merge into those of the sclera without any abrupt histologic transition corresponding to the change from the transparent to the opaque portion of the corneo-scleral coat.

The permeability, the degree of hydration, the transparency and the absence of blood vessels are four properties which distinguish the cornea from the sclera, and indeed from most other tissues. These properties have been extensively studied in this laboratory during the past two years and, as a result of the new findings, especially as regards permeability, have led to a new concept of corneal physiology. The data are to be reported in detail elsewhere.[1] A preliminary report of some of the findings and conclusions which are of general interest are presented here.

The excised cornea was found to be, in effect, impermeable in either direction to NaCl but freely permeable in both directions to H_2O. Removal of the epithelium caused the cornea to become permeable to NaCl, from which it was concluded that the epithelium was an effective semipermeable membrane with respect to NaCl. The permeability of the endothelium could not be adequately studied with the excised cornea because of damage resulting from the manipulation. But if the corneal epithelium is first removed the properties of the endothelium may be studied in the intact eye. In this manner it was shown that the endothelium is substantially like the epithelium in being an effective semipermeable membrane with respect to NaCl. Thus the substantia propria, while permeable to NaCl and water, is bounded on either side by membranes permeable only to water.

The normal degree of corneal hydration appears to be quite unusual, for when pieces of cornea are immersed in various aqueous solutions they swell several hundred per cent. This was found to be true, even though the bath fluid was blood serum or aqueous humor and despite wide variations in hydrogen ion concentration or in tonicity of the solutions. The only way in which the explanted cornea could be maintained in a state of dehydration comparable to that existing normally was by maintaining an osmotic gradient across the intact epithelium or endothelium, or both, so that water was abstracted from the cornea as rapidly as it became available in the stroma. Presumably a similar mechanism is operative *in vivo;* fluid diffuses into the cornea from the vascular plexus at the corneo-scleral junction, and its water is continuously transferred into the hypertonic tears on the anterior surface and into the hypertonic aqueous on the posterior surface.

The maintenance of corneal dehydration is essential for transparency. Removal of the semipermeable membranes or lowering the tonicity of the bath fluids will allow the cornea to swell and become opaque. Presumably the interstitial fluid, having a different refractive index from that of the structural components of the cornea, must be removed or prevented from accumulating in order to maintain optical homogeneity.

Correlated with the dehydrating mechanism as described above is the effect on circulation. The cornea has no vascular or lymphatic vessels, and nutritive material is provided by diffusion from the periphery. It now seems likely that, in addition to diffusion, the continuous abstraction of water from the corneal surfaces ensures a movement of fluid which serves to transport oxygen and other dissolved materials from the blood to the corneal tissues.

By contrast the sclera has no semipermeable membranes and therefore no dehydrating mechanism as described above for the cornea. In consequence, the sclera is normally hydrated to its physiologic limit and is opaque. If, however, it is artificially dehydrated, as by drying in air, it becomes transparent like the cornea. The optical difference, then, between the cornea and sclera appears to be due, not to any structural difference in their respective fibers, but to the fact that the former has a dehydrating mechanism not present in the latter.

DAVID G. COGAN
V. EVERETT KINSEY

HOWE LABORATORY
OF OPHTHALMOLOGY,
HARVARD MEDICAL SCHOOL

[1] *Archives of Ophthalmology.*

PHYSIOLOGICAL ACTIVITY OF ASCORBIC ACID IN PLANT LIFE

THE diurnal variation of ascorbic acid in tomato plants previously noted,[1] if common to all plants, merits further consideration in determining the best time to harvest edible greens. If greens are to be shipped or canned, is it preferable to cut them in the evening or in the morning? Using young tomato plants grown in pots as subject material, a number of pertinent experiments have been made.

The plants to be allowed to grow overnight were washed free of soil gently to avoid root injury; adhering water was blotted off with absorbent paper; the plants were weighed and at once replanted. Such repotted plants gained very little in weight overnight even though the pots were standing in water to cover the soil, whereas cut plants standing in water always gained appreciably.

Knowing the change in weights of the plants held overnight, both cut and growing, it was possible to calculate the ascorbic acid content in the morning back to the weight of the previous evening and thus eliminate the dilution effect. Typical results are given

[1] SCIENCE, December 13, 1940, p. 561.

in Table 1, the morning ascorbic acid values calculated back to the weight of the plants in the evening. The

TABLE 1

ASCORBIC ACID VALUES—MG PER CENT

	Expt. 1	Expt. 2	Expt. 3
Evening (4–5 P.M.)	62.8	52.0	46.3
Next morning—cut plants (8–9 A.M.)	47.7 (15)	32.9 (18)	22.5 (12)
Next morning—uncut plants (8–9 A.M.)	31.5 (0)	27.8 (3.5)	18.2 (2)

figures in parentheses represent the per cent. increase in weight of the plants overnight.

From these data it appears that the cut plants retained, respectively, 51, 18 and 24 per cent. more ascorbic acid than the growing plants in the three experiments; even though the cut plants gained 10 to 15 per cent. more in weight, their percentage of ascorbic acid was, respectively, 34, 7 and 10 per cent. higher than uncut plants in the three experiments.

The data indicate that the losses in ascorbic acid noted in vegetables and fruits in storage are not due entirely to oxidation by atmospheric oxygen, as is often stated, but due to its being used in some physiological process, the activity of which is diminished by severing the plant from the root system.

EDWARD F. KOHMAN
DONALD R. PORTER

CAMPBELL SOUP COMPANY,
CAMDEN, N. J.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN EGG INOCULATOR AND SHELL MEMBRANE TEASER FOR VIRUS CULTURE

IN view of the extensive use now made of the chorio-allantoic membrane of chick embryos for the cultivation of viruses, it seemed desirable to simplify the technique of inoculation and at the same time, if possible, decrease the losses due to accidental injury of the membrane. The egg inoculator, shown in Fig. 1, satisfies these requirements.

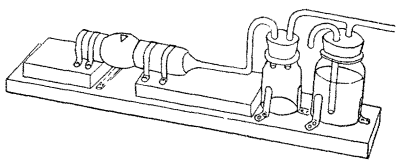

FIG. 1. Egg inoculator.

A triangular window is cut in the shell in the usual manner and a hole drilled into the air sac. The egg is then placed between the two rubber rings of the inoculator. The one which grasps the pointed end of the egg is mounted on a movable base actuated by springs which force the rings together. The other ring forms a tight junction with the egg and is connected with a suction device. A simple by-pass prevents the suction from becoming great enough to cause damage. When the suction exceeds the hydrostatic pressure of 5 centimeters of water, air passes down the tube and bubbles up into the system, maintaining the negative pressure at a constant level. The air sac and through it the interior of the egg is, in this way, subjected to a continuous negative pressure while the fragment of shell is being removed and the slit made in the shell membrane.

Instead of a needle for making the slit in the membrane, a shell membrane teaser is used. This is easily formed from a single limb of a pair of curved forceps. The tip is bent backwards in such a way that when the instrument is applied vertically to the shell membrane, and then drawn sideways, the serrations catch the fibers of the membrane. The lateral traction causes a tear in the membrane at a slight distance from the teaser. The location of the slit, together with the fact that the constant suction causes the chorio-allantois to drop the instant the slightest tear forms in the shell membrane, combine to prevent injury by the instrument to the chorio-allantois. The egg is now ready for inoculation in the usual manner.

WOLCOTT B. DUNHAM

DEPARTMENT OF BACTERIOLOGY,
NEW YORK POST-GRADUATE MEDICAL
SCHOOL AND HOSPITAL,
COLUMBIA UNIVERSITY

A QUANTITATIVE VAPORIZER

AIR disinfection depends upon quantitative dosage control. Vaporization of chemical disinfectant may be quantitatively controlled by regulation of heat applied. In non-conducting fluids resistance coils can be submerged directly into the liquid and, since heat loss from the walls of a vessel at constant temperature (near boiling point of the fluid) is uniform, the excess heat absorbed in vaporization can be regulated by the amount of current supplied to the coil.

The sketch shows a simple U tube with a short length of heating element immersed in propylene glycol used in experimental study of chemical disinfection of air. To prevent uncovered resistance wire from reaching ignition point, copper leads transmit the current through the liquid to the coil. The air stream passing over the surface of the liquid carries the vapor into the dosing chambers.

An ordinary heating element submerged in a beaker of propylene glycol will evaporate upwards of a gram per minute. Care should be taken not to allow resis-