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Precipitation reactions were developed by Oudin at the Pasteur Institute of Paris for the specific purpose of analysis of animal serum. It is remarkable that a tool which proved to be so useful to the biologist was created to achieve a predetermined aim. The history of gel reactions was to follow the same extraordinary pattern of concept before the fact. Ouchterlony added a second dimension to gel reactions; a third well allowed for analysis of antigens from different sources. Reactions which were believed to be due to ‘cross-reactivity’ of the same antibody with different antigens proved to be due to different antibodies, each reacting with its homologous antigen. Furthermore, double diffusion produced evidence of a new unsuspected type of reaction, ‘partial identity’. In this reaction, antibody recognizes common parts in structure between antigens from different sources, which are, for the rest of their constituents, different. Oudin and Ouchterlony had not only given biologists a new tool, they had provoked a revolution in our concepts of antigen-antibody interaction. Soon, characterization reactions, chemical and enzymatic properties were performed on antigen-antibody arcs and enormous data began to accumulate. However, because of the expansion in analytical possibilities brought about by gel reactions, new difficulties arose. In analysis of complex mixtures of antigens, gel diffusion reactions produced a series of precipitin bands concentrated in a small area in which recognition was impossible. Pierre Grabar, then at the Pasteur Institute of Paris, opened a third dimension. By submitting the antigen mixture to electrophoresis before carrying out the double immune diffusion reaction, he separated the complex series of bands.
into a set of independent double diffusion reactions at locations imposed by ionization characteristics of antigens. It must be kept in mind that these characteristics, being born in the nature of antigens, are forever with us. Properly separated by electrophoresis, human serum will exhibit seven distinct zones, by ionization alone, not using sieving gel. The best advantages of combining electrophoresis with double diffusion can be obtained if a good method of electrophoresis is used during the first phase of analysis. In the first edition of this work, I emphasized the simplicity of immunoelectrophoretic analysis. I wish to emphasize again, at the risk of redundancy, that high resolution is easier to achieve than medium or low resolution because good reproducibility and definition have been obtained through simplification of the equipment and the method used. With this method it has been possible to accumulate a collection of plates that are comparable, and modifications due to disease are clearly identifiable. Interpretation of abnormalities has now been extended to 18 proteins in human serum alone. For this reason, sacrifices in resolution based on economy of gel and antiserum are not justified. In addition, there are other proteins whose role is not established and an effort should be made to expand the scope of interpretation, rather than simplify. Those who have used my book and have been kind enough to offer their comments have found the description of deviations from normal and their relationship with disease useful. Accordingly, I have decided to re-orient Chapter 6. The classification of immunologic deficiency appears to have been changed since the publication of the first edition. It will be changed again. Because this is not a book of immunology, it seems more reasonable to adopt a classification based upon protein abnormality. Perturbations in synthesis will always cause the same effects and therefore
permit a stable classification.

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In this last respect, it should be pointed out that therapy often affects the balance of protein synthesis and interpretation should be made only with full knowledge of any chemotherapy involved. For example, states of complement activity are affected by corticosteroids. With the advent of effective chemotherapy, myeloma paraproteins disappear. The pattern of granulomatous disease returns to normal in a very short time. Immunoelectrophoresis is no longer useful only as an aid to clinical diagnostic, it has become a tool in the control of chemotherapy. We found it desirable to elaborate briefly on this new aspect. One old but long neglected form of immunoelectrophoresis has been revived in the form of 'counter-immunoelectrophoresis'. Considering the number of applications of this technique, we felt it advisable to describe both method and applications. Finally, a new system of photographic report involving a fast dry process has been developed. The clinical pathologist will now be able to add a permanent record to his report. A photographic report is highly desirable because physicians will be permitted to appreciate directly the usefulness of immunoelectrophoretic analysis and will be able to compare patterns during follow-up studies of difficult cases. Also, it has been possible to integrate the film on IBM standard cards fitted with a window. Not only is this system compatible with existing filing equipment, but it may open the way to computer reading. To summarize this introduction, I wish to express my definite conviction that in this fascinating field of immunoelectrophoresis, perspectives remain gigantic.

Pierre Charles Arquembour
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