to alter the relations between oxygen supply and demand.

Attention is also given to cell cycle analysis and to the methodology involved in the establishment in vitro of systems of hematopoietic cells for determining the biochemical actions of erythropoietin at a molecular level, a subject with which Krantz has had considerable direct experience. There is a good discussion of embryonic and fetal erythropoiesis and the influence exerted by erythropoietin on these processes. It is of interest that mouse fetal liver cells are responsive to erythropoietin for a period associated with hepatic erythropoiesis, which suggests that an erythropoietin may play a physiologic role in red cell development in fetal liver. Finally, relations of these basic considerations to clinical problems are discussed, with the possibilty that derailments of erythropoiesis, such as those that occur in aplastic anemia and in primary polycythemia, may be attributable not only to basic defects in the hematopoietic elements themselves but also to alterations in the production, utilization, or metabolism of erythropoietin as well as to plasma erythropoiesis inhibitors. In this regard, the authors call attention to the need for a pure erythropoietin to initiate clinical trials for the treatment of anemias of renal origin and those in which the requirement for erythropoietin may be greater than normal.

This valuable reference book is recommended for both neophytes and experts in the study of erythropoiesis and its humoral control. It should also prove useful to general biologists interested in pursuing the mechanisms underlying the action of a specific triggering agent, in this case erythropoietin, on differentiation processes in a mammalian cell system.

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Multiple Births

The Biology of Twinning in Man. M. G. BULMER. Clarendon, New York, 1970. x, 206 pp., illus. $6.40.

Written by a lecturer in biomathematics in the University of Oxford, this monograph considers a field in which he has researched. In the first chapter he reviews the evidence for two types of twins, monozygotic and dizygotic, and then the evidence for a third, or intermediate, type of twinning in which a double gametic contribution comes from the father. Such might take any one of three forms, called (i) primary oocytary if the primary oocyte divides equally, (ii) secondary oocytary if the second oocyte divides equally, and (iii) uniovular dispermatic if the ovum divides equally. The evidence would suggest that if such a third type occurs it is rare. One of the best indications of its existence is the rare occurrence of unlike-sexed twins both with mongolism.

A chapter on the embryology of twinning discusses the three types of monozygotic twins according to placentation, this depending in turn on the stage at which the separation occurs. (i) If the division of the zygote occurs before the morula stage, that is, before differentiation of the trophoblast from which the chorion and placenta develop, the twins develop separate choria and amnia and are indistinguishable in fetal membrane from dizygotic twins. About a third of monozygotic twins are of this type; division must have occurred before the fifth day after fertilization. (ii) If the inner cell mass divides into two after the differentiation of the trophoblast but before that of the amnion, the resulting twins will have a common chorion but separate amnia. A majority of monozygotic twins are of this type. (iii) About 1 percent of monozygotic twins have a single amnion (and single chorion). In these instances division occurs in the embryonic disc late, after differentiation of the amnion. The very rare conjoined ("Siamese") twins are a special example of the third type. Information on differences in the degree of dissimilarity of monozygotic twins according to the type of placentation is meager; such as there is the author reviews in the third chapter.

The frequency of twinning in relation to factors such as geography, race, and maternal age and parity, higher multiple births, and the inheritance of twinning are other topics discussed. The use of twins in genetic research is discussed from a methodologic point of view; results of application of the method are not presented except for a few examples, such as Kallmann and Reisner's data on tuberculosis. In an interesting chapter the evolutionary significance of litter size is discussed beginning with Wood Jones's theory, advanced in *Arboreal Man* (1916), that multiple births represented a selective disadvantage under conditions of life in the trees.

In appendices to three chapters, the author discusses some more specifically biometrical aspects: methods for estimating the likelihood of monozygosity, including the use of quantitative traits such as the dermatoglyphic ridge counts; the Poisson and Yule processes, expounded in relation to higher multiple births; quantitative genetics (partitioning the variance and correlation between relatives), discussed in relation to the inheritance of twinning. A rather long and seemingly well-selected bibliography, as well as author and subject indexes, is provided.

This is a welcome addition to the literature in human genetics. Nothing quite like it is available.

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Life of a Mathematician

Hilbert. CONSTANCE REID. With an appreciation of Hilbert's mathematical work by Hermann Weyl. Springer-Verlag, New York, 1970. xii, 292 pp., illus. $8.80.

This biography is woven out of three distinct themes. It presents a sensitive portrait of a great human being. It describes accurately and intelligibly on a nontechnical level the world of mathematical ideas in which Hilbert created his masterpieces. And it illuminates the background of German social history against which the drama of Hilbert's life was played.

Hilbert's life (1862–1943) coincided with the golden age of German science and with the flowering of German militaristic nationalism. He lived long enough to see his country's intellectual and military preeminence shattered in a common ruin. Anyone who reads this book comes face-to-face with the central enigma of German destiny. How could it have happened that, as Hilbert's pupil Hermann Weyl said in 1945, "Two classes enjoyed a prestige far higher than corresponds to American standards: the military and the scholars. Germany was unquestionably militaristically minded; but that is only one side of the picture: the German nation gloried in her army *and* in her universities"? To an American in the year 1970 it seems especially urgent to understand the roots of the German tragedy. In our culture too there has been, in the years since Weyl spoke, a parallel rise in public respect for military and for academic institutions. Now that there is