past year, including the special studies aided by an academy grant from the American Association.

At the Saturday afternoon session following the business meeting the presidential address, "Vertebrate Evolution—A Record and Some Implications," was given by Professor George M. Robertson, of Dartmouth College.

At the business meeting it was announced that the council had recommended the awarding of the grant for the current year from the American Association for the Advancement of Science to Dr. Henry I. Baldwin, of the State Forestry Department, for assistance in compiling and publishing "A Flora of the Fox Research Forest." The committee on conservation, of which Mr. Laurence W. Rathbun, chief forester of the Society for the Preservation of New Hampshire Forests, is chairman, made a report of its activities and presented plans for further work.

The following officers were elected for 1937–38: *President,* Professor Karl W. Woodward, University of New Hampshire; *Vice-president,* Dr. Henry I. Baldwin, research forester, State Forestry Department; *Secretary-Treasurer,* Professor George W. White, University of New Hampshire; *Member of the Executive Council,* Professor George M. Robertson, Dartmouth College; *Councillor to the American Association for the Advancement of Science,* Professor Walter C. O'Kane, University of New Hampshire.

GEORGE W. WHITE,
Secretary

SPECIAL ARTICLES

THE BEHAVIOR OF CERTAIN DUSTS[1] UNDER MECHANICAL[2] IMPINGEMENT

ONE type of method for the examination of the dustiness of the air depends on the mechanical impingement of a known volume of the dust-laden air at a considerable velocity on a dry or wetted surface. From the number of dust particles found on a limited area of the dry surface or in a certain volume of the wetting liquid the number of dust particles in a unit volume of the sampled air is calculated. The possibility of breakage of the dust particles due to their force of impact on the impingement surface has been suggested from time to time, but as far as the writers know no investigations on this point have ever been published. If breakage did occur there would be more particles formed than were originally present, and furthermore a particle size determination on the resultant particles would show greater numbers in the smaller sizes than were present in the air.

So far we have used only three dusts in our experiments. Finely ground orthoclase feldspar and quartz were classified by settling in a mixture of water and ethyl alcohol. This method of classification has been described in detail by Cummings.[3] The fraction of each dust between 5 and 10 microns was resettled five times to remove adhering "fines." The third dust used was dried spores of pencillium oxalicum. The spores are uniform in size, averaging 2 microns in diameter by 4 microns in length.

TABLE 1

	Impinging velocity[4] meters per second	Conditions of impingement	Ratio of smaller particles to particles of original size (approx.)	Average dimensions of shattered particles microns
Feldspar	40 ± 10	Dry surface of gelatine and glycerine	4.5 : 1	1.0–1.5
Feldspar	70 ± 10	Dry glass plate[5]	100 : 1	1.0 and less
Feldspar	100 ± 10	Dry glass plate	100 : 1	1.0 and less
Feldspar	150 ± 10	Glass plate submerged in water	50 : 1	1.5 and less; considerable ultra-microscopic material
Pen. Oxal.	40 ± 10	Dry surface of gelatine and glycerine	0 : 1	None shattered
Pen. Oxal.	70 ± 10	Dry glass plate	0 : 1	None shattered
Pen. Oxal.	100 ± 10	Dry glass plate	0 : 1	None shattered
Pen. Oxal.	150 ± 10	Glass plate submerged in water	0 : 1	None shattered
Quartz	40 ± 10	Dry surface of gelatine and glycerine	3 : 1	1.0–1.5
Quartz	70 ± 10	Dry glass plate	25 : 1	1.0 and less
Quartz	100 ± 10	Dry glass plate	50 : 1	1.0 and less
Quartz	150 ± 10	Glass plate submerged in water	50 : 1	1.5 and less; considerable ultra-microscopic material

Behavior of the three dusts under various conditions are given in Table 1.

[1] The term "dust" is used to denote solid particles 0.5 to 10 microns in longest dimension.

[2] The term "mechanical" is used to denote a force caused mechanically rather than thermally or electrically.

[3] D. E. Cummings, *Jour. Ind. Hyg.*, 245–56, 1929.

[4] The velocities given above were obtained by dividing the volume of air sampled in a unit time by the area of

From the data in Table 1 it is concluded:

(1) The composition of the dust is a factor in the amount of crushing under mechanical impingement.

(2) The velocity of impact as well as the surface on which and the medium in which the impact occurs has a bearing on the amount of crushing.

(3) With the exception of impingement on a wetted surface, the smallest particles noted were on the order of a micron. It appears, therefore, there is a limit to the fineness that a particle will shatter at definite velocities and conditions.

(4) In the case of impingement on a wetted surface considerable material below 0.5 micron was noted. It may be that this was formed by attrition of the water-borne particles by other particles in the incoming air stream.

(5) In all cases of dry impingement a variable amount of scattering of particles outside of the field of impingement was seen. This indicates incomplete retention of these dusts on the impingement surfaces.

(6) With two of the three dusts any estimation of particle size distribution in the air from the resultant particles is erroneous.

(7) With each of the three dusts examined an estimation under the above conditions of the number of particles in the air sampled is erroneous.

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OVULATION INDUCED OUT OF SEASON

OVULATION has been induced in a variety of Amphibia during the non-breeding season by the injection of the anterior pituitary hormone. Since the original description of the technique of inducing ovulation and of artificially inseminating eggs of the frog, *Rana pipiens*,[1] there have been a number of refinements so that now one can count on securing fertilized eggs and developing tadpoles at any time of the year from early September until the normal breeding season, in March. From March until July, *Rana clamitans* can be used, and *Rana catesbeiana* (the bullfrog) will respond to pituitary-induced ovulation until late in August. *Acris gryllus* normally breeds from February to October, and *Rana sphenocephala* from February to December. With inhibition of normal ovulation by refrigeration, amphibian eggs may be available for twelve months of the year. The technique, as now used, will be briefly described.

With few exceptions, *Rana pipiens* can not be considered sexually mature unless it measures 74 mm from snout to cloaca. Frogs are secured from one of the frog farms and are placed immediately in a copper-lined tank in the refrigerator, through which runs a slow stream of water. Frogs may be kept at this temperature (about 4 to 6° C.) for several weeks without showing gonadal deterioration. Twenty-four hours before eggs are desired an obviously mature female is injected with whole anterior pituitaries from two adult female or four adult male frogs. Mammalian or fish pituitaries have not been successfully used with frogs in inducing sexual reactions, but such pituitaries will induce ovulation and amplexus in toads and breeding reactions in salamanders. Amphibian pituitaries will, in general, induce such reactions in *Rana pipiens*.

It has been found that the average male anterior pituitary (*Rana pipiens*) is 16 per cent. heavier and 60 per cent. as potent as the average female gland in respect to inducing ovulation. The glands must be quickly excised, as they rapidly lose their potency in dead frogs. If the head is cut off; the lower jaw removed; the base of the cranium cut along each side of the brain; the parasphenoidal bone deflected forward, the anterior pituitary gland will be seen as a pink organ lying just posterior to the optic chiasma. Occasionally it will adhere to the base of the cranium and will be surrounded by white endolymphatic tissue, which has no apparent sex hormone value. The pituitary is placed in 1 cc of distilled water, 35 per cent. alcohol or Ringer's solution. Generally 1 cc of fluid is used per gland, partly as a check on the number of glands used. When the proper number of glands has been secured, they are sucked up into the barrel of a hypodermic syringe, with no attempt to macerate the pituitaries. It has been found that the fresh gland will easily pass through a No. 20 hypodermic needle and that if the gland is previously macerated, some of the hormone is lost by adhesion to the inner sides of the syringe. The needle is applied to the syringe and injected through a lower quadrant of the abdomen, avoiding deep penetration and consequent danger of internal injury. Immediately following injection the frog is placed in a container with enough water to partly immerse the body. If amplexus and normal fertilization are desired, a male may be similarly injected and amplexus will be achieved in about 9 to 12 hours at ordinary laboratory temperatures of 22–25° C. In this case only pond or spring water, or 10 per cent. Holtfreter's[2] modification of amphibian Ringer's can be used, since tap water is generally lethal to sperm.

If insemination is to be controlled, the female should

the impingement orifice. The actual velocities at the surface where impingement takes place are of necessity lower, due to mechanical design.

[5] In all cases using a dry glass plate, the dust-laden air was previously humidified by passage through a tube containing moisture.

[1] R. Rugh, *Biol. Bull.*, 66: 22, 1934.

[2] J. Holtfreter, *Arch. f. Ent. Mech. der Org.*, Bd. 124, S. 404, 1931.