

THE National Advisory Cancer Council has recommended a grant of \$23,000 to the University of California for the clinical investigation of cancer therapy with neutron rays, under the direction of Dr. E. O. Lawrence. It has also recommended a grant of \$7,500 to the American College of Surgeons toward continuation of a study of hospitals and clinics for the determination of further needs in order to provide adequate clinical cancer service.

THE will of Dr. William Hallock Park, bacteriologist, formerly director of the Bureau of Laboratories of the New York City Department of Health, set aside his residuary estate to establish and maintain a fellowship fund for research in medicine, clinical work and bacteriological and filterable virus diseases. The fund is to continue in perpetuity and is to be known as the "William Hallock Park Research Fund." Dr. Park

died on April 6. The trustees are authorized to accept gifts from other donors to the fund. The committee consists of the dean of the New York University College of Medicine, the dean of the College of Physicians and Surgeons of Columbia University, the dean of the Cornell University Medical College, Dr. Camille K. Cayley and Bela Schick. Dr. Cayley receives a bequest of \$20,000 with discretionary power to use part of it for research work in medicine.

G. MATHEWS, an Australian ornithologist living in England, has presented to the Commonwealth for the National Library in Canberra what is believed to be the most valuable collection of books on Australian birds in the world. The library was shipped to Australia in April, and Mr. Matthews will visit Australia for two months in order to assist in setting up the books and arranging the catalogue.

DISCUSSION

THE LUMINESCENCE OF ADHESIVE TAPE

INTEREST in bioluminescence has led me to investigate a number of luminescent phenomena which sometimes have been vaguely referred to as triboluminescence and whose explanation does not seem to be widely understood. Most experimenters have observed the transient greenish luminescence which occurs at the point where electricians or surgeons' or "Scotch" tape is stripped from a roll. With some samples this luminescence may be so bright that it is visible with only partially dark-adapted eyes. The phenomenon can be repeated if the tape is rewound and then re-stripped and also appears when the sticky sides of the tape are pressed together and then separated. It occurs under cold or hot water since a film of air prevents the immediate wetting of the surface. Rubber cement (grippit) whether holding together two pieces of metal, glass, paper, Cellophane or two different materials gives luminescence when the surfaces are separated.

What is not so well known is that many substances when closely adhering to each other will also luminesce when pulled apart. Films when stripped from glass or metal will give a flash of luminescence, for example, collodion dissolved in ether-alcohol mixtures poured on a glass plate and allowed to dry; also ambroid, or rubber latex in aqueous solution such as is used in making toy rubber balloons. However, dextrin as an adhesive separated in the moist stage does not luminesce.

Collodion films are the most striking luminescent bodies. A film removed from glass can be pressed on the glass and will luminesce when removed a second time. Stroking the collodion with the fingers will also result in luminescence but not if the fingers have been

moistened with water. Cellophane does not luminesce when stroked with dry fingers.

It is an old observation that mica sheets give a flash of light when split or when crumpled together. Rubber bands will also flash when snapped, although I have only observed the light in one or two instances as the stretched band returned to the short form.

It is apparent that these phenomena have a decidedly electrical flavor. A sheet of collodion stripped from glass or ebonite has a high negative charge, leaving the glass and ebonite positive. It is attracted to the glass with considerable force and sticks to the hand and other objects. The sign of the charge is easily determined by pith ball experiments.

The explanation of such luminescences appears to be this: whenever two surfaces are separated from each other the capacity diminishes and the voltage rises until a discharge takes place, exciting the surrounding gas to luminesce. It is not possible to prove that mica sheets or tire tape, surgeons' tape or Scotch tape are oppositely charged as a whole when pulled apart, but there are no doubt local positive and negative regions developed, the discharge between them giving rise to luminescence.

That a discharge does actually take place can be readily shown by stripping surgeons' tape or Scotch tape in an atmosphere of 2 to 4 cm Hg pressure of neon gas. Then the luminescence is reddish instead of yellowish. Red luminescence also occurs when two strips of mica are pulled apart or when collodion or ambroid or rubber cement is stripped from glass in a low-pressure neon atmosphere. When black tire tape is stripped in neon, the reddish luminescence is not marked. Possibly we have in this case the quenching

of the neon by some unknown volatile constituent of the tire tape, since even n-butyl phthalate, whose vapor pressure compares with that of mercury, contains something that prevents neon luminescence when excited electrically.

The phenomenon is quite similar to the well-known luminescence when mercury is shaken in an exhausted tube. If neon is present the luminescence is reddish. The light in a Torricellian vacuum at the head of a mercury column when carried from room to room was observed by Picard in 1675.

These experiments suggested study of the flashes of light observed when crystals are broken, true triboluminescence, characteristic of either minerals or organic compounds, as when two lumps of sugar are rubbed together. If a crystal is piezoelectric, large potential differences are built up by compression. Rochelle salt crystals, strongly piezoelectric, give an orange luminescence when shaken in a tube with 5 cm of neon but no light when shaken in a tube with air, although a flash of light appears in air when the crystal is broken with a hammer. Sugar crystals (rock candy), also piezoelectric, give orange flashes when crushed in 5 cm of neon. Indeed, a large number of substances which do not luminesce on crushing or rubbing in air give a reddish luminescence if shaken with a steel ball in a glass tube containing 5 cm neon. Such are fragments of pyrex glass, galena, Kieselgur (filtercel No. 503), KClO_3 crystals, KCl crystals (some samples of which are said to be triboluminescent in air), chitinous Cypridina shells and silk fragments. The reddish luminescence observed in shaking these materials is undoubtedly due to discharges from tribo- or piezo-electricity. However, when crystals of salicylamid, salophen and uranyl nitrate, markedly triboluminescent in air, are shaken in 5 cm neon, in addition to some orange luminescence, which represents electrical discharge in the neon, the bright greenish or colorless sparks of triboluminescence are still apparent. They are not definitely orange or reddish in color.

In triboluminescence of some crystals we therefore have the possibility of light from electrical discharge in the surrounding gas and in addition the excitation of molecules of the crystals themselves. It is noteworthy that salicylamid, salophen and uranyl nitrate are all markedly fluorescent substances whose molecules are excited by ultra-violet light. The luminescence on stripping tapes covered with rubber cement or the separation of various films from surfaces appears to be due entirely to electrical discharge in the surrounding gas.

It is a pleasure to acknowledge the assistance of Mr. Charles Butt in carrying out these experiments.

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CONSUMPTION OF TEOSINTE SEED BY BIRDS IN GUATEMALA

TEOSINTE (*Euchlaena mexicana*), the wild relative of maize, occurs in Guatemala and Mexico often along fence-rows. Kempton and Popenoe¹ suggested birds as a possible factor in the spread of this grass. During a residence in Guatemala for the purpose of studying the maize agriculture of the Indians for the Carnegie Institution of Washington, the writer undertook observations in most of the teosinte localities of the republic with a view to determining what role, if any, birds might play in the distribution of the plant.

A visit was made to the Jutiapa region in southeastern Guatemala in the month of October, 1937. The teosinte seed proved to be unripe at that time, although in other years the month of October had marked the maturity and almost complete scattering of the seed. The prolonged rainy season of 1937 apparently delayed the ripening of the seed, which reached maturity near the end of the following month. During a second visit to Jutiapa made in this month (November), large numbers of birds were observed in the teosinte growths. Many examples were shot and stomach contents noted, whereby it was shown that several species of birds feed upon teosinte seed. A most remarkable fact brought out by these observations is that the birds do not swallow the entire rachis segments, but first remove the horny outer covering which might prove indigestible. The exact manner in which the birds accomplish the extraction of the inner grain was not observed, but local residents claim that at times one can hear the cracking of the outer shell by the birds. All the birds in whose stomachs the seed was found possess powerful beaks.

Specimens collected in the teosinte fields and sent to Washington for the collections of the U. S. National Museum were identified by Dr. Alexander Wetmore as belonging to the following species: *Passerina cyanea*, indigo bunting; *Guiraca caerulea caerulea*, eastern blue grosbeak; *Guiraca caerulea eurhyncha*, large-billed blue grosbeak; *Aimophila ruficauda*, russet-tailed ground sparrow.

The first two species are winter migrants from the United States, and the ground sparrow is native to Guatemala. The large-billed blue grosbeak, if not native to Guatemala, may be a migrant from farther north in Mexico.

Teosinte seed was found in the stomachs of all birds belonging to the first three species above listed. In the specimens of ground sparrow (*Aimophila*) the stomach contents were not identified with certainty and did not appear to be teosinte seed.

During subsequent collecting of teosinte seed in the region of Jacaltenango and San Antonio Huista in northwestern Guatemala in December of the same year,

¹ J. H. Kempton and Wilson Popenoe, *Carnegie Inst. Pub.* No. 483, p. 210, June, 1937.