increasing positive numbers. At present we write 10^{-1}, 10^{-2}, 10^{-3}, . . . mm of mercury; or we use 10^{-3} mm, the micron, as the basic unit for measuring vacuum, and write 1, 0.1, 0.01, . . . , micron.

In Townsend's proposed system, the reciprocal of the negative power of 10, expressing pressure in millimeters of mercury, is multiplied by 10, thus resulting in positive, integral numbers of two figures. In this system, 10^{-1}, 10^{-2}, 10^{-3}, . . . , become 10, 20, 30, . . . vacuum units. This is similar to the method of expressing relative sound intensity levels, the reference level for vacuum being 1 mm. There is logic in using approximately 1 mm as the division point between pressure and vacuum. In its practical application, the range of values ordinarily used would lie between 10 and 70 vacuum units.

The suggestion appears practicable and logical. This note is written to bring it to the attention of American scientists and technologists who may not have access to *Nature*.

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THE OXIDATION OF BILIRUBIN BY PEROXIDASE

PEROXIDASE, in the presence of hydrogen peroxide, is known to oxidize phenols and aromatic amines and iodides. Milk peroxidase oxidizes nitrites and tryptophane.[1] Recently we have discovered that peroxidase oxidizes bilirubin to biliverdin. This reaction takes place in a narrow zone around pH 7.4.

It has been generally assumed that *in vivo* hemoglobin is broken down to biliverdin and that the biliverdin is then reduced more or less completely to bilirubin. However this may be, we wish to point out the possibility that bilirubin may be converted to biliverdin in the liver by action of peroxidase and peroxide. In 1934 Schreus and Carrie[2] observed that when liver brew was incubated with hemoglobin between pH 7 and 8, a blue-green pigment was formed. This was probably biliverdin. The formation of this substance was shown to be inhibited by catalase and favored when the digests were kept at 70°, at which temperature liver catalase was destroyed. We assume that the inhibitory effect of catalase was due to its destruction of hydrogen peroxide.

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[1] S. Thurlow, *Biochem. Jour.*, 19: 175, 1925.

[2] H. T. Schreus and C. Carrie, *Klin. Wochenschr.*, 13(2), 1670, 1934; *Med. Welt*, 9: 1135, 1935; quoted from *Chem. Abstracts*, 31, 6310, 1937.

THE IMPORTANCE OF DEGENERATIVE CHANGES IN LIVING ORGANISMS

VARIATIONS that reduce the amount and rate of growth in long-inbred lines of maize appear in the form of dwarf plants, narrow leaves, crooked stalks, reduced chlorophyll and plants that seem normal but are delayed in flowering and maturing. All the mutations so far observed are either neutral or disadvantageous to the organism. Unfavorable types such as these would be expected to be eliminated by natural competition, but when tested in hybrid combinations with the normal lines from which they originated, these degenerate individuals improve the performance of their offspring and definitely have advantage in survival. Increases over the normal, better parent range up to 104 per cent. in yield of grain, and up to 9 per cent. in height of stalk. This larger growth is made in less time.

Favorable mutations in plants and animals are extremely rare both under natural conditions and in the laboratory. The evidence indicates that they appear first in the heterozygous condition and segregate as unfavorable deviations from normal. Hereditary material is so highly developed and delicately balanced that changes of any kind usually result in a reduction of some kind. Ultimately these new alleles may be brought into equilibrium with the remaining gene complex in such a way as to promote better growth and survival. In this way evolution proceeds by first taking a step backward before going forward.

The fact that unfavorable characters appear so frequently and persist so long in many organisms indicates that they have survival value. These results, recently obtained and to be reported in detail, emphasize the need for caution before eliminating apparently degenerate individuals in plant and animal breeding practice as well as in any eugenic program.

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A REACTION OF ASCORBIC ACID WITH α-AMINO ACIDS

IN SCIENCE of May 25, 1945, Koppanyi, Vivino and Veitch described a red color reaction of ascorbic acid with various α-amino acids. Somewhat over a year ago we observed the development of a bright red color on and in surgical catgut (mainly collagen) when immersed in ascorbic acid solutions, and we believe the same reaction as described by those authors to be involved.

When raw or processed (heat sterilized) plain catgut strands were immersed in ascorbic acid solutions of 50 mg per cent. or more, and stored at room temperature, the strands were uniformly red in three

days. The "dyeing" of the gut coils, kept in upright stoppered test-tubes, appeared after one day on the top end, progressing toward the bottom. No reagent other than ascorbic acid was added, and heating did not accelerate the reaction. The red color was stable for several weeks, then turned gradually brown. The liquid stayed entirely clear and colorless.

This color development took place when the ascorbic acid was dissolved in absolute or in 95 per cent. U. S. P. ethanol, or in a mixture of ethanol-isopropanol 4:1, containing 5 per cent. water, not however in absolute methanol or in water. In the latter two solvents a brown discoloration of the gut was obtained, similar to, though weaker than that developing from the red color. With xylol as medium no visible reaction took place.

The alcoholic or alcoholic-aqueous systems employed cause gut to soften and swell (non-boilable catgut), the final stage being reached within one week. Collagen contains available amino groups whose number may be gradually increased when swelling. The fact that the color is found exclusively on the gut strands and not in the liquid media, suggests the reaction of the ascorbic acid to take place with insoluble reactive groups ($-NH_2$) of the protein, ruling out ammonia in the case of gut.

The oxidation of the ascorbic acid may be attributed to air oxygen, evidenced by the progression of the color from the top, near the liquid-air interphase, toward the bottom.

Koppanyi *et al.* have pointed out that the color is less stable in water than in alcohol (supposedly ethanol). This and the lesser stability of ascorbic acid in water and apparently methanol can explain the failure of the red color to appear in these solvents. In xylol gut does not swell nor soften (boilable catgut), and the solubility of ascorbic acid is low if not zero, hence no reaction takes place. Qualitative tests for ascorbic acid according to Szent-Györgyi (Merck Index 3955), carried out under same conditions for all systems, were positive after a three-day period in all solvents, except in methanol (destruction?) and in xylol (insolubility?). A number of other reducing agents or sugars did not cause this color development with catgut. The reaction of ascorbic acid with other proteins has not been studied, but may furnish some information as to their characteristics.

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HOMING, MIGRATION AND INSTINCT

PLATT and Dare, under the heading "The Homing Instinct in Pigeons" in your issue of April 27, 1945 (p. 439), express the belief that it is more reasonable to "explain the homing and migratory habits of birds by assuming that they use familiar landmarks, together with simple geographical, meteorological and ecological relationships rather than that they possess a new sense organ." They describe recent experiments in the homing of pigeons and point out that their results suggest that training and familiarity with landmarks are integral factors in the successful return of birds to their lofts.

While this opinion corroborates, in essence, the views expressed by earlier investigators of homing in pigeons,[1] it should be pointed out that the coupling of the words "homing" and "migration," as though they were different manifestations of a single phenomenon, appears to be unwarranted. Pigeons have been used often enough as "guinea-pigs" of the air in attempts to elucidate questions of migration (the physicist, Kelvin, being possibly the first to have done so) yet their very success as homing agents rests primarily on the fact that they are entirely devoid of any migratory instinct. One can not, in fact, argue legitimately from the homing habits of pigeons to the migratory ways of other species.

That the generalization made by Platt and Dare can not be upheld is evidenced in the first annual migrations of the young of numerous species of birds which undertake their initial fall journey without knowledge of landmarks or the chaperonage of adults. The young of our cowbirds, for instance, or European cuckoos, reach their predestined wintering grounds without either parental or foster-parental guidance, while certain species of the flightless penguins migrate annually by swimming from the antarctic to South America and back with infallible precision, through a murky ocean from which they are presumably incapable of getting bearings and on which there exist no landmarks.

On November 9, 1940, approximately a month after the last resident crow had gone south, I liberated 54 young crows of the year near Edmonton, Alberta, from the area on which they had been hatched and subsequently trapped as juveniles in July and August. They were merely held in a spacious flying cage during the intervening period; no adults were with them. By November 20 over 50 per cent. had been retaken, the furthest 250 miles southeast of the point of liberation on a line directly joining Edmonton and central Oklahoma, the wintering ground of 95 per cent. of Alberta crows. None of the birds recovered had deviated materially from this line and some of them were traveling at 50 miles per day, a remarkable rate for crows. The temperature was below zero F. and the ground blanketed with snow.

[1] *E.g.*, B. B. Riviere, Verhandlungen des VI. Internat. Ornithologen-Kongresses, Kopenhagen, 1926.