serum is no more toxic for man than is horse serum; immediate reactions do not occur with any greater frequency. Serum sickness has been infrequent and of a mild character.

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IDENTICAL TWINS IN A MOUSE CROSS

IN 1934 the late Dr. C. V. Green[1] published statistical evidence that there occur occasionally in mice uniovular twins, since pairs of individuals with identical color characters and of like sex occur more frequently than chance alone would indicate to be probable. Miss Bodemann[2] has also described and figured two mouse embryos in the primitive streak stage found enclosed within a common yolk sac endoderm layer, among the progeny of x-rayed mice, evidence which points to the same conclusion as that reached by Green.

We are able to support Green's conclusion with observational evidence of the occurrence of a pair of identical twins under conditions which render their identification all but unmistakable.

The genes for two recessive mutant characters (dilution (d) and short ear (se)) are borne in the same mouse autosome at closely adjacent loci. Gates (1928), who made a "repulsion" cross, observed no crossovers in an F_2 population of 426 individuals involving a test of 852 chromosomes. Snell (1928), however, in a similar but more extensive search for cross-overs reported the occurrence of one crossover in 1,158 cases; later in data hitherto unpublished he observed two crossovers in 890 cases. In backcross populations, Miss Copeland in 1931 reported the occurrence of one crossover in 106 cases, an observation confirmed by Snell, though he himself observed no crossovers among 1,034 backcross young. Combining these various observations, the indicated occurrence of crossovers up to 1931 was 4 in 4,040, or roughly 1 in 1,000 cases.

Subsequently, Castle, Gates, Reed and Law[3] made a cross in which short ear and dilution were introduced in the coupling relationship, reciprocal backcrosses being later made to the double recessive (d se) race. The observed recombinations and their respective frequencies were as follows:

	D Se	d Se	D se	d se
♀ F_1 × ♂ d se	827	2	0	792
♂ F_1 × ♀ d se	67	0	1	68
Totals	**894**	**2**	**1**	**860**

Three crossovers were thus observed in 1,757 cases, or about 1.75 to a thousand, a frequency somewhat greater than that previously reported, but based chiefly on the behavior of heterozygous females in which crossing over is known to be more frequent than in males. We may then safely conclude that the normal amount of crossing over between the loci for dilution and short ear is not over one or two for a thousand cases.

Besides the three crossover cases already reported, there was observed, in a backcross between a doubly heterozygous female and a double recessive male, a pair of dilute brown males having long ears and so belonging in the crossover class, d Se. Since a crossover has a probability of occurrence of only one or two in a thousand, the odds against the occurrence simultaneously in the same litter of two independent crossovers identical in sex and three independent color characters would be about 332 to 1, according to calculations made by Snell, the details of which need not be reported here.

We accordingly regard the conclusion as justified that the pair of long-eared dilute brown male individuals which occurred in the same backcross litter were in reality *identical twins* derived from the fertilization of a single egg in which a rare crossover had occurred between the loci for dilution and short ear.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW APPARATUS FOR CONSTANT TEMPERATURE

THE continuous maintenance of precise temperatures by the use of heating units is now a relatively simple matter, but the available temperatures dependent upon the controlled application of heat are necessarily above the temperature of the room in which the apparatus is kept. There is also equipment for maintaining fixed temperatures below room temperature by the use of refrigerating units. In connection with experimental work by the senior author, it was desired to have several chambers in which constant temperature could be maintained independently of room temperature, the temperature of one chamber would be independent of that of any other, and there would be complete flexibility within a wide range of low and high temperatures.

We have designed and had in satisfactory use for

[1] SCIENCE, 80: 616, December 28, 1934.
[2] *Anat. Record*, 62: 291–294, 1935.
[3] *Genetics*, 21: 310–323, July, 1936.

nearly two years a relatively inexpensive multiple constant temperature apparatus meeting these requirements. It contains a single refrigeration chamber from which a non-freezing fluid circulates through the other chambers, each of which is provided with a simple heating unit (an incandescent light bulb in our case) controlled by an accurate thermoregulator. The flow of cold fluid need be regulated only roughly. For temperatures above the possible high level of room temperature, the flow of cold fluid is of course stopped.

We have not as yet tried to maintain temperature above 50° C. or more than slightly below freezing, but these extremes in our own practice do not necessarily mark the limits to which the apparatus is adaptable. Similarly, although we have now only six culture chambers, there is no apparent reason why the number of chambers may not be increased.

The setting of the temperature in any chamber to a tenth of a degree requires but a few minutes or perhaps a half hour, depending upon one's skill in manipulating the thermoregulator. Thereafter the temperature of the chamber remains constant for weeks or months, unless a change is desired or an accident intervenes, and, with ordinary care, the latter contingency need rarely, if ever, arise. Because of the heavy insulation, even the cessation of electric currents for a short time effects little change; the circulation of cooling fluid, as well as the operation of the heating unit, is arrested with interruption of electric current.

This multiple-chambered constant temperature apparatus is described and illustrated in a forthcoming issue of the *Journal* of the Elisha Mitchell Scientific Society.

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THE VISUALIZATION OF DIFFERENT ORGANS IN NORMAL UNANESTHETIZED ANIMALS

EXPERIMENTS have recently been performed in which the colons of cats were made permanently opaque to x-rays by injecting a solution of thorium dioxide (Thorotrast) just underneath the serous membrane at various points along the entire length of the colon wall. Three to four weeks after the operation this material became quite uniformly distributed, so that it gave a clear outline of the organ which could be studied in an empty as well as a distended state.

The animals showed no harmful effects from the presence of the Thorotrast. One cat, whose colon was injected over sixteen months ago, and three others more than seven months ago are still in apparently perfect health.

Experiments to visualize the stomach and urinary bladder of cats as well as the crop, gizzard and uterus of the fowl in the same manner are now under way which promise to give results just as satisfactory as those obtained on the colon.[1]

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A METHOD OF DEMONSTRATING CO_2 PRODUCTION DURING RESPIRATION

BARIUM hydroxide and the formation of barium carbonate have been much used in elementary botany classes to demonstrate the production of CO_2 by germinating seeds during respiration. The writer has made use of a method which is even more striking and which requires no special apparatus. Two 250 cc Erlenmeyer flasks are connected in series by the usual method, *i.e.*, right angle glass tubing, rubber tubing and single hole cork stoppers. In flask A are placed 100 pea seeds which have been germinated from 12 to 24 hours. In flask B are placed 50 cc of an alcoholic solution of phenolphthalein, to which has been added a drop of 10 per cent. NaOH, just sufficient to give the solution a brilliant red color. Before the apparatus is connected the students are shown the characteristic color reaction of phenolphthalein in acid and basic solutions. The connection is then made between flasks A and B and in a few days it will be noted that the phenolphthalein solution has lost its color. This demonstration has been found to be of interest to students in the class in elementary plant physiology at Vanderbilt University and might easily be used to supplement the usual demonstration in the general course.

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[1] A more complete description of this method will appear in the *Anatomical Record* of 1937.

BOOKS RECEIVED

ALLISTON, NORMAN. *Mathematical Snack Bar; A Collection of Notes and Results.* Pp. 155. Heffer, Cambridge, England. 7s. 6d.

Collection de Monographies sur la Théorie des Fonctions. *Théorie Générale des Fonctionnelles.* Tome I: *Généralités sur les Fonctionnelles, Théorie des Équations Intégrales.* Vito Volterra et Joseph Pérès. Pp. xii + 359. Gauthier-Villars, Paris. 100 fr.

DE DONDER, TH. and PIERRE VAN RYSSELBERGHE. *Thermodynamic Theory of Affinity; A Book of Principles.* Pp. 142. 4 figures. Stanford University Press. $3.00.

Transactions of the Royal Entomological Society of London. Vol. 84, *The Tsetse Flies of East Africa; A First Study of their Ecology, with a View to their Control.* C. F. M. SWYNNERTON. Pp. xxxvi + 579. 33 figures. 22 plates. The Society, London.