presence of an MTV was demonstrated by fostering tumor-free hybrids, $(O_{20} \times DBAf)_{F1}$, on the GR stock; the hybrids then had high incidence of tumors. By reciprocally crossbreeding the GR and C57Bl strains, it was shown that a GR agent is transmitted as well by the male as by the female.

The likelihood of a mouse's having breast cancer is proportional to the number of mammary glands permitted to develop. This was concluded by A. Dux (Netherlands Cancer Institute) from experiments in which she removed from one to nine of the mammary glands from young females. Dux also reported that the genetic influence on tumorigenesis is located specifically in the mammary gland. She transplanted mammary glands from C3H susceptible and O_{20} resistant females into completely mammectomized hybrids (C3H $\times$ O_{20} agent-bearing and $O_{20} \times$ C3H supposedly agent-free). With C3H glands in agent-bearing hosts, tumor incidence was 100 percent at a mean tumor age of 233 days; with O_{20} glands in agent-bearing hosts, it was 95 percent at a mean age of 323 days; with C3H glands in agent-free hosts, it was 85 percent at a mean age of 492 days; and with O_{20} glands in agent-free hosts, it was 11 percent at a mean age of 511 days.

Methods for obtaining large quantities of milk from mice were reported by W. F. Feller (National Cancer Institute). Fourteen days after birth, the young are taken away from the mother 4 hours before she is milked, and she is injected intraperitoneally with 100 milliunits of oxytocin before gentle suction (10 cm-Hg) is applied to moistened nipples; many mothers yield 1 ml per milking. The young are returned to her immediately. She can then be milked once daily for 5 days.

The mass of data presented permitted far-reaching conclusions to be drawn. The MTV (the B particle) can initiate mammary carcinoma and represents the milk agent responsible for most of the spontaneous mammary tumors of mice. It is a lipid-rich RNA virus resembling the myxoviruses. A second virus, a nodule-inducing virus, morphologically indistinguishable from the MTV, is responsible for the few tumors that appear late in life in some strains (particularly C3H) which have been kept free of MTV by foster-nursing. The nodule-inducing virus is transmitted by either parent only at conception. Both viruses are under hormonal and genetic control in the host, the development of tumors being dependent on both factors, but neither hormones nor heredity ordinarily initiate a mammary adenocarcinoma without the presence of a virus. Many so-called virus-free mice in which tumors have appeared under certain conditions are now believed to be virus-bearing. Most, but not all, strains and families of mice are carriers of one or both (or possibly other) related viruses, and as such can respond to hormonal stimulation by the development of tumors.

Subviral infectious units and viral inhibitors are in evidence. Nodule-inducing virus and also leukemia virus can interfere with the action of MTV, possibly through an immunological response; such responses to these viruses have now been demonstrated.

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Paleopathology

A symposium on human paleopathology was held in Washington on 14 January 1965 under the auspices of the Subcommittee on Geographic Pathology, National Academy of Sciences–National Research Council.

The chairman, Saul Jarcho (Mt. Sinai Hospital, New York), summarized the historical development and present condition of human paleopathology in the United States. The great age was the period approximately between 1900 and 1935, represented by the work of Hrdlička, Moodie, Hooton, and H. U. Williams. In contrast, the last 30 years have seen no major synthetic work and no major discovery. In the United States at the present time, Jarcho continued, paleopathology functions as a province of physical anthropology in which much of the work is done by a few general pathologists, osteopathologists, orthopedic surgeons, and roentgenologists, most of whom have had no formal training in anthropology. Because most contemporary pathologists have avoided paleopathology, the new methods used in their laboratories have not been applied to prehistoric tissues. Jarcho said that urgent current needs are (i) establishment of a registry for examination and central recording of prehistoric human remains and for applying the new analytical methods, and (ii) the extension of medical indexing to include paleopathology, thereby overcoming the inaccessibility of the literature. These innovations would serve as a basis for the reanimation of human paleopathology in the United States.

Temkin (Johns Hopkins) stated that the interest in paleopathology displayed by medical historians had sometimes produced uneasiness in archeologists: an example was Sudhoff's research on the history of syphilis, especially his work on the famous edict of Maximilian I in 1495, research that was challenged by the more accurate work of Haustein. Temkin felt that the best place for paleopathology in the academic structure has not yet been determined. Long (Pedlar Mills, Va.) agreed that paleopathology has been slighted in medical schools and that the same is true of comparative pathology. The dry Southwest and the moister river valleys elsewhere in the United States are capable of yielding valuable information on the past incidence of such diseases as tuberculosis, arteriosclerosis, and stone. Bayne-Jones (Washington, D.C.), after presenting family reminiscences of his grandfather, Joseph Jones, who exhumed syphilitic skeletons in the southeastern United States and thereby provoked prolonged controversy, emphasized the importance of the epidemiologic viewpoint in paleopathology. It would be especially important, he felt, to gain information on diseases which developed simultaneously in widely separated regions. Cassedy (NIH) spoke of the close relation between research in paleopathology and research into modern health; both are included in the mandate of the Public Health Service. NIH has supported a wide range of laboratory research in pathology, believing that historical studies have a definite value in the understanding of disease; paleopathology is an appropriate field for government support. The History of Life Sciences Study Section has made a formal statement of its interest in the field.

T. D. Stewart (Smithsonian Institution) referred to the Smithsonian Institution's long interest in paleopathology. He expressed disillusionment with much that has been published in the literature, citing several examples. Hooton's work on Pecos Pueblo has great merits and some defects; it is one of the few studies of prehistoric

populations. Stewart also adverted to the dangers of dogmatic pronouncements, as exemplified in trephined skulls studied by Hrdlička; later studies revealed large multangular areas surrounding the perforations, probably attributable to infection of the scalp. Another example was that of linear markings on tibiae; these had been attributed to cauterization, but were actually nothing more than vascular impressions. In commenting on arthritis Stewart pointed to the need for studies of the relative frequency of lesions in different parts of the vertebral column in different populations: white men showed cervical arthritis much more frequently than Pueblo Indians.

Putschar (Massachusetts General Hospital) discussed the possibility of arriving at a sound diagnosis from the examination of fossil bones. In addition to customary pathologic and roentgen methods, he emphasized the study of polished surfaces under surface illumination, a method originally developed by mineralogists and metallurgists. Except in Paget's disease, microscopic examination of macerated bone frequently fails to reveal a diagnostic pattern. Putschar also reviewed the types of skeletal disease which are likely to be recognizable in prehistoric remains. Congenital skeletal lesions usually pose no great diagnostic difficulty, Putschar continued. Inflammatory lesions prove much more vexatious to the paleopathologist; the commonest consists of periosteal deposition of bone, with or without architectural change of the subjacent diaphyseal cortex in long bones. This lesion often appears to be in a chronic or healed stage; frequently it is impossible to determine whether the changes are of traumatic or infectious origin. Traumatic causes are especially probable along subcutaneous bone surfaces (of the tibia, for example), but are less likely in bony areas covered by thick layers of muscle. The frail trabeculations so often seen nowadays in fibrous dysplasias, hyperparathyroidism, and osteoblastic metastasis are probably often not sturdy enough for prolonged preservation after burial.

H. L. Jaffe (Hospital for Joint Diseases, New York) emphasized the importance of roentgen study in paleopathology: "The x-ray is almost part of the picture of the pathology." He pointed out certain difficulties and pitfalls: for example, a case of localized thickening of a femur, attributed to syphilis, in which he suspected the correct diagnosis to be cortical abscess. Jaffe also mentioned the possibility of confusing Paget's disease with syphilis and tuberculous with syphilitic lesions of the skull.

Hamperl (Bonn, Germany) quoted Plato on the immortality of bone. He adverted to the special usefulness of x-ray study of bone sections 3 mm thick. L. Johnson (Armed Forces Institute of Pathology) pointed to difficulties of diagnosis in paleopathology and felt that scientists had been led astray by excessive attention to scientific etiology. Emphasis should be placed on biodynamic aspects and especially on the attempt to obtain kinetic data from static material.

Osborne (California State College) described the excavations of Mesa Verde, Colorado, and Miles (University of Colorado) presented the paleopathologic findings in the more than 40,000 bones discovered during the excavations. Interesting observations included rotational deformities about the long axis of the lower extremity, a high incidence of degenerative arthritis, and two cases of symmetrical osteoporosis of the skull. Interestingly, no gross disturbances of osseous development, such as osteogenesis imperfecta, achondroplasia, osteopetrosis, or arthrogryposis, were found; such processes are thought to be genetically recessive and to occur with increasing frequency in a highly inbred population, as that at Mesa Verde is assumed to have been. A pair of child's crutches and an aspen-bark corset were also discovered.

Roney (University of Kansas) discussed the findings at Sonoma 229, a coastal midden about 45 miles north of San Francisco, assigned to the Middle Horizon of California and dating probably from the 6th to the 3rd century B.C. There was evidence of a high subadult mortality; it was estimated that 39 percent of the population died before the age of 20. A few cases suggested syphilis, Roney said, and there was one example of probable tuberculosis. High incidences of metatarsal fracture and of Colles' fracture were observed; dental attrition was common, but caries was rare. Throughout this study, emphasis was placed on epidemiological and ecological aspects.

Brues (University of Oklahoma) discussed the high frequency of anteversion of the femoral neck among native populations of North America. She also referred to her own studies at the Morris Site in Southeastern Oklahoma, where lesions resembling those of syphilis were found to be common; she referred to these as "syphiloid." Brues felt that it was important to try to establish the range and limits of these and other syndromes.

S. F. Cook (University of California, Berkeley) considered some of the implications of Roney's paper, especially with respect to ancient populations and the magnitude and dynamics of the changes that they underwent. Research on paleodemography is scant; paleopathology can be expected to contribute heavily to it. Sites in the interior of California studied by McCown showed incidences differing markedly from those found in Roney's coastal site.

J. E. Anderson (State University of New York, Buffalo) pointed to the differences between Roney's epidemiological point of view and Miles's functionally oriented approach. Referring to his own studies in Mexico, he discussed differences in the pattern of dental disease found in the same site at different periods. He mentioned the difficulty inherent in assuming that the occupants of a cemetery constitute a fair sample of a population. Anderson also pointed out the rarity of dependable statistics on the incidence of disease in prehistoric populations.

Moseley (Mt. Sinai Hospital) described his radiologic studies of the skeleton in contemporary cases of blood dyscrasia, emphasizing aspects capable of being applied to paleopathology. Such conditions include thalassemia, sickle-cell anemia, hereditary spherocytosis, nonspherocytic hemolytic anemia, iron-deficiency anemia, and the erythroid hyperplasia observed in cyanotic forms of congenital heart disease. Cranial changes similar to those which occur in thalassemia have been found occasionally in all these diseases, except that absent aeration of the maxillary sinuses is virtually limited to thalassemia. Absence of aeration is due to swelling of the maxilla, which may also be great enough to cause dental malocclusion and hypertelorism, Moseley stated. If, as sometimes happens, the sphenoid and the temporal bones participate in the swelling, pneumatization may also fail to occur in the sphenoid and mastoid air cells. Paleopathologists occupied with "symmetrical osteoporosis" apparently

have shown little or no awareness of these facts.

Frost (Henry Ford Hospital, Detroit) described his quantitative ("morphometric") studies of the internal and external growth and regression of bone under various conditions, emphasizing measurement of the products of cellular activity rather than the osteoblastic and osteoclastic cells themselves; conditions studied included thyrotoxicosis, hyperparathyroidism, Cushing's syndrome, hypophosphatasia, and many others. Frost also tried to elucidate the biochemical relations between physical loads and the internal remodeling of cortical bone.

The papers of Moseley and Frost were discussed by Blumberg (Armed Forces Institute of Pathology) and Simon (Mt. Sinai Hospital), who showed slides illustrating the preservation of bone structure in prehistoric humans and animals under normal and pathological conditions. Simon showed roentgen films of a prehistoric human skeleton from the collection of the Museum of Northern Arizona, in which there were sclerotic lesions in the pelvis that were roentgenographically indistinguishable from lesions in a person now under treatment for Hodgkin's disease.

In closing, the chairman announced that the establishment of a central Registry of Human Paleopathology is now being planned at a major eastern university. The symposium attendance was 91; the proceedings will be published in the *Journal of the History of Medicine*.

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Sensory Research Discussion: "Sonar" and Electronic Reading for the Blind

Problems encountered by the blind since the beginning of time have included difficulty in navigation and inability to read. To a degree these have been overcome by dog guides, the "long cane," braille, and Talking Book. That sophisticated electronic aids may be on the way is indicated by the proceedings of Sensory Research Discussion No. 53 (Massachusetts Institute of Technology, Cambridge, 10 November 1964), where progress in British research on sensory aids for the blind was reported. American and other efforts were reviewed in prior discussions.

John Hancock Davis continues his work at Bradford Institute of Technology to develop a recognition reading machine for the blind which will react audibly to the optical scanning of ordinary ink-print on paper; he hopes to accommodate several type fonts with his machine.

Patrick W. Nye (National Physical Laboratory) is working on a reading process for the blind wherein lines of ordinary print are scanned optically and certain features of the writing are extracted. The processor detects the presence of ascenders, descenders, "x"-height verticals, horizontal line segments, and diagonally inclined segments. These feature-analysis data are used to control a "resonance vocoder" or "parametric artificial talker" (PAT) which emits an audible output that can be learned.

Don Liddle (University of London) is trying to determine human capability in ferreting out an audible, comprehensible signal buried in noise and the speed with which this can be done. The temporal factor in discriminating a signal in noise is relevant to the mobility of blind travelers because more prompt corrective action after sensing faint sounds, echoes, or sound shadows of dangerous objects increases safety.

In regard to the ultrasonic aid for the blind developed by Leslie Kay (Lanchester College of Technology) and being produced by Ultra Electronics, Ltd., J. K. Dupress (M.I.T.) indicated that six metal prototypes are complete. These hand-held, torch-like devices are about 20 cm long and weigh 340 g. Probing the environment with swept-frequency ultrasonic pulses, these "torches" receive energy returned by reflecting objects and produce a signal which communicates information regarding such objects to the blind user. Kay hopes to develop a miniaturized binaural version of his unit.

J. Alfred Leonard (Applied Psychology Research Unit, Cambridge) is compiling data on the abilities of blind persons to steer straight courses. He is also studying ability to balance on a narrow rail, comparing performance by sighted and blind individuals. Leonard hopes to develop an understanding of the contribution of various degrees of partial vision to performance of such tasks and to capability in mobility. He is also working with auditory means for indicating the course for blind students running on an athletic track. A social survey of the mobility of blind persons in England is also a current project which Leonard hopes will lead to a good base for a long-range research program on mobility of the blind.

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Education in Chemistry: United States and Japan

A United States–Japan conference on chemistry education took place in Oiso, Japan, 16–20 November 1964; the meeting was financed in part by the NSF and the Japan Society for the Promotion of Science. Six Americans and 11 Japanese attended.

The teaching of chemistry at the college undergraduate level was discussed. College chemistry curricula in the two countries were surveyed, with reference to the nature of high school chemistry courses. In Japan, high school chemistry is uniformly controlled by the Ministry of Education, but college curricula vary according to various circumstances; such conditions contrast markedly with those in the United States.

The meeting went on to discuss introductory college chemistry courses; common problems such as teaching techniques in handling large numbers of students and methods of instruction in the laboratory were dealt with. Discussion of the introduction of physical principles such as thermodynamics and quantum mechanics into introductory chemistry courses was especially stimulating; there was common agreement that better ways of uniting the two principles of energy and structure should be sought. Advanced courses in analytical, organic, and physical chemistry were described; suggestions for their rearrangement were made by both Americans and Japanese.

Lastly, the problem of teaching chemistry to nonscience students was dealt with. Reports on experiments were made by both teams; there was universal agreement that such courses should be limited in breadth and greater in depth and perception, rather than the reverse. Various specific recommendations were made to agencies of both governments.

The American delegation consisted