There seems to be little doubt that the extracts of the two tissues which have previously been shown to reduce the takes of transplanted cancer have an influence on natural or spontaneous cancer. This inhibiting action is evident not only on the local post-operative recurrence, and the growth of autografts where there was direct contact between the extracts and the cancer cells, but is observable likewise on untreated or unoperated tumors at a distance when the inhibiting materials were injected into the peritoneal cavity.

We do not consider that the results stated necessarily establish the hypothesis on which the experiment was based, for the complexity of the materials makes it quite possible that this explanation is not the correct one. The general relations between the factors which influence the origin and growth of spontaneous tumors, the balancing mechanism of normal tissues, and the inhibitor which has been isolated from the chicken sarcomas can not be seriously discussed until further knowledge is available.

A more detailed report, including data on histological types of the tumors, metastasis occurrence, etc., will be published later. At present the results recorded here are considered of only theoretical importance.

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FUNDAMENTAL LIMITS TO THE SIZES OF CLASTIC GRAINS

TEN years ago the writer presented a scale of size limits for the terms boulder, cobble, pebble, granule and sand, silt and clay grains.[1] The scale was based on average prevailing opinion and stated in units to conform to certain sieve openings in the mechanical analysis scale first used extensively by Udden.[2] With growing precision in terminology and increasing use of quantitative methods of analysis of detrital materials, the usage suggested by the writer has been generally accepted, with only occasional modification of certain terms.

Names for the unconsolidated and consolidated aggregate were also proposed and differ from the fragment names chiefly in the bracketing of the aggregates of boulders, cobbles, pebbles and granules under the single name "gravel." In this usage there is tacit implication that the materials gravel, sand, silt and clay are of equal rank in classification. Aside from purely arbitrary division into classes of equal width on an arithmetic or geometric scale, equality of rank would result only from the use of limits having coordinate natural or genetic significance.

Recently, the writer was led to further consideration of these terms and the conclusion was reached that the seeming narrow unity of the materials sand, silt and clay and the wide size range in the gravel class probably represent an unconscious recognition by man, layman as well as geologist, of certain genetic units based on the several fundamental modes of transport by running water and on several modes of derivation from parent rocks. This interpretation is shown in the following table:

TABLE I

Mode of transport	Usual source	Name of aggregate
Traction	All available hard rocks	Gravel
Inertia suspension	Mono-mineral grains of phanerites (chiefly)	Sand
Viscous suspension	Mono-mineral grains of any rocks (chiefly)	Silt
Colloidal suspension	Molecularly decomposable materials	Clay

In Table I there are listed four distinct modes of handling which occur in running water. Both traction and inertia suspension take place approximately in accordance with the so-called Sixth Power Law, which postulates a complete transfer of kinetic energy from water to particle and which makes no allowance for the subsidiary effect of viscous drag. Viscous suspension, on the other hand, accounts for the transport of finer particles in which the surface effect is greater relative to the mass. The size-velocity relationship in this range is defined by the well-known Stokes Law.[3] Still smaller particles are kept in suspension chiefly by the kinetic effects found in dispersed systems, *i.e.*, colloid systems.

It should, of course, be recognized that none of the lines of demarcation between these modes of transport are sharp and that water-transported detrital materials occur in a continuous series from large boulders to clay particles. However, it appears that each of the processes of transportation has an optimum range in nature and that only partial overlapping occurs. Where more than one of the

[1] C. K. Wentworth, "A Scale of Grade and Class Terms for Clastic Sediments," *Jour. of Geology*, 30: 377–392. 1922.

[2] J. A. Udden, "Mechanical Composition of Clastic Sediments," *Geol. Soc. Amer. Bull.*, 25: 655–744. 1914.

[3] G. G. Stokes, "On the Effect of the Internal Friction of Fluids on the Motion of Pendulums," *Trans. Cambridge Philos. Soc.*, Vol. 9, part 2, pp. 8–106, espec. sec. 4, pp. 48–57, 1851.

processes is carried on concurrently by the same stream, the processes are either found quite distinct in different parts of the stream, or the conditions of flood and tumultuous flow are obviously ill-adapted to effective segregation of the grains by sizes.

If the thesis here implied be correct, the several processes are sufficiently distinct, in spite of overlapping due to variation in velocity, so that detrital materials found in natural deposits occur more abundantly well within the individual coarseness ranges represented by gravel, sand, silt and clay, than in the ranges transitional between those classes. The assumed arrangement of these modes is shown in the figure.

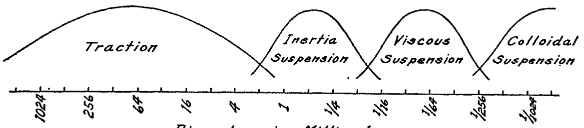

FIG. 1

Column two of Table I suggests a possible further natural contrast of sizes. It is thought that phanerites with grain sizes from ½ mm to 2 or 3 mm are enormously more abundant than similar rocks of coarser grain and that these furnish quartz grains preponderantly in the sand sizes. Among acid rocks, those of finer grain than ½ mm are subordinate to the coarser ones.[4] Aphanitic basic rocks are exposed over far larger outcrop area than coarser basic rocks. Few basic rocks yield mono-mineral grains of sufficient durability to exert any important effect in fixing sand sizes. By far the most important control exerted by the grain size of igneous rocks is due to the predominant sizes of quartz grains in granites.

In the calcareous detrital sediments of certain beaches, the sizes of shells or of other parts of particular species of animals locally give rise to somewhat homogeneous, well-sorted sediments. In particular, one may note the opercula of turbo snails, segments of sea-urchin spines and the tests of foraminifera.[5] These are, of course, much too localized to have been significant in fixing the established concept of sediment grades.

Some may point out that the foregoing discussion is based on the assumption that detrital sedimentary materials have been chiefly sorted by water. The reply is that materials chiefly assembled by other agencies are mostly not readily classifiable in the common terms. For example, glacial till requires a name of its own, the material of kames and eskers deposited by water under somewhat unusual conditions is commonly a somewhat indeterminate mixture of sand and gravel.

Loess, derived perhaps largely from glacial silt and deposited by the wind, does not correspond exactly either with sand or silt or clay. Most soils are also cases in point. Materials accumulated through imperfect action of water are commonly difficult to classify, such as many of the deposits of arid regions and terrace materials deposited by streams excessively flooded by glacial or other waters.

We are forced to recognize that the gravel-sand-silt-clay scale is an aqueous scale and there appears to be a true genetic, even if complex, basis for the grades represented by our common size terms. Wind action may result in superior sorting of sands originally accumulated by aqueous agencies. Whether a well-sorted, well-rounded, mature sand has ever been produced exclusively by the action of wind on the debris from a granite or other suitable rock may well be doubted. If such derivation has taken place, it must be very exceptional and very local.

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4 R. A. Daly, "Igneous Rocks and Their Origin," pp. 42–52, 1914.

5 C. K. Wentworth and H. S. Ladd, "Pacific Island Sediments," Univ. of Iowa Studies in Natural History, Vol. XIII, No. 2, pp. 19–23, 1931.

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