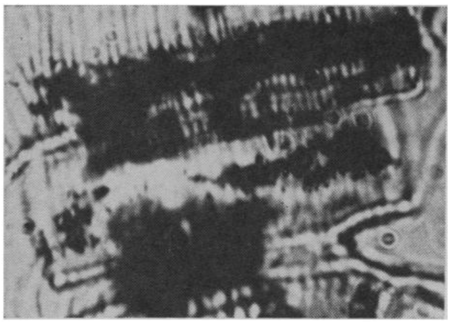

Fig. 2. Microradioautogram of ^{14}C-NAA in the xylem tissue of a petiole 2 days after the tissue was debladed and $10^{-3}M$ ^{14}C-NAA was applied to the petiolar stub (× 400).

in air, liquid emulsion (Type NTB-2, Eastman Kodak) was spread evenly over the sections, dried, and exposed in a volatile-free box containing $CaCl_2$. The microradioautographs were developed, and the sections were stained with Azure B.

The distribution of ^{14}C-NAA in the lower pulvinus during development of the abscission layer is depicted in the microradioautograms in Fig. 1, *A* through *E*. The abscission layer was first evident 3 days after application of $10^{-3}M$ ^{14}C-NAA to the petiolar stump. The first localization of labeled NAA occurred at this time and became more pronounced at 4 days (Fig. 1, *B* and *C*). By the 5th and 6th day the abscission layer was readily evident, and considerable radioactivity was localized in or between the cell walls of tissue immediately adjacent and distal to the abscission layer (Fig. 1, *D* and *E*). There was no localization of ^{14}C-NAA in the abscission layer (Fig. 1*E*).

Conductive tissue appeared to be a pathway for basipetal movement, since numerous xylem elements were heavily labeled (Fig. 2).

When ^{14}C-NAA was applied at $10^{-5}M$, the abscission layer was well-defined 2 days after treatment. Abscission of the petiole was promoted at this concentration, whereas at $10^{-3}M$ NAA abscission was delayed. No labeled NAA accumulated in the abscission layer per se, but rather in tissue adjacent and distal to the abscission layer (Fig. 1*F*).

We interpret the absence of ^{14}C-NAA localization in the abscission layer to mean that the abscission layer is not the primary locus of NAA action. More likely, NAA influences abscission indirectly through tissue distal to the abscission layer.

Another possible interpretation is that the abscission layer forms a physical barrier resulting in accumulation distal to it. We have found that basipetal movement of phosphorus and ribidium through the abscission zone increased after the 3rd day (following deblading); however, calcium decreased (*6*). Further, if ^{14}C-NAA localization was related solely to the presence of the abscission layer, then accumulation would be expected to occur earlier at $10^{-5}M$ than $10^{-3}M$, and this was not the case.

Of further significance is the similarity of ^{14}C-NAA distribution patterns (Fig. 1, *E* and *F*) observed subsequent to treatment at concentrations known (*3, 4*) to delay ($10^{-3}M$) and accelerate ($10^{-5}M$) abscission. In these studies (data not reported) $10^{-3}M$ NAA delayed abscission by 3 days and $10^{-5}M$ accelerated abscission by 2 days as compared to a lanolin control. At $10^{-3}M$ both the auxin gradient and concentration should favor a delay in abscission. Presumably, also at $10^{-5}M$ the auxin gradient and concentration would be expected to delay abscission, but abscission was accelerated. Thus, our data do not support either the gradient or concentration concept as an explanation for auxin control of abscission, but do confirm the absence of a correlation between distally applied NAA detectable on the two sides of the abscission layer and the abscission process (*7*).

Addicott (*2*) visualizes the acceleration of abscission by low concentrations of NAA as an antagonism to auxin whereby the effective concentrations of endogenous auxin are lowered. Rubinstein and Leopold (*7*) and Rasmussen (*6*) have found an induction period during which auxin delayed abscission, but after its completion accelerated abscission. In view of these findings, another explanation may be that the auxin optima of the two processes are such that the effect of low auxin is mainly on the postinductive process, that is, the induction period is not delayed but the postinduction period is accelerated, as suggested by Rubinstein and Leopold.

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Scolytid Beetles Associated with Douglas Fir: Response to Terpenes

Abstract. *Douglas-fir oleoresin and the terpene hydrocarbons (α-pinene, β-pinene, limonene, camphene, geraniol, and α-terpineol) attracted various bark and timber beetles associated with Douglas-fir forests during their flight. In responding to these volatile terpenes the bettles are directed to favorable breeding material.*

Several species of bark and timber beetles (family Scolytidae) select and invade physiologically weakened or damaged or felled trees shortly after flight begins in the spring. Bark beetles that prefer freshly cut trees invade them virtually within minutes of cutting (*1*). How do the first invading or pioneer beetles find their host and what mechanism guides them to it? Because there is often no discernible difference in shape or color between vigorous and weakened trees or between freshly cut and old logs, it may be assumed that what attracts the pioneer beetles is olfactory in nature and is effected by some substance or substances of the host tree. From mechanically damaged or freshly cut Douglas fir, exuding oleoresin contacts the air at once. In fact, response of *Dendroctonus valens* Lec. to oleoresin of ponderosa pine has been observed in the field (*2*), and in the laboratory various bark beetles, associated with pine and spruce forests, were attracted by very low concentrations of α-pinene, β-pinene, limonene, and α-terpineol (*3*).

Various solutions of Douglas-fir oleoresin and of its various fractions were tested amid stands of Douglas fir, *Pseudotsuga menziesii* (Mirb.)

Table 1. Numbers of various scolytid beetles, in flight, attracted to traps baited with Douglas fir oleoresin and terpene hydrocarbons during 10-hour testing. Df, Douglas fir.

Bait, in ethanol	*Dendroctonus pseudotsugae*		*Gnathotrichus*		*Trypodendron lineatum*	*Hylastes*		*Dryocoetes autographus*	*Pseudohylesinus*	
	♀	♂	*sulcatus*	*retusus*		*nigrinus*	*ruber*		*nebulosus*	*grandis*
2.5% Df resin	342	187	48	10	6	32	19	7	31	0
1% α-pinene	310	157	182	7	7	38	25	10	8	29
1% β-pinene	10	5	62	8	10	10	12	9	9	8
1% limonene	161	108	14	7	7	16	0	0	0	7
1% camphene	403	235	88	0	9	18	9	8	12	0
1% geraniol	9	5	45	5	0	11	0	0	0	6
1% α-terpineol	0	0	11	7	0	12	8	0	0	0
1% myrcene*	0	0	0	0	7	0	0	0	0	41
					Controls					
Df log	103	32	36	8	0	16	5	2	128	22
Grand fir log	0	0	0	0	0	0	0	0	0	114
95% ethanol	0	0	0	0	0	0	0	0	0	0

* Benzene solution.

Franco, 280 years old, about 32 km west of Corvallis, Oregon. The forest also contains a few other conifers: western hemlock, *Tsuga heterophylla* (Raf.) Sarg.; grand fir, *Abies grandis* (Dougl.) Lind.; and western red cedar, *Thuja plicata* Donn. Nine species of bark and ambrosia beetles are there associated with Douglas fir: *Dendroctonus pseudotsugae* Hopkins, *Pseudohylesinus nebulosus* (Lec.), *P. grandis* Sw., *Dryocoetes autographus* Swaine, *Hylastes ruber* Swaine, *H. nigrinus* (Mann.), *Trypodendron lineatum* (Oliv.), *Gnathotrichus sulcatus* (Lec.), and *G. retusus* (Lec.).

The proportion of terpene hydrocarbons in Douglas-fir wood differs from that in the bark (*4*). Wood contains 30 percent α-pinene, 6 percent 1-camphene, 14 percent 1-limonene, and 32 percent 1-α-terpineol; in bark are 28 percent 1-α-pinene, 24 percent 1-β-pinene, 7 percent 1-camphene, 8 percent limonene, 6 percent geraniol, and azulenogenic sequiterpenes (*5*). After preliminary experiments with various concentrations, a 2.5-percent solution of Douglas-fir oleoresin and a 1-percent solution of the terpene hydrocarbons in ethanol were chosen; with myrcene, the solvent used was benzene. The solutions were placed in six baited traps (*6*), and tests were run for several hours at a time at weekly intervals throughout the 1964–65 seasons. Fresh logs of Douglas fir and grand fir, ethanol, and empty traps were used as controls. The traps were stationed throughout the forest, 90 m apart, and the insects were collected two or three times per hour.

The results appear in Table 1. Since the density of population of any particular species of insect varied from day to day because of such factors as temperature and intensity of emergence throughout the season, it was not intended to establish exact quantitative differences in attractive power of the various terpenes. However, at least with abundant species such as *Dendroctonus pseudotsugae* and *G. sulcatus*, there were evident differences in attractive power of the terpenes. For example, α-pinene, limonene, and camphene were more attractive to the Douglas-fir beetle than β-pinene, geraniol, and α-terpineol, but β-pinene and geraniol attracted considerable numbers of *G. sulcatus*. Although *Dryocoetes autographus* and *T. lineatum* also abounded, few responded; unlike *Dendroctonus pseudotsugae, G. sulcatus*, and *P. nebulosus* these species do not prefer freshly cut or wind-thrown trees, and it is probable that products of tree deterioration play a role in attracting them. The slight response by *P. nebulosus* may reflect the fact that its speak flight had occurred in March, before the tests with terpene hydrocarbons were begun. The principal host of *P. grandis* is grand fir; its preference for the grand fir log and myrcene is evident.

The fact that twice as many females as males of the Douglas-fir beetle responded to resin and the terpenes (Table 1) may reflect the selection behavior of the beetle, as only females locate the breeding material and initiate the galleries. The fact that attraction to the terpenes is more pronounced in those species that prefer freshly cut and wind-thrown trees indicates that their dispersal flight is directed toward breeding material in the forest by the volatile terpenes. Such orientation is termed "host or primary attraction" and precedes the "secondary or beetle attraction" that occurs in several species in response to beetle-produced pheromones (*6, 7*).

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Seroprimatology of Chimpanzees: Blood-Group Distribution as a "Racial" Characteristic

Abstract. *Significant differences in the distribution of human-type and simian-type blood groups have been demonstrated in chimpanzees classified into subspecies or "races" on the basis of morphological traits. The differences in chimpanzees are analogous to racial differences in the distribution of blood groups in man.*

We use the term "seroprimatology" in analogy to the term "seroanthropology," which refers to the anthropological characterization of human populations by differences in the distribution of their serological properties. This branch of physical anthropology originated from the demonstration by L. and H. Hirszfeld (*1*) of differences in distributions of the A-B-O blood groups among contingents of troops of various ethnic origins stationed at Salonika, in the Balkans, during World War I. Numerous subsequent studies concerned A-B-O blood groups, other blood groups that were later discovered, and