urban tradition in Mesoamerica. Quetzalcoatl is one of the principal creator gods and, depending on the source, was involved in the creation (and destruction, since events were cyclical) of the world, of humankind, of corn, of knowledge, and so on. In this case, however, the focus is his identification with Tollan, the archetypical Mesoamerican city. Tollan, the capital of the Toltec empire was cited in Aztec myth and history as a place of abundance and the center of creativity. The Quetzalcoatl-Tollan symbolism was also associated with the legitimization and development of Teotihuacan, Cholollan, Xochicalco, Chichen-Itza, and Tenochtitlan.

Just as Quetzalcoatl was involved in the creation of Tollan, his overthrow by the rival forces of Tezcatlipoca led to its downfall. According to Aztec mythology he would return from the East one day and reclaim his throne. Cortes and the Spanish conquerors arrived in Mexico from the East. They were believed by Moctezuma to be the god himself, a factor that made Moctezuma abdicate his leadership role and contributed to the downfall of the Aztecs. Thus, ironically, the myth of Quetzalcoatl was a paradigm both for the creation and legitimization of the Aztec empire and for its downfall.

Carrasco does an excellent exposition of a model of urbanization that serves as a corrective to a current cultural materialist trend that uses population pressure as the prime mover for cultural change. In the present case, the sacred city stimulates population increases and attracts more people into the city's sphere of influence. In turn this requires intensification in agriculture and technology. The key component is the emergence of a religio-political elite controlling all institutions, which in turn is legitimized by its identification with and control of the sacred microcosm of the central city. The archeological work of Sanders, Parsons, and Santley in the Valley of Mexico certainly supports this theory of state formation for Teotihuacan.

Carrasco is not uniformly successful in demonstrating the centrality of Quetzalcoatl in all of the six cities. It is difficult to perceive Tollan as a paradigm for Teotihuacan, which was founded a millennium earlier. It is also clear that the dominant symbolic structures at Teotihuacan are the pyramids of the Sun and Moon, with an *axis mundi* centered in the cave located underneath the pyramid of the Sun, and that the dominant agricultural-fertility diety is Tlaloc, not Quetzalcoatl. In the case of Tenochtitlan, the principal deities that legitimized the rulers and the empire belonged to the warrior-god complex of Tezcatlipoca rather than to the Quetzalcoatl myth.

The argument of the book would have been enormously strengthened if some of the possible alternative sources of mythic justification for an empire had been examined critically and compared to the Quetzalcoatl model. Such an example is the Aztecs' belief that they were the "people of the sun" who prevented the end of the world by nourishing the sun by sacrificing war captives.

A fringe benefit is an excellent discussion and critique of the usual primary sources of information on Mesoamerican beliefs. These range from pre-conquest codices to the encyclopedic work of Sahagun. The discussion would not be new to experts in the area, but the virtue of this chapter is that all the various types of sources are discussed here and that Carrasco brings together views from a variety of widely dispersed sources.

This book constitutes an interesting and challenging approach to the interpretation of Mesoamerican religion, urbanism, and archeology. It will provoke considerable debate.

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An Elizabethan Scientist

Thomas Harriot. A Biography. JOHN W. SHIRLEY. Clarendon (Oxford University Press), New York, 1983. xii, 508 pp., illus. $55.

Thomas Harriot (1560–1621) was England's leading scientist as the Elizabethan age drew to an end. To cite just a few of his achievements: he discovered the sine law of refraction (Snell's law) and the parabolic path of projectiles, and, independently of Galileo, he first turned the telescope to the heavens, drew a lunar map, and observed sunspots. He was, moreover, not solely a contemplative scholar: during 1585 and 1586 he participated in Sir Walter Ralegh's epoch-making, though ill-fated, voyage to explore Virginia and establish an English colony.

Harriot's name, nonetheless, is barely known outside a small group of scholars. Undoubtedly, this is because he published only one work, his (non-scientific) *Briefe and True Report of the New Found Land of Virginia* (1588), and his literary executors just one more, *Artis analyticae praxis* (1631), on algebraic equations. Harriot's reputation has undergone many vicissitudes in the past four centuries. In his own day he was highly regarded despite his lack of publication, for he communicated his results to a wide circle; and his fame even reached Kepler in Germany. It is, however, only in the last four decades, with the systematic study of his surviving papers and the documentation of his life, that we are attaining a true historical assessment. John W. Shirley has been in the vanguard of this renaissance of Harriot studies, and the present biography culminates more than 35 years of research.

Through his long association with Ralegh as a scientific and technical adviser, Harriot actively participated in England's growth into a major maritime nation. He applied mathematics, astronomy, and mechanics to contemporary problems of navigation, cartography, and ballistics and made notable contributions both to improved practice and to the sciences themselves. For instance, to construct a true sea chart he demonstrated that stereographic projections are conformal, solved the rectification and quadrature of the equiangular or logarithmic spiral, and developed sophisticated interpolation formulas—all in advance of his time. In addition to preparing papers and charts for Ralegh and lecturing to him and his men on seafaring, the efficient Harriot also handled his administrative and business matters.

Though moving in court circles may have been exciting and financially rewarding, it could also be a risky business. In the 1590's, when Ralegh's enemies attacked him as a free-thinking atheist, they also implicated Harriot. He was investigated for atheism, but no formal charges were laid against him. In 1605, Harriot's second patron and Ralegh's close friend Henry Percy, 9th Earl of Northumberland ("the Wizard Earl"), was imprisoned on trumped-up charges in the Gunpowder Plot. Harriot and others associated with Northumberland were also rounded up and imprisoned. Harriot spent some time in the Gatehouse, but he fared far better than his patrons, Ralegh, who spent 13 years in the Tower, and Northumberland, who spent 16. Beginning in the 17th century, the story grew up of the Wizard Earl and his Three Magi (Robert Hues and Walter Warner, in addition to Harriot) who carried out philosophical discussions and scientific experiments in the Tower as a sort of early learned society. Shirley devotes a chapter to debunking this myth, although he has set up something of a straw man by so rigidly demanding "a formal association" involving all four

simultaneously, when there is no doubt that a very interesting but looser association did exist.

The more than 9000 surviving sheets of Harriot's papers consist mostly of mathematical results and experimental and observational records—typifying in many ways the emerging "new science" of the Scientific Revolution—but they contain little that reveals their broader context and even less that reveals his aims and motives. Consequently, only by painstaking analysis of his manuscripts have historians been able to recognize their significance, reconstruct the development of his thought, and place it in historical perspective. Perhaps because of these difficulties of interpretation, and also because he recently edited *A Source Book for the Study of Thomas Harriot* (Arno Press, 1981) that contains reprints of much of the specialist literature, Shirley has chosen not to present Harriot's scientific work in depth. Indeed, he virtually ignores his mathematics. Since Harriot's scientific investigations were the principal passion of his life, this results in a meticulously documented chronicle of his life rather than a full-bodied biography. Still, Shirley's book will bring the intriguing Harriot to a broader audience and for historians serve as a solid foundation for future research.

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Biological Development

From Egg to Embryo. Determinative Events in Early Development. J. M. W. SLACK. Cambridge University Press, New York, 1983. x, 241 pp., illus. $49.50. Developmental and Cell Biology Series, 13.

The development of a batch of embryos is always impressive because of the uniformity of the developmental process and the dramatic increase in complexity that occurs as the egg generates an organism with a definite body plan. *From Egg to Embryo* deals with the mechanisms that underlie the genesis of this spatial pattern. It was written to explain the mind set and the major findings of experimental embryologists to a general audience of biologists.

The book is divided into three parts. The first part delimits the problem that Slack is concerned with: the mechanisms that are responsible for regional specification in the early embryo. Slack argues, I think quite correctly, that elucidating these mechanisms is the central problem in the field of developmental biology. This part of the book also introduces the concepts and defines the terms that experimental embryologists use. Words that serve as bridges between observations and concepts sometimes have different meanings for different workers in this field, and there has been a tendency for groups of developmental biologists to invent their own jargon. Slack has defined his terms carefully in order to avoid these problems. One might quibble with a few definitions; most of these cases reflect the Wolpertization of English developmental biology.

The second part of the book provides an overview of the experimental evidence that indicates when and how regional specification occurs during early embryogenesis in amphibians, insects, other selected invertebrates, the mouse, and the chick. This survey is very well done. It not only points out the unique contribution that each of these groups has made to experimental embryology, it also considers the outcome of a set of similar experiments on embryos of animals that develop in different ways. This allows one to try to compare the extent to which the embryos use the same developmental mechanisms. The chapter on invertebrates other than insects is not as well done as the chapters on the other groups. Many of the eggs of such invertebrates have localized cytoplasmic determinants that appear to be responsible for regional specification in the early embryo. Slack seems a bit uncomfortable with this notion.

The last part of the book presents a number of models devised by theoretical biologists that could be used to explain various aspects of regional specification. These models fall into three general classes; they deal with reaction systems that could exist in more than one stable steady state, the role of axial properties in integrating developmental events in different parts of an embryo, and the emergence of discontinuities between regions in the embryo. Such models are just beginning to have an impact on developmental biology. Variants of some of the models discussed here have played an important role as a guide to research work on regulation in *Hydra* and *Dictyostelium*. This work has involved an active collaboration between model builders and experimentalists. Unfortunately there aren't any good examples of this kind of approach involving early embryogenesis. Though Slack does a good job of describing the models he presents and explaining their limitations, most of his attempts to use the models in the context of early embryogenesis only engender skepticism on the part of the reader.

This book would make an excellent special topics textbook in an advanced undergraduate course in developmental biology. It is much more interesting than any of the current textbooks on the market.

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