

weights over a period of 2 months. One mouse was unaffected.

Six normal mice were radiated in the same way and none of these developed signs of homologous disease or had a positive antiglobulin test. There was a slight, transient weight loss and leukopenia, but within 2 weeks these control mice were completely normal.

Three other groups of BDF₁ mice were also given 400 r of total body radiation: group A, six mice that were given 400×10^6 or less C57Bl/6 spleen cells 5 months before radiation; group B, six mice that had received 440×10^6 C57Bl/6 spleen cells 6 months before radiation and that were "cured" of homologous disease by the administration of prednisone (3); group C, eight mice that had received 400×10^6 C57Bl/6 spleen cells 9 months before radiation and that were "cured" of homologous disease by the administration of 6-mercaptopurine (3). None of these mice died and none developed overt signs of homologous disease, although two mice in group A, one mouse in group B and two mice in group C developed transient, weakly positive antiglobulin tests.

A substantial body of evidence indicates that homologous disease is due to an immunologic attack by grafted cells against the host. Since the disease in the radiated mice of these experiments was identical in every respect to severe homologous disease, the present results indicate that grafted lymphoid tissue may reside dormant in the hybrid recipient for a long period of time. The cells are not destroyed by "exhaustive sensitization," since they are quickly triggered into action by sublethal doses of radiation. It is not known why the parental cells are inactive, and the role of radiation in activating them is not clear. However, in view of the recent finding that radiation disrupts acquired immunologic tolerance (4), it is possible that in some mice the parental cells develop tolerance to host antigens, thus mitigating the development of homologous disease. Radiation might break the state of tolerance in the graft by at least two mechanisms: (i) inhibiting a host versus graft reaction (5), and (ii) stimulating proliferation of the grafted tissue. Evidently, a critical number of grafted cells is necessary, since mice given small numbers of parental cells (group A), or recipients in which the grafted cells were presumably destroyed by chemotherapy (groups B and C) failed to develop the reaction.

The analogy between homologous disease and human autoimmune disease has been stated previously (1). The present experiments offer a striking model of the exacerbation of chronic lymphocytic leukemia or lymphosarcoma by radiation or alkylating agents. In these cases, not only does the course of the disease accelerate, but autoimmune phenomena frequently appear. Perhaps a similar phenomenon, namely abrogation of "tolerance" of the tumor for the patient's antigens, occurs in some cases of malignant lymphoma treated with these agents (6).

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Altruism or Arousal in the Rat?

Abstract. *If rats are exposed successively to white noise, then to recorded rat squeals, or alternatively to squeals first and then white noise, and if, in both situations, they are allowed to shut off the auditory stimulation by applying pressure on a bar, they will touch the bar more frequently when exposed to white noise. The results indicate that the bar-pressing behavior is the expression of increased activity resulting from the increased stimulation.*

Rice and Gainer (1) have described behavior in the albino rat which, they suggest, might be homologous to altruism. Their rats would press a bar to lower a suspended animal showing obvious signs of distress, such as "squealing and convulsive wriggling." Since the operating rats in this situation pressed the bar significantly more often

than control animals, their behavior was interpreted as being altruistic.

This conclusion does not follow unless it can be demonstrated that the bar is pressed specifically to relieve the distress of the other animal. Indeed, there could be various reasons for the behavior described by Rice and Gainer. The extra stimulation in the experimental, as opposed to the control situation, may raise the general activity level of the organism and hence increase the number of bar presses. This could be considered an arousal phenomenon. For the purposes of the present study, the question is simply: is there some specific component in the squeal of a distressed rat which triggers, in a listening rat, behavior calculated to relieve the distress, or does the increased stimulation result in increased activity?

To resolve this problem an experiment was carried out with ten male albino rats of the Wistar strain, all experimentally naive. From the age of 5 weeks they were handled and weighed daily. At 6 weeks they were introduced to an experimental box constructed according to the specifications of Rice and Gainer (1), in two groups of five, chosen at random. Each group remained in the box for 10 minutes. For the next 7 days, each rat spent 10 minutes alone in the experimental box.

Two weeks later each rat of group I was placed in the box, individually, and immediately the white noise was switched on by the experimenter. Whenever the subject touched the bar, the noise was turned off for 15 seconds. If the subject touched the bar again during the 15-second quiet period, an additional 15-second period of silence was allowed before the noise was switched on. Group II was subjected to exactly the same treatment, with the exception that it was exposed to the recorded squeals. Each rat remained in the box for 10 minutes, and the number of times it touched the bar was recorded.

Both groups were tested under the conditions described above for 5 consecutive days. After 2 days of rest, they were tested for another 5 days, with the conditions interchanged, that is, group I was exposed to squeals and group II to white noise.

To obtain "squeals," two other rats were placed in the box and subjected to electric shock. The squeals were recorded on Ampex Instrumentation tape, with an Ampex tape recorder, type 311-2. A loop was made from this recording and analyzed with the Bruel

Table 1. Analysis of variance on number of bar presses under the two treatments with trials pooled.

Source	df	MS	F
Between subjects	9	315.1	3.63
Between sessions	1	57.8	
Between treatments	1	5313.8	61.3*
Remainder	8	86.7	

* $p < .001$.

and Kjaer noise-measuring system, consisting of a condenser microphone cartridge type 4131, a cathode follower (type 2613), an audio spectrum analyzer (type 2109), and a level recorder, type 2304. The tape loop could be played back, through a power amplifier, and an Altec 604 speaker. A white-noise generator, Grason Stradler No. 455.3, could be switched into the system instead of the tape recorder, the output being 80 db relative to 0.002 dyne/cm². The speaker enclosure was mounted in such a way that the experimental box could be placed directly under the speaker.

The results of the experiment are shown in Fig. 1. The average number of times the bar was touched for white noise is roughly the same for both groups after the first two trials, and is consistently higher than that for squeals, which is also roughly the same for both groups. Group I, exposed initially to white noise, takes three trials to reach asymptote. The analysis of variance (Table 1) shows a significant difference between the "noise" and "squeal" treatments.

The results show clearly that there is no specific component in the squeal of a distressed rat which evokes what might be called altruistic behavior, when this behavior is defined as pressing a bar to stop the squeal. On the other hand, when the sound of white

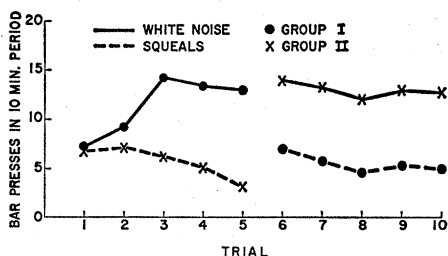


Fig. 1. Average number of bar presses in a 10-minute period, for two groups of rats, one group being exposed to white noise on five successive days followed by exposure to "distress" squeals on another five successive days, the other group being exposed to "distress" squeals, followed by white noise.

noise can be stopped by pressing a bar, rats learn to do this very quickly, and maintain a comparatively high level of responding. Therefore, the squeals and the white noise must be regarded simply as two sources of auditory stimulation, the latter giving rise to more behavioral activity than the former.

Further, the fact that the group exposed to white noise on the first five trials reaches asymptote only on the third trial suggests that this increased activity is directed rather than undirected. This might indicate that the stimuli are noxious in differing degrees. However, comparison between data from the present study and that of Rice and Gainer shows that the number of bar presses reported by the latter authors lies between those of the recorded squeals and the white noise. This adds support to the activation explanation, since increased arousal could be expected in the Rice and Gainer situation where squeals were provided by a wriggling rat (on a hoist), prodded by

an experimenter, in a compartment very close to the bar. On the other hand, one would not expect the squeals to be more noxious simply because the experimenter and a live rat are present. Furthermore, in the Rice and Gainer situation, bar pressing did not suppress the presence of either the rat or the experimenter. The comparison is also more difficult to explain if the bar-pressing behavior is interpreted as altruistic, since, in that case, both situations with squeals—either live or recorded—should yield more frequent bar pressing than the white noise.

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Nature of Cohesion within Pollen Tetrads of *Typha latifolia*

Abstract. Pollen tetrads in *Typha latifolia* result from the fusion of the outermost portion of the exine (the tectum) where microspores within the meiotic tetrad are contiguous. Exine stratification is discussed.

The electron microscope has been used successfully by a number of investigators (1) to study the nature of pollen exine stratification and fine structure. However, none has investigated pollen which remains in tetrads or polyads at maturity. Pollen tetrads and polyads are common in a number of families (2) and have been used in systematic treatments to separate genera and species (3); they have also been treated as phylogenetically advanced over monads (4). The genetic basis for pollen tetrad formation is little known, though Levan (5) has reported a *Petunia* line containing a recessive gene for pollen tetrad formation. In an attempt to obtain an insight into the nature of cohesion in pollen tetrads a sample of *Typha latifolia* L. pollen was obtained for study. Wodehouse (6) has reported that pollen tetrads of *T. latifolia* are generally of the isobilateral or rhomboidal types with a number of other orientations occurring. Wodehouse characterized the ornamentation of *T. latifolia* pollen grains as finely reticulate, with the reticulate pattern present on all surfaces including those involved in cohesion. While Wodehouse

was not able to discern the presence of columellae supporting the ornamentation, Erdtman (7) indicates that columellae are present in *T. capensis*.

Pollen of *T. latifolia* was collected fresh and placed in 70-percent ethanol for 24 hours to clean pollen surfaces of oil droplets and remnants of tapetal materials. The cleaned sample was divided into two portions. The first was stained by 1-percent OsO₄ at room temperature for 2 hours; the second portion was acetylated (heated to 100°C in a mixture of 9 parts acetic

Table 1. Exine thicknesses of *Typha latifolia* pollen. Thicknesses are averages of representative wall areas, as measured from electron micrographs.)

Component	Thickness (μ)
<i>Free-wall surface</i>	
Tectum (including spinules)	0.6
Columellae	.2
Foot layer	.45
Endexine	.1 or less
<i>Cohesion surface</i>	
Shared tectum	0.14
Columellae	Barely perceptible
Foot layer	.15
Endexine	.1 or less