and 3 of the cuvette holder. Standard cuvettes containing appropriate blanks can be placed in positions 2 and 4.

Catalytic hydrogenation. The sintered glass funnel is used in the side-arm assembly, and the manifold is connected to the anaerobic cell as illustrated in Fig. 2. With all pinchclamps and stopcocks open, the manifold system is flushed for a few minutes. Stopcock *A* is then closed while the nitrogen continues to flow through stopcock *C* and tube *E*. The catalyst (platinum black, palladium black, and so forth) and the solution to be reduced (0.2 ml maximum) are then placed on the sintered disk, and stopcock *C* is inserted into the upper joint of the sintered glass funnel. Pinchclamp *D* is closed and stopcock *A* is immediately opened, thus shunting the flow of nitrogen through the cell, up through the sintered glass funnel, and out tube *E*. When reduction is complete, stopcock *B* is closed, pinchclamp *D* is opened, and the pinchclamp on tube *E* is closed, in that order. The pressure builds up and forces the solution through the sintered glass plate, through stopcock *A*, and into the side arm (*3*). When all the solution has been filtered, pinchclamp *E* is opened, stopcock *A* is closed, and the sintered glass funnel is removed. The subsequent steps are carried out as previously described.

This apparatus has been used successfully to study the enzymatic reduction of cytochrome oxidase. Since this enzyme is readily reoxidized by small amounts of oxygen (*4*), and since no difficulties were encountered in maintaining this enzyme in its reduced state, adequate anaerobic conditions are provided by this assembly.

References and Notes

* Present address, Department of Anatomy, University of Minnesota Medical School, Minneapolis.

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New Electrophoresis Cell for Dual Analysis

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Most of the cells in use today for moving-boundary electrophoresis are based on the design and principles of Tiselius (*1*). These cells are of two types. One, following Tiselius' original design, consists of a sliding sectional U-tube and detachable electrode vessels. The other type, which has come into use in recent years, is a one-piece cell. The essential feature of both cells is that the U-tube has vertical limbs of rectangular cross section with optically flat faces and electrode vessels attached to both of its sides. In the one-piece cell there are no sliding sections, and the boundaries are formed by careful layering rather than by shearing.

One disadvantage of moving-boundary electrophoresis is that, with the cells currently available, only one experiment at a time can be performed. Since from 1 to 3 hr is required for an experiment, the usefulness of the method is limited by the amount of time required per run. To overcome this difficulty, many investigators have resorted to paper electrophoresis, which has sufficient capacity for multiple simultaneous runs. However, this method is not always a satisfactory substitute, because its resolution of components is often inferior to that obtained with the moving-boundary technique, and the determination of mobilities is subject to various correction factors (*2*).

Electrophoretic cells capable of multiple analysis have been developed by Polson (*3*). These employ the center section of a sliding sectional cell and a semipermeable membrane across the bottom of the channels. Apparently only descending patterns can be obtained with these cells.

In the course of a project performed at this laboratory it was found necessary to do pairs of electrophoretic analyses under as nearly identical conditions as possible. To satisfy these conditions, we have developed the dual analysis cell described here. Because of the relative ease of filling and handling, the one-piece

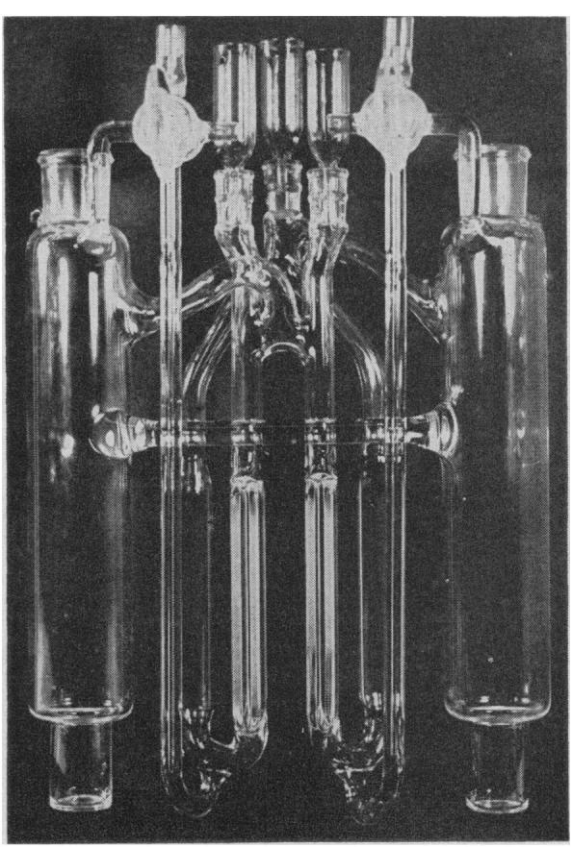

Fig. 1. The dual electrophoresis cell.

design, which is quite satisfactory for most purposes, was chosen. Furthermore, the design permits one to obtain ascending or descending patterns as desired.

The dual analysis electrophoresis cell consists of two U-tubes so connected as to constitute a parallel electric circuit whose branches are of equal path length (Fig. 1). The two inner limbs are of rectangular cross section and constitute the optical sections of the cell. The outer limbs, made of nonoptical glass tubing, function as reservoirs for the solutions to be analyzed. In principle all four channels could be of rectangular cross section and function optically, provided that the Schleiren lens of the optical system is of a sufficiently large diameter. In this case, both ascending and descending patterns could be obtained for each sample. This particular cell was designed to fit the Aminco-Stern portable electrophoresis apparatus. The lens diameter in this instrument dictated the use of only two optical channels. Depending on the position of the starting boundaries and the polarity of the electrodes, one may therefore obtain either ascending or descending patterns, but not both. In order to allow the dual analysis of two different samples, a separate filling capillary is connected to the base of each U-tube. Boundary formation is effected by the simultaneous filling of the channels through the capillaries at a slow uniform rate of flow.

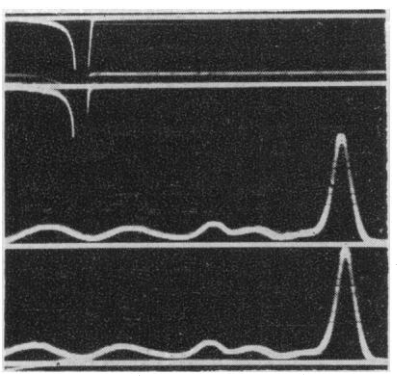

Fig. 2. Patterns obtained on dual analysis of normal human serum. Reading from top to bottom: starting boundary, left channel; starting boundary, right channel; final pattern, left channel; final pattern, right channel.

To test the identity of the patterns obtained from the two channels, a sample of normal serum dialyzed against barbiturate buffer (pH 8.6; ionic strength 0.1) was divided into two aliquots and analyzed simultaneously in the cell. The patterns obtained are shown in Fig. 2. The relative percentages of each component are shown in Table 1. As can be seen, the patterns are virtually identical, both in shape and position of the components. The values of the relative percentages of the components are quite similar. Such differences as do occur may be ascribed to errors associated with the procedure used in the tracing and planimetry of the patterns.

Table 1. Relative percentage concentration of serum protein components analyzed simultaneously.

Channel	Components				
	Albumin	Alpha-1	Alpha-2	Beta	Gamma
Left	52.1	4.4	10.2	14.3	19.0
Right	51.7	4.5	10.2	14.5	19.1

Aside from dual runs on the same sample, the cell has been found to be extremely useful for analyzing two different samples under the same conditions. For statistical and comparative purposes its advantages are evident. For routine analyses the double output of the cell is a saving of both time and labor (*4*).

References and Notes

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4. We wish to acknowledge our gratitude to Karl Schuman of Cliffside Park, N.J., who constructed the original model of the cell, and to A. Henley of the American Instrument Co., Silver Springs, Md., for his activity in the further development of the cell. We are indebted to B. W. Volk, director of laboratories and A. Saifer, chief of the Biochemistry Department, Jewish Chronic Disease Hospital, for their encouragement and aid in permitting this work to be performed under grant No. B-285 of the U.S. Public Health Service.

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Nowadays it is a truism that advances in physical science depend upon advances in the instruments which scientists employ.—KARL DARROW.