Pathology of Erythroblastic Mitosis in Occupational Benzenic Erythropathy and Erythremia

In vivo and in vitro Studies

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To professor

Paolo Introzzi
on the occasion
of his 30th year of teaching

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Foreword

When, in 1892, I made my first contacts with biological circles of Pavia I was astonished to see that the doctrine of cellular multiplication bound to the names of Virchow, Kölliker, Fleming and Carnoy was still considered with some mistrust and that even some scientific authorities were speaking with some derision of aster, aureole and polar fields of the karyokinesis. I am happy today that I was not contaminated by this incredulity; in fact, I had the chance to have found hospitality in Golgi’s Institute where Kölliker, Boveri, Nansen had stayed and discussed problems of cellular proliferation together with our Teacher and both his pupils Luigi Sala and Achille Monti. Luigi Sala, having studied in Berlin in the Institute of Hertwig and having just returned to Italy to conduct some research on the maturative meiosis and proliferative mitosis of Ascaris eggs, was so kind as to make me observe directly under the microscope the phenomenon of karyokinesis in action in his very clean preparations. The least I can do is to point out that the easy mistrust and the hypercriticism of new orientations and new techniques whereas being often a reason for delay in doctrinal progress, are nevertheless constructive elements of the genuine discovery. Thus it had been karyokinesis. In the course of a few years, especially thanks to the work of Fleming, Carnoy, Van Beneden, Bizozzzero and many other histologists the reconstruction of the phenomenon in its known phases was conceived,
and prevented further deviations and errors. There occurred indeed some deviations, e.g. when Telezynsky maintained that the contents of the nucleus in the living state and at rest is homogeneous and that the chromosomes appear in mitosis by neoformation out of a diffuse mass; and even more so when Paolo della Valle interpreted the chromosomes as flowing crystals. However, this was a rather more welcomed than dangerous deviation because it stimulated a more profound study of the phenomenon. This could, however, not be properly done until the kinetics of karyokinesis were further reconstructed by statistical evaluation of the events observed on fixed and stained preparations and which were to be arranged in a logical succession by the investigators. The phenomenon, however, could not be directly followed in its continuity. Help was looked for in vitro cell and tissue cultures. When this was provided, Levi and his school obtained findings of appreciable significance; but the visibility of the chromosomes in the living cell was not sufficiently clear. When information was obtained through some additional technical expendiency, the suspicion of lesions and artefacts was obvious. Thus the ideal mean was to be developed in such a way that the cell structures should become visible by their own optical properties. The innovation had to be accomplished by optical means, which had to make it possible to appreciate the structures in the living state on the basis of microscopy alone. In this way phase contrast microscopy was developed. Rondanelli and his collaborators became masters in the use and application of this method, developing through numerous experiments a personal technique aimed at the kinetic study of mitosis. They soon achieved to record faithfully the phenomenon with cinemicrophotography.

As histologist and also as an experienced hematologist coming from a renowned school, that of Ferrata, he selected as study material among others the erythroblasts of circulating blood and those cultivated in vitro. In this book of the investigators, coming from the school of hematology of Pavia, various aspects of the pathology of erythroblast mitosis and in particular of the pathology of erythroblast mitosis of humans after benzene intoxication are exposed, critically discussed and evaluated with a unique personal experience. The similarities and possible differences between lesions caused by accidental intoxication in humans and experimental lesions effected in newt erythroblasts are clearly confronted and evaluated. This was scientifically useful because it permitted the authors to refer easily to the fundamental characteristics of the classical mitosis typical of newt.
On the other hand, the attentive reader of this book will not miss the importance of the experiment of nature which some mitotic lesions of human erythroblasts caused by benzene represent and how they contribute also to the elucidation of more general problems of karyokinesis. Those who have had or will have the chance of seeing the film projection of some mitoses, as shown in their sequence in the book itself, will have made a remarkable step forward in knowledge and will have become familiar with a phenomenon generally described in rather obscure terms.

Pavia, 1968

A. Pensa