azimuth, observed from the McDonald Observatory, Fort Davis, Texas. The behavior of the dust layer was also observed after sunset on 2 October from an altitude of 30,000 ft over Ohio, although no definitive height observations could be secured.

On the evening of 5 October we timed the transit of the earth's shadow through the layer, which occurred at the true horizon 45 ± 1 minutes after local sunset. The appearance of the sunset glow is one of pure golden color, rather uniform in intensity up to a distinct pinkish gold upper boundary. The upper boundary describes an arc of a circle with a maximum height on 5 October about 5° south of the solar azimuth. Above the boundary the sky appears deep blue, but a fainter lavender glow with a less distinct upper boundary could be seen against the darkening sky. The time of disappearance at the horizon of the upper boundary of the fainter secondary glow was 69 ± 1 minutes after local sunset on this date.

On 6 October the secondary glow was hard to distinguish and on 7 October no trace was visible, although on the latter date the haze layer was so opaque that even the sunlit upper boundary of the primary glow could not be clearly distinguished. The twilight on 7 October, however, deepened quite slowly ending $1^h\ 30^m \pm 10$ minutes after sunset, apparently caused by multiple scattering in the ash stratum.

The times measured can be readily converted into a height of the boundary of 22.3 km (73,000 ft), for the brighter glow, and 52.6 km (173,000 ft), for the fainter. No correction for refraction was made since the times of sunset and occultation at the horizon were both measured directly. The effect of horizon screening is also assumed to be the same as that of the additional refraction of the illuminating solar rays in the computations.

It is well established that the presence of the ash from the eruption of the volcano Agung on Bali on 17 March 1963 became apparent some months ago at Mt. Stromlo Observatory near Canberra, Australia (32°S), where it has caused the photoelectric extinction coefficients to be significantly increased. Bok (*1*) has reported to us that the dust is readily visible as a disc of white scattered light extending 20° to 30° diameter about the sun. The intensity of the dust that has apparently diffused to 30°N is much less conspicuous, to date, and it is only readily visible after sunset and before sunrise.

It is interesting to note that the eruption of Krakatoa on Java in 1883 produced a glow stratum with an average height of 18 km (*2*) which lasted several years, producing brilliant sunrise and sunset glows even in the high latitudes of the northern hemisphere. Therefore, the height measured by us is in good agreement with that reported for Krakatoa. We would like to point out that some ash from Agung appears to have been injected into the thermal rise in the mesosphere since the height of the secondary layer of 53 km is well above the thin stratosphere at the latitude of Tucson, Arizona. A similar high layer (*2*) presented an appearance that was debated as a secondary reflection of the primary glow.

The intensity and detailed appearance of the sunset glow changes from day to day and a study of the appearance of the glow and height determinations over an extended period of time and from as many places as possible should be useful in the study of the circulation of the high atmosphere.

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7 October 1963

## Natural Kinin in Peach Fruitlets

Abstract. *An aqueous extract from peach fruitlets caused a kinin-like stimulation of olive callus in tissue cultures. Activity appeared only when indole-3-acetic acid was also used. The extract caused weight increase and growth characteristics similar to control cultures provided with commercial kinetin.*

Of the few known sources for plant extracts that are active in plant cell division (*1*), the most common are coconut milk, coconut meat, and maize endosperm. In 1959 Goldacre and Bottomley extracted such a fraction from apple fruitlets (*2*). Using tobacco pith they compared it with synthetic kinetin.

We extracted from peach fruitlets a highly active fraction that promotes cell division. One hundred grams of fruitlets 10 to 15 days old were autoclaved in water for 5 minutes immediately after picking and then homogenized. After filtration, the clear solution was frozen and stored in the dark.

Table 1. Effect of aqueous extract of peach fruitlets on the growth of olive callus in vitro, in the presence and absence of the growth regulators IAA (2 ppm) and kinetin (0.2 ppm). Results are expressed in milligrams (fresh weight) per tissue. Each figure is the mean of ten repetitions.

| No regulator | IAA | Kinetin | IAA and kinetin |
|---|---|---|---|
| | *No extract* | | |
| 7 | 19 | 30 | 152 |
| | *Extract from 250 mg of fruitlets* | | |
| 19 | 268 | 32 | 274 |
| | *Extract from 1 g of fruitlets* | | |
| 12 | 210 | 13 | 181 |
| | *Extract from 4 g of fruitlets* | | |
| 14 | 9 | 13 | 13 |

This extract was added at various concentrations to a modified White's (*3*) culture medium (the inorganic fraction was doubled, and the *p*H was adjusted to 6.6). Indole-3-acetic acid (IAA) and kinetin were added to this medium separately and in combination. Olive callus, grown in vitro for six subcultures, was used as the test tissue. Two pieces, about 12 mg each, of 7-week-old callus, grown in the dark, were planted in each flask and grown under dim incandescent light at 26°C. Their weight after 49 days is shown in Table 1.

Normal olive callus growth could be achieved in the control cultures only in the presence of both IAA and kinetin. However, with the addition of the extract, intensive growth occurred also when IAA alone was included in the medium.

High concentrations of the extract inhibited growth. This inhibition seemed to be due to interfering substances, for it occurred at the same concentration both with and without the addition of kinetin. The quality of growth of the cultures was about the same when both regulators were used without extract and when only IAA was used with extract. Thus extract compensated for the absence of kinetin in promoting growth. Hence a natural highly active, kinetin-like substance was present in the fruitlet extract (*4*).

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4. Thanks are due G. Messer for technical assistance. This is contribution No. 524-E, 1962 series, from the National and University Institute of Agriculture, Rohovot, Israel.

9 August 1963


## Thymus: Its Limited Role in the Recovery of Homograft Response in Irradiated Mice


Abstract. *Adult mice subjected to thymectomy or sham thymectomy received lethal irradiation and subsequent protective infusion of syngeneic bone marrow. Thirty days later they received allogeneic and xenogeneic skin grafts. Donors of the xenogeneic grafts were rats. The thymectomized mice rejected the grafts of rat skin only slightly later than the controls did; in contrast, the time of retention of allogeneic grafts was significantly longer in the thymectomized mice.*


Recent reports (*1*, *2*) have indicated that the thymus in an adult animal is essential for the complete recovery of the homograft response after irradiation at lethal and sublethal dosages. However, work at the U.S. Naval Radiological Defense Laboratory, San Francisco (*3*), suggests that, while a normal homograft response toward allogeneic grafts appears to be dependent upon normal thymic function, the thymus of the adult mouse plays little or no role in the rejection of xenogeneic skin grafts from rat donors. The work of Miller *et al.* (*2*) with thymectomized adult mice that had received irradiation at lethal dosages and protection against the lethal effects of the radiation through subsequent infusion of syngeneic bone marrow provided an excellent experimental model with which to further evaluate the role of the thymus in the rejection of allogeneic and xenogeneic skin grafts.

In male mice 12 to 14 weeks old, of strain (C57L × A)$F_1$ (hereafter designated "$LAF_1$") thymectomies or "sham thymectomies" were performed according to the method of Miller (*4*). One week after surgery the mice received 870 rad of whole-body x-radiation [$LD_{99}$ + 100 rad: 250 kv(peak), 15 ma; half-value layer, 1.5 mm Cu; 30 rad/min]. Immediately after irradiation the mice received an intravenous infusion of syngeneic bone marrow cells ($3.0 \times 10^6$ cells). Thirty days after irradiation the surviving mice received grafts of syngeneic, allogeneic, and xenogeneic skin. Donors of the allogeneic grafts were mice of a strain that differed from that of the recipient with respect to the H2 locus. The donors of the skin grafts were adult male mice of strains $LAF_1(H2^{ab})$, BALB/c ($H2^d$), and (C3H × DBA/2)$F_1$ (or "C3D/2$F_1$") ($H2^{kd}$), and 3-week-old male Sprague-Dawley rats. The method of Bailey and Usama for orthotopic grafting of tail skin was used (*5*). Details of the grafting and the criteria of rejection (total destruction of the engrafted tissue) have been reported elsewhere (*3*). In Table 1, mean survival time of the grafts, with standard deviation, is reported for the groups in which the rejection of all grafts was complete at the time of writing. The survival time for each graft is reported for the groups in which some allogeneic grafts remained intact.

Eight of nine mice (strain $LAF_1$) in which sham thymectomies had been performed and 10 of 12 thymectomized mice of the same strain survived irradiation. The mice subjected to sham thymectomy rejected allogeneic grafts in approximately 14 days and grafts of rat skin in 10 days (Table 1). The thymectomized mice rejected rat grafts in approximately 14 days; in contrast, the first allogeneic graft was rejected at 18 days after grafting, and 11 of 20 grafts were intact 40 days after grafting.

These experiments suggest that the recovery of at least one function of the "immune mechanism"—the function of the rejection of xenogeneic grafts—after irradiation of lethal dosages is not dependent upon the presence of the adult thymus. These and other data (*3*, *6*) suggest, further, that grafts of xenogeneic solid tissue are rejected by a cell system functionally and physiologically distinct from the "thymus-dependent mechanism" (*2*).

Failure of syngeneic bone marrow with its lymphoid cell component (*7*) to restore the normal "lymphopoietic and immune functions"—the function of the rejection of allogeneic grafts—in these mice underlines the importance of the host contribution to the immune mechanism of the radiation chimera. It appears that the host contributes its thymic regulatory apparatus (*1*, *2*, *8*) and perhaps the cell system which deals with grafts of xenogeneic solid tissue (*9*).

Table 1. Rejection of allogeneic and xenogeneic skin grafts by adult mice of strain $LAF_1$ that had been subjected to thymectomy, or sham thymectomy, and irradiation at lethal dosages. The mice were protected against the lethal effects of the x-irradiation by an infusion of cells of syngeneic bone marrow.

| No. of mice | Survival time of graft (days)* | | |
|---|---|---|---|
| | Strain BALB/c | Strain C3D/2$F_1$ | Rat |
| | *Sham thymectomy* | | |
| 8 | 14.1 ± 4.2† | 14.7 ± 3.0† | 10.0 ± 1.4† |
| | *Thymectomy* | | |
| 10 | 18, 25, 30, 30, 35, 40, 40, 40, 40, 40, respectively | 28, 30, 32, 32, 40, 40, 40, 40, 40, 40, respectively | 14.0 ± 2.4† |

* Times as of day 40 after grafting. † Means, plus or minus standard deviation.


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9. The studies reported here were supported in part by funds from the Bureau of Medicine and Surgery, U.S. Navy.

19 August 1963