion of its length; and strands of mitochondrial RNA will, when disassociated from each other, form bands in a hybrid helix with disassociated strands of mitochondrial DNA, but not with nuclear DNA.

Substantial similarity of sequences is necessary along the molecular chain for hybridization, which is considered an extremely subtle test of structure.

The work of the Attardis is of special interest for two reasons. First of all, they used HeLa tumor cells of human origin. This shows the importance of cytoplasmic inheritance in higher organisms, says Dr. Giuseppi Attardi. Previous work on cytoplasmic inheritance was all done on yeast, neurospora and protozoa. Second, the structural proteins of mitochondrial membranes in lower organisms are very similar to the unique structural proteins of the membrane surrounding the nucleus and of the membrane that supports the ribosomal particles. It may well turn out that the synthesis of these proteins is also controlled by genetic material located outside the nucleus.

AEC BUDGET

Money for ABM warhead

The Atomic Energy Commission's $2 billion-plus budget passed the Senate last week.

The money approved by the Senate was some $17 million more than that appropriated earlier by the House. But $15 million of that increase is for increased testing and development of nuclear weapons, chiefly for the just-decided-on antiballistic-missile system. Altogether, the Senate appropriated $715.5 million for weapons, plus another $107 million for nuclear propulsion for the Navy.

Both houses included $7.3 million to make a start on the controversial 200-Bev accelerator at Weston, Ill. The suburban Chicago site had been attacked by civil rights leaders on the grounds that equal housing isn't available there; a House-Senate conference is necessary to iron out differences.

LEGISLATIVE REBIRTH

Arizona project revives

The controversial Central Arizona Project (SN: 7/15), for months apparently moribund if not actually dead, has been forcibly revived.

Reconsideration was brought about by Senator Carl Hayden (D-Ariz.) who had threatened to bypass the foot-dragging House Interior Committee and attach the $768 million project authorization to a public works appropriation bill. He withdrew the threat last week after Representative Wayne Aspinall (D-Colo.), chairman of the Interior Committee announced that his Committee would take up CAP early next session.

Aspinall is holding out for augmentation of the Colorado.