from Affonso Arinhos had fed on February 7, 9, 10, 11 and 14, was found prostrate in its cage with a subnormal temperature and was sacrificed. This animal showed fever on the 17th, 18th, 19th and 21st, but was not bled because of its previous irregular temperature. Microscopic examination of the liver showed typical lesions of yellow fever, including inclusion bodies, and the blood drawn on the day of death gave positive mouse-protection test results. While it was impossible to fix the date of infection of Monkey 5, experience with other animals suggested that infection probably occurred on the 14th, when only one specimen of *A. leucocelaenus* fed.

(2) *Haemagogus capricorni* (Lutz). Between February 7 and 11, six *H. capricorni,* also collected at Affonso Arinhos, were allowed to feed upon Monkey 4. Between February 24 and 26, twelve additional insects of the same species, collected near Bemposta and Pedro do Rio, were allowed to bite the same animal. The monkey first showed fever on February 28 and died three days later. Autopsy findings followed by microscopic examination of the liver indicated that the animal died of yellow fever. Blood drawn on the first day of fever caused typical yellow fever encephalitis in mice. Blood drawn shortly before death produced fatal encephalitis in one of six mice, and also gave positive mouse-protection test results.

It is believed that Monkey 4 became infected from a lot of four mosquitoes which fed on it on February 24. An emulsion of these mosquitoes injected into mice caused typical yellow fever encephalitis. Monkey 3 was inoculated with second-passage mouse-brain material, with the result that virus was demonstrated in the blood stream and specific yellow fever antibodies were afterward found to be present in the serum.

The supernatant fluid from an emulsion of 118 *H. capricorni,* collected in the same infected areas of Bemposta and Pedro do Rio on March 10, produced encephalitis in mice. Transfer of infective brain material resulted in infection of Monkey 6, with demonstrable circulating virus, and the production of specific immunity as shown by the mouse-protection test. Fifty-eight of the mosquitoes included in this emulsion had fed on Monkey 8 without infecting it.

(3) *Sabethine Mosquitoes.* Owing to the numerous species in the sabethine group and the difficulty of naked-eye classification, it proved impractical during this preliminary study to separate the sabethines by species previous to feeding and injection.

Twenty-one of 88 specimens in a mixed group of *Sabethoides, Limatus, Wyeomyia, Goeldia* and *Trichoprosopon,* caught together with the first lot of infected *Haemagogus* at Bemposta and Pedro do Rio, February 24, fed on Monkey 9. This monkey developed no evidence of infection or immunity. The inoculation of the supernatant fluid from an emulsion of the 88 mosquitoes, however, produced encephalitis in mice. Second mouse-passage material produced infection in Monkey 4A with circulating virus and the production of specific immunity.

These results show that one or more of the 88 specimens in this group had fed on an infected person or animal before capture. The negative results in Monkey 9 may have been due to failure of infected mosquitoes to feed, to the non-completion of the incubation period of the virus in the mosquito or possibly to inability of the infected species to transmit, even though capable of conserving the virus for long periods of time.

The evidence presented incriminates two species of forest-inhabiting mosquitoes, *Aedes leucocelaenus* (D. and S.) and *Haemagogus capricorni* (Lutz), as natural vectors of yellow fever, and indicates that one or more species of sabethine mosquitoes may harbor the virus of the disease without definitely implicating them in actual transmission.

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THE TREATMENT OF SPONTANEOUS TUMORS IN DOGS BY THE INJECTION OF HEPTYL ALDEHYDE[1]

FOLLOWING the observation that the addition of heptyl aldehyde to the otherwise normal diet of mice harboring spontaneous carcinomas of the mammary gland brings about liquefaction and certain retrogressive changes of the tumors without injury to the animal by such treatment,[2] it seemed logical to test out the possibility that dogs suffering from spontaneous tumors might respond in a similar manner. The amount of material needed, however, to bring about retrogressive changes in tumors in mice by the addition of the material to the diet would be entirely too great for practical purposes in dogs. Consequently, the subcutaneous injection of small amounts of heptyl aldehyde has been injected into dogs (from 0.10 to 1.00 cc at a time). Injection of the material into mice was found to be impractical for the reason that ulceration at the site of injection invariably occurred. Even though liquefaction of tumors in mice was brought about by the injection of heptyl aldehyde at remote spots, this local reaction interfered with subsequent injections and even with complete recovery of the mouse from a single injection. Due, perhaps, to the tougher skin of the dog, local sloughing of tissue is not pro-

[1] This experiment has been made possible by grants from the International Cancer Research Foundation, the Anna Fuller Fund and from the Jane Coffin Childs Fund. The dogs have been kept under normal outdoor conditions in the Whitney kennels at Orange, Connecticut.

[2] L. C. Strong, SCIENCE, 87: 144, 1938.

duced by the injection of freshly prepared heptyl aldehyde. Extreme care, however, of keeping the heptyl aldehyde free of excessive decomposition products has always been employed. A temporary edema was produced with the larger injected doses.

So far, ten dogs with various types of spontaneous tumors have received periodic injections of heptyl aldehyde. Improvement of the dogs by body weight increase, physical appearance and general activity has been the rule in all cases. Softening of the tumors (with complete regression of the mass in several dogs) has been obtained in all dogs, except one that has a mammary gland tumor which is heavily infiltrated with calcium. The same type of liquefaction has been obtained in dogs as was had in the tumors of the mammary gland in mice. Following periods of softening and of draining of clear fluid, the tumors as a rule have gradually disappeared.

Injections have usually been performed at sites remote from the tumors. In a few cases, however, when the tumor was large (the size of a baseball or larger), the first injection was performed directly into the tumor and this was followed, when the tumors began to slough off, by injections at remote sites to the tumors.

The details of this investigation shall be published within a reasonable time. The data so far obtained, however, are so encouraging that this note is published.

The first two dogs with spontaneous tumors (both fibroadenoma of the mammary gland, as indicated by biopsy) which have been given the present treatment of the injection of heptyl aldehyde warrants further comment. One dog, a cocker spaniel female, eight years old, had numerous hard nodules throughout the mammary gland. These ranged in size from a pea to a lump 2.5 inches in diameter by $\frac{5}{8}$ inch thick. A mass 2 inches in diameter had been removed by operation a year previously. The dog had not had a normal heat period for more than two years. For example, at her last period in August–September, 1937, she had remained in heat for at least 40 days, during which time she accepted a male eight times over the entire period without any signs of pregnancy. Two months following the start of the first treatment with heptyl aldehyde she had a normal heat period. She was bred to a male normally and twenty-four days later, she had normal size embryos. These embryos subsequently became resorbed—a phenomenon which is not surprising when it is realized that heptyl aldehyde in mice acts as an abortifacient. This resorption of embryos may, however, have been due to the age of the dog. The dog has gained weight and is in normal health at the present time without any sign of tumor. The second dog, a Scottish terrier of similar age, had a solitary nodule in the breast about the size of a small orange. After several treatments with heptyl aldehyde (remote to the tumor) the mass completely regressed. The dog has gained weight and is apparently in normal health, having since treatment had a normal heat period, whereas, previously she had a long history of prolonged and abnormal heat periods with numerous failures to conceive.

It is realized that spontaneous tumors in dogs do occasionally regress. It is also recognized that many dogs do continue to grow their tumors until death results. The proper analysis and evaluation of the present data must wait until statistically significant numbers are obtained. The data so far obtained are noteworthy, and it is planned to carry on the work on a larger series of dogs and other animals suffering from spontaneous tumors.

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RELATIONSHIP BETWEEN MEAN SEA LEVEL AND SAND MOVEMENTS[1]

AT the Scripps Institution of Oceanography there is a 1,000-foot pier, extending from a sandy beach out into the open ocean. For two years, weekly measurements of sand elevations were made from the pier to determine the beach profile and the changes in sand elevation. These observations were taken at stations 20 feet apart, along the length of the pier. Since October, measurements have been made daily, and during one 36-hour period, on October 20 and 21, these measurements were made every 40 minutes.

Continuous readings of sea level are available from the Coast and Geodetic Survey tide gauge, located on the end of the pier. Averaging these hourly sea level heights for days, weeks and months gives the mean sea level for these periods. The distances from the deck of the pier to the sand at 50 equally spaced stations were averaged for the same periods. Both mean sea level and mean sand level show considerable variation. The accompanying figure shows that there is a decided relationship between the two.

It will be observed that a rise or fall in mean sea level is accompanied by a rise or fall in the mean level of the sand. The average ratio of these changes is roughly 3 to 1, that is, a rise of one foot in mean sea level is accompanied by approximately a three-foot rise in the mean level of the sand. The agreement of course is not perfect, and some instances of marked deviations will be observed.

These changes show a distinct relationship to the seasons during the two-year period. It will be noted

[1] Contributions from the Scripps Institution of Oceanography, New Series, No. 7.