In March the only immature individuals in the colonies of *Tenuirostritermes* were the large brachypterous nymphs (with rudimentary wings), destined to become the alates which swarmed in July with the summer rains. The colony consisted almost entirely, therefore, of terminal sterile individuals, the workers, and the nasutes.

The cycle in *Gnathamitermes* differs strikingly from that of *Tenuirostritermes* in several features. In addition to the workers, soldiers, and brachypterous nymphs, there were present in colonies of *Gnathamitermes* many apterous individuals like the workers but slightly smaller and with unpigmented heads. These proved to be the late nymphal instar of the sterile castes.

Beginning in early April some of these nymphs were found to be molting into the worker stage and from May 15 callow soldiers were found in some colonies. Therefore, the older apterous nymphs found in *Gnathamitermes* colonies may be of two types, one destined to become workers, the other to become soldier nymphs; or they may be indifferent, capable of giving rise either to workers or to soldiers.

Eggs were first found in *Tenuirostritermes* colonies on April 3. On April 24 eggs were first recorded in *Gnathamitermes* and probably first appeared there a week or two earlier. Eggs were abundant thereafter in the colonies of both species until our departure in late August, and presumably for some time after that.

The existence of the restricted period of reproduction in our species of Termitidae makes it possible to determine with certainty the lines leading to the several castes, since their appearance from the first eggs may be followed chronologically.

Thus, the junior author was able to trace, in some detail, the lines of development of the different castes of *Tenuirostritermes*. Conclusions made from field observations were checked by segregating the different stages and observing in the laboratory the stage derived from each by molting. The outstanding feature of her findings was that the three major lines leading, respectively, to the nasute, the worker, and the alate types are differentiated very early in development and can be distinguished readily from a very early molt—certainly the first molt for the nasutes and probably also for the other two castes. It seems safe to say that the nasute line is determined sometime during the first stadium. Both Emerson (*3*) and Bathellier (*1*) show the nasute-like "nasute nymph" molting from a pigmented, worker-like stage, whereas we found that the nasute of *Tenuirostritermes* molts from an entirely unpigmented nymph and confirmed this origin in the incipient colony. The reduction by one in antennal segments recorded by Emerson and Bathellier was found to occur also in *Tenuirostritermes*.

Nymphs initiating the worker line arise from large-bodied nymphs probably of the first instar. These do not molt until several days after the appearance of the nymphs of the nasute line.

The time required for the development of each of the various stages of the sterile castes in the primary colonies of *Tenuirostritermes* in the laboratory agreed closely with that in the first brood of the year in older colonies in the field.

The young of the alate line, made obvious by the possession of wing buds, arise from large-bodied young nymphs indistinguishable from those which give rise to the worker line. The first wing-budded nymphs were observed in August, after the alates had flown, whereas the nasute and worker lines were being renewed from the time of the first appearance of young, about May 1.

More than 400 pairs of dealated reproductives of each species were set up and allowed to develop as primary incipient colonies. Many of these seemingly developed normally. The incipient colonies of the two species were found to differ in the development of castes in the same ways as did the older colonies in the field. Flourishing incipient primary colonies of *Tenuirostritermes* consisted of from 15 to 20 nasutes and 45 to 55 workers. In *Gnathamitermes* colonies, the numbers were smaller (20–30), and no soldiers or workers appeared, all developing to the last apterous nymphal stage and remaining in that stage for months beyond the time when all members of *Tenuirostritermes* primary incipient colonies had become either workers or nasutes.

The conditions reported here make it obvious that primary colonies of *Gnathamitermes* are not favorable subjects for experiments on determination of castes, since the nymphs do not complete their development until the following year. The same is true for *Amitermes wheeleri*, whose reproductive cycle parallels that of *G. perplexus*.

The primary colony of *Tenuirostritermes* offers certain important advantages for experimental studies. The primary pair contain all the food necessary to allow the large primary group to develop to the definitive caste, worker or nasute. This development takes place rapidly, the first worker appearing about 60 days after setting up the dealated pair and the first nasute about 3 days later. It should be possible, therefore, to test the inhibiting effect of the presence of introduced workers or nasutes upon the caste development within such primary colonies.

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Lethal Effect of X-Rays on Marine Microplankton Organisms[1]

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Published literature concerning the effect of X-rays upon free-living microorganisms has dealt chiefly with fresh-water life. Ralston (*1*), however, found dosages of about 18,000 r lethal to *Dunaliella salina*. The present experiments deal with four genera of Protista obtained through the courtesy of Vance Tartar, of the State of Washington Department of Fisheries. These may be designated as (1) *Chlorella* sp. (Loosanoff's culture), a 2-μ, spherical green alga; (2) *Nitzschia closterium* (Loosanoff's culture), a diatom; (3) an unidentified green car-

[1] This paper is based on work performed under contract No. W-28-094-eng-33 with the Manhattan District-Atomic Energy Commission.

teriid mastigophoran 14 μ long with four flagella, from Burley Lagoon, near Gig Harbor, Washington; and (4) an unidentified brown mastigophoran 8–10 μ long with two long flagella, from Rosedale, Washington.

On February 28, 1946, seven 5-cc. samples, taken in a random manner from each of the cultures, were removed to 1-dram shell vials for experimentation. The cultures filled the vials to a depth of about 38 mm. Two of each series, the first and the last removed, were used as controls. The other 5 vials were subjected at the rate of 132 r/minute to doses in roentgens of 1,000, 10,000, 25,000, 50,000, and 100,000. X-rays were produced at 200 kv. and 20 Ma. with filters of 1 mm. of aluminum and 0.5 mm. of copper. The target distance was 13 inches as measured to the middle of the depth of the culture in the vials. The vials were arranged in a cluster of 4-inch maximum diameter. On March 1 a second series of cultures was also exposed to the same amount of radiation, but in order to shorten the time of exposure the rate was increased to 530 r/minute by halving the target distance to 6.5 inches.

The number of swimming brown flagellates was determined by the use of blood-counting chambers immediately after the removal of the last vial from the X-ray machine. The dose that was immobilizing to 50 per cent of these organisms within 24 hours appeared to be about 50,000 r, while 100,000 r was almost 100 per cent effective. Viability was not readily ascertained in the other species. After irradiation the cultures were transferred to larger vials of 6-dram capacity, and 12 days later were subdivided, about two-thirds of each being removed to an 8-ounce jar. Several days later, when the culture had evaporated to about half of its original volume, the loss was compensated by adding sea water containing 0.1 per cent of milk. Population densities in the cultures were determined at irregular intervals by counting the number of organisms per unit volume of culture, using ruled blood-counting chambers.

TABLE 1
SUMMARY OF FIRST MONTH'S COUNTS EXPRESSED AS PERCENTAGE OF HIGHEST COUNT

Dose in r	*Chlorella*	*Nitzschia closterium*	Carteriid	Brown mastigophoran
0	100	100	80	29
0	83	72	100	100
1,000	94	67	67	66
10,000	75	34	61	37
25,000	58	20	46	0
50,000	43	12	14	0
100,000	23	8	81	0

The results shown are based on counts made only during the first month of the experiment. For the first 45 days there was general agreement in the effect upon all four organisms. Later tendencies of the counts extending to 5 months were erratic or obscure, possibly because of contamination of cultures. The concentrations of each organism at the various dosage levels are compared in Table 1. To arrive at these figures for a species, the counts in each irradiation group were averaged and then expressed as percentage of the highest average count for that species. The carteriid counts at the 100,000-r level were high and suggest faulty technique, but other counts were in general inversely related to amount of exposure above 1,000 r. The counts of cultures exposed to 50,000 r and 100,000 r were low. Counts of cultures exposed to 1,000 r were not unlike the controls in that in 9 cases these were greater than, and in 10 cases less than, the controls. On this same basis of 19 counts for each culture the times that the 10,000 r treatment exceeded the control were twice; for 25,000-r, once; for 50,000 r, none; and for 100,000 r, once.

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The Contagious Nature of a Lymphoid Tumor in Chickens

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Nearly all treatises on tumors stress the point that little foundation exists in the theory that a tumor, or any agent responsible for a tumor, is communicable in nature. Arrayed against this theory of noninfection is the ever-increasing amount of data suggesting a virus etiology for certain tumors. The specificity of certain of the viruses and the indisputable evidence of infection, direct or indirect, that is associated with virus diseases, lead one to continue the search for a virus or virus-like agent which causes tumors and which is transmissible by contact with infected animals. Again, the knowledge which has been gained in an overall study of other diseases leads one to believe that, in the genesis of specific types of tumors, some orderly pathogenic stimulus is necessary to incite, directly or indirectly, neoplastic growth. Likewise, the myriad of seemingly spontaneous tumors occurring in the animal kingdom exists because certain necessary requirements of host-pathogen-environment relationship have been fulfilled.

In strains of mice susceptible to pulmonary tumors, it is not unusual to find that approximately 90 per cent of the animals at 18 months of age show "spontaneous" tumors (*3*). A description of these indicates such a similar host reaction that it is difficult to believe they were not activated by a common agent and that this agent, through some as yet unexplained manner, can find a portal of entry from one animal to another. Bittner (*2*), Andervont (*1*), and others have shown that mammary adenocarcinomas in mice were due primarily to the relationship between the genetic influence, the hormonal influence, and the milk influence in certain individuals. Discovery of an agent responsible for mammary tumors in mice was the result of carefully designed objective experimentation which included the development of host animals of similar genetic potentialities.

Among the important factors working against any experiment attempting to prove the communicable nature of agents responsible for tumors are the following: (1) If a tumor agent were transmitted by contact from one animal to another, the length of time which elapses before a tumor is grossly visible is generally too great to ascertain that such contact had any relationship to the tumor eventually formed. (2) It is almost impossible to be sure that the experimental animals are actually free of any tumor agent prior to the time of exposure. (3) There are not available enough experimental inbred animals which