The recording instrument consists of a G-E Photoelectric Potentiometer Model 8CE5 (Fig. 2). This instrument has a current consumption of .01 ma at balance position and a full-scale response time of 0.3–0.4 sec. It was found that our recorder would not operate with direct leads from our patients because the source impedance was high and there was insufficient dampening of the galvanometer. An impedance-changer in the form of a double triode amplifier operating with an input impedance of 10^7 ohms is used. The amplifier is d-c–operated, is built in conjunction with a millivoltmeter, and has a gain of approximately 5.3. An additional advantage is the further reduction in current consumption imposed on the source of the potential being measured.[2]

The mechanical recordings are obtained with the aid of a pressure-operated strain gauge, the metal bellows of which is fed from the lumen of the Miller-Abbott tube leading from an intragastric balloon. The output of the strain gauge is, in turn, fed into a G-E Photoelectric Potentiometer Recorder identical with that used for the electrical recordings. Both the recorder from the electrical side and that from the mechanical side are synchronized so that the total electrical activity and total mechanical activity of the stomach are synchronously and continuously recorded (Fig. 2).

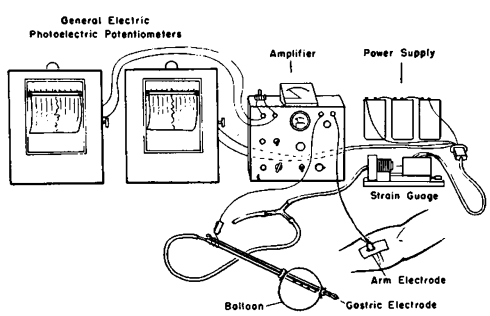

FIG. 2.

The above-described apparatus has the following advantages over that employed in the earlier work:

1. The recording instrument provides a continuous record instead of a connected series of spot-checks.
2. A full-scale deflection time of 0.3–0.4 sec instead of one of 28 sec.
3. The substitution of the stable silver-silver chloride electrode system for the calomel half-cell system.
4. The use of a long silver conductor instead of the liquid column conductors with their variable high resistance. This modification also dispenses with a large number of liquid interfaces.
5. The greatly lowered current consumption from the source being measured.
6. The inclusion of a method for accurately measuring synchronous variations in intragastric pressure.

Using the above apparatus we have recorded the electrical potential patterns from stomachs of normal subjects and of documented cases of duodenal and

[2] Purchased from H. S. Burr, Sterling Hall, New Haven, Conn.

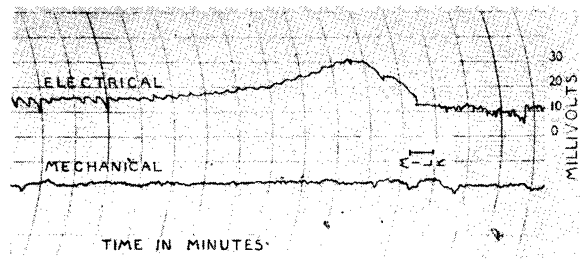

FIG. 3.

gastric ulcer, gastric carcinoma, and atrophic gastritis. Certain noteworthy facts are revealed regarding both normal gastric physiology and the electrical and mechanical behavior of diseased stomachs, which will be reported in detail in a subsequent paper.

Sixty-three determinations were performed on normal subjects. Fig. 3 show a typical pattern, with the upper line representing the electrical, and the lower line the mechanical, activity. The general characteristics of this group are:

Electrical: (1) A fairly regular baseline in rhythm, rate, and amplitude. The rhythm varies from 3–12/min with an amplitude of approximately 4–6 mv. (2) The milk response is immediate with increase in negativity, and dampening of amplitude.

Mechanical: (1) A fairly regular baseline corresponding to the electrical in rate, rhythm, and amplitude. (2) No appreciable change in baseline or amplitude with the ingestion of milk.

Reference

1. GOODMAN, E. N. *Surg. Gynecol. Obst.*, **75**, 583 (1942).

False Absorption Bands in the Region of 200–230 mμ Caused by Stray Radiation in the Beckman Spectrophotometer

Leo J. Saidel, A. Robert Goldfarb, and Wallace B. Kalt

Department of Biochemistry, The Chicago Medical School, Chicago, Illinois

Although most textbooks on spectrophotometry discuss errors caused by stray radiation, it is believed that the manifestations of these errors and their seriousness are not realized by many research workers in biology and chemistry, who are now using the Beckman Model DU spectrophotometer in the far ultraviolet region, where stray radiation is appreciable. Moreover, of those who are aware of the danger, many simply evade it by limiting their observations to the region above 220 mμ or by rejecting absorbancy[1] readings above a certain limit (*1*). Neither of these practices alone insures against false results, apart from the fact that the first practice may lead one to overlook important information, and the other may be inconvenient.

The effect of stray radiation in the region of 200–

[1] The terms are defined in *Natl. Bur. Standards Circ. (U. S.)* 484 (1949).

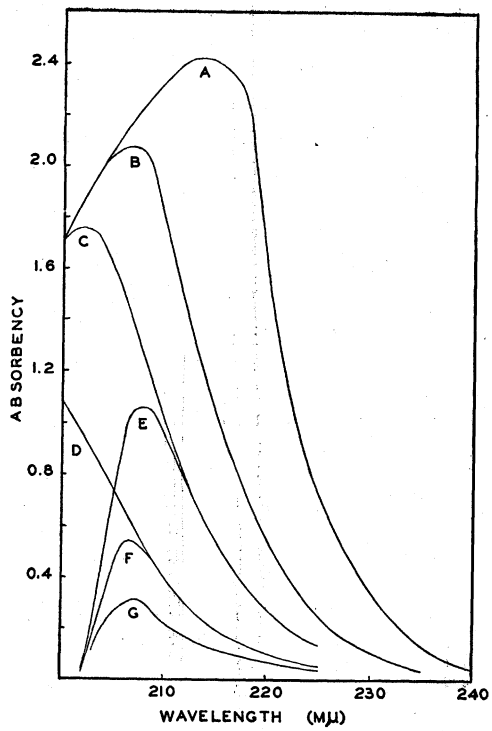

FIG. 1. Uncorrected absorption curves for glycine in water, curves *A–D*, and in 0.5 *M* phosphate buffer, pH 6.6, curves *E–G*. The concentration of glycine was, for curve *A*, 0.2 *M*; for curve *B*, 0.067 *M*; for curve *C*, 0.033 *M*; for curve *D*, 0.013 *M*; for curve *E*, 0.033 *M*; for curve *F*, 0.013 *M*; and for curve *G*, 0.0067 *M*.

230 mμ on the absorption curves of compounds that absorb in this region (and this includes practically all compounds to some degree) will be illustrated in the following discussion. No attempt will be made to give a general treatment of stray radiation, as this has been extensively covered in the literature (*2*).

All absorption data, unless otherwise indicated, were obtained with a Beckman Model DU spectrophotometer, serial No. 1146, in which the load resistor in the phototube housing had been changed from 3,000 megohms to 10,000 megohms in order to permit readings at 200 mμ. When experiments were first undertaken, it was observed that water solutions of any compound that absorbed appreciably in the region around 200 mμ displayed an absorption maximum if sufficiently high concentrations of the compound were used. The maximum occurred at wavelengths as high as 240 mμ and at absorbancy readings as low as 0.45. Examination revealed that the collimating mirror was fogged. In curves *A–D* of Fig. 1, however, absorption data are plotted for solutions of glycine in water which were obtained after the mirrors were resilvered, and the instrument was carefully cleaned and checked by the manufacturer. The solutions were read in 10-mm silica cuvettes against a water blank. That the observed maxima are false was demonstrated by the following observations: (1) According to Ley and Arends (*3*), who employed a vacuum spectrograph, glycine has no absorption maximum in the region from 185 mμ to 235 mμ. (2) When the solution from which curve *B* was obtained was run on a Cary spectrophotometer, again no maximum was found in this region.[2]

Since curve *D* plotted from absorbancy values lower than 1.2 contained no maximum, one might consider this a safe upper absorbancy limit. However, the danger of selecting any arbitrary absorbancy limit is illustrated by curves *E–G* of Fig. 1, obtained with solutions of glycine of different concentrations in 0.5 *M* phosphate buffer of pH 6.6 in 10-mm silica cuvettes. Again the maxima are all false—even the one plotted from absorbancy values lower than 0.35. The explanation lies partly in the high absorbance of the solvent which, read against an empty compartment in the cuvette holder, had itself a value of about 1.4 at 205 mμ. Yet purified ethyl alcohol has been reported (*4*) as having an extinction coefficient corresponding to an absorbance in a 10-mm cell of about 2.0 at 200 mμ, and a 0.1 *M* solution of reagent-grade sodium hydroxide in water has been found to have an absorbance in a 10-mm cell > 2.0 at 215 mμ. These are both solvents commonly used in ultraviolet spectrophotometric work. The absorbancy values from which curves *E–G* were plotted were obtained by subtracting solvent absorbances from the solution absorbances. This is equivalent to the general practice of reading the solution against the solvent as blank.

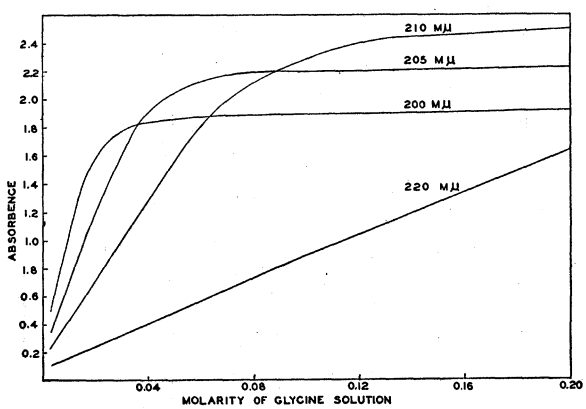

FIG. 2. Glycine in water.

In Fig. 2 the absorbance of glycine in water is plotted as a function of glycine concentration at several different wavelengths. Similar curves would be obtained with any compound that absorbs in this region and is transparent at higher wavelengths. Such a curve shows at a glance which absorbance readings must be rejected at each wavelength and provides a method for correcting the acceptable absorbance readings which are also in error.[3] Assuming Beer's law holds over this range of concentrations, a straight line of positive slope should have resulted at all wave-

[2] The authors gratefully acknowledge their appreciation to W. A. Holmwood and H. W. Alter, of General Electric Laboratories, for this information.

[3] The authors are indebted to T. Parke, of Lilly Research Laboratories, for helpful discussions, suggesting this type of correction for stray radiation.

lengths. Instead, it may be seen that the 200 mμ curve approaches linearity only at absorbance values up to about 1.4, the 205 mμ curve up to about 1.8, and the 210 mμ curve up to about 1.9. Absorbances below these values may be corrected; those above must be rejected. In this region where the solvent absorbs appreciably, it is advisable to read and correct solution and solvent absorbances separately.

To make corrections, it is necessary first to estimate stray radiation. This can be done by making use of the expression $A = \log \frac{I_{o\lambda} + I_{ox}}{I_\lambda + I_x}$, where A is the observed absorbance, $I_{o\lambda}$ is the intensity of the incident monochromatic radiation, I_{ox} is the intensity of the incident stray radiation, I_λ is the intensity of the transmitted monochromatic radiation, and I_x is the intensity of the transmitted stray radiation. The nearly horizontal portion of the curves in Fig. 2 represents a condition where the concentration of the absorbing substance, i.e., glycine, is so great that the transmitted monochromatic radiation is effectively zero, $I_\lambda = 0$, whereas the stray radiation, which comes from higher wavelengths, is almost completely transmitted, $I_{ox} = I_x$. Therefore, over this portion of the curve, approximately, $A = \log \frac{I_{o\lambda} + I_{ox}}{I_{ox}}$, from which it is apparent that the ratio of incident stray radiation to total incident radiation, $\alpha = \frac{I_{ox}}{I_{o\lambda} + I_{ox}} = \text{antilog } (-A)$, where A is best taken as the intercept of this portion of the curve with the ordinate. Thus, at 200 mμ $\alpha = 0.014$; at 205 mμ $\alpha = 0.007$; and at 210 mμ $\alpha = 0.005$. The values have been found to vary from instrument to instrument and from time to time, depending on several factors, among which are the condition of the mirrors and the intensity of the hydrogen discharge lamp.

It is evident that the stray radiation increases with decreasing wavelength. It is this property of the instrument which, in spite of such very small amounts of stray radiation, produces the dip in the absorption curve in a region where it should be rising. For, with the monochromatic light almost completely absorbed, the instrument essentially records only the increase in stray radiation with decreasing wavelength.

Once α has been determined, corrections may be made by means of a table (*5*) or the following equation: $A' = \log \frac{1 - \alpha}{T - \alpha}$, where A' is the corrected absorbance and T is the experimentally observed transmittance = antilog $(-A)$.

The above considerations have permitted the safe extension of the working range of the Beckman spectrophotometer down to 200 mμ. Because so many different compounds have an appreciable and characteristic extinction coefficient around 200 mμ, it is believed that the region has important analytical possibilities that have been almost completely neglected thus far. Studies on proteins, peptides, amino acids, and related compounds have already been initiated with interesting and useful results to be published soon.

References

1. Doub, L., and Vandenbelt, J. M. *J. Am. Chem. Soc.*, **69**, 2714 (1947).
2. Hogness, T. R., Zscheile, F. P., Jr., and Sidwell, A. E., Jr. *J. Phys. Chem.*, **41**, 379 (1937).
3. Ley, H., and Arends, B. *Z. physik. Chem.*, **B17**, 177 (1932).
4. Klevens, H. B., and Platt, J. R. *J. Am. Chem. Soc.*, **69**, 3055 (1947).
5. Opler, A. *J. Optical Soc. Am.*, **40**, 401 (1950).

Electron Microscope Study of Epidermal Fibers[1]

William E. Adolph, Richard F. Baker, and George M. Leiby

Veterans Administration Hospital, Long Beach, California, and School of Medicine, University of Southern California, Los Angeles

For many years the status of intracellular fibrils in the stratum spinosum of human skin has been much debated. Their appearance has been sketched by Rio Hortega (*1*) who represented them as extensions of the intercellular bridges. Chambers and Renyi (*2*), however, working with living material and a micromanipulator, found no evidence of intracellular fibrils and concluded that the fibrils were an artifact of fixation.

The present results were derived from normal human skin, preliminary to a study of pathological changes. Samples were obtained by punch-biopsies, the punch used being 1 mm in diameter. The samples, approximately 1 mm × 1 mm, were immediately put into 2% osmic acid and fixed for 24 hr. After washing and conventional alcohol dehydration, they were double-embedded in celloidin and hard paraffin. The celloidin was gradually increased in concentration to 12% and finally hardened in chloroform. Conventional paraffin immersion completed the embedding. The samples were oriented in plastic blocks so that cutting would be at right angles to the skin surface. Thin sections (0.1 μ) were cut on a modified Spencer microtome (*3*) and mounted on 200-mesh copper screens after extracting the paraffin and most of the collodion.

The results of many views of the stratum spinosum from a number of independent samples taken mostly from the upper arm are typified in Fig. 1. Intercellular bridges are clearly evident and appear to terminate at the cell boundaries, although no definite conclusions can be drawn as to whether they are protoplasmic in structure. On close view the precipitated cytoplasm also exhibits a fine feltwork of fibers, but they are of a different order of size than the intracellular fibers which have been described and furthermore are laid down in a random manner hav-

[1] Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.