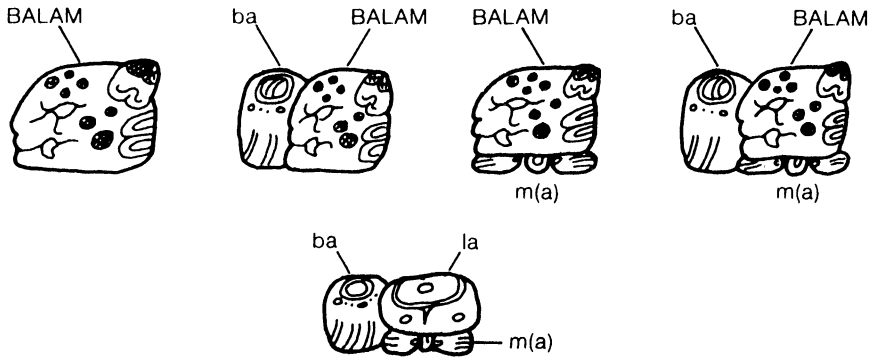

"Alternative spellings for *balam*, 'jaguar.' According to his whim, the scribe could write this purely logographically; logographically with phonetic complements; or purely syllabically." [From *Breaking the Maya Code*]

Floyd Lounsbury, against an increasingly unhappy cadre of archeologists brought up to believe Thompson's despairing conclusion that the non-calendric texts were linguistically impenetrable. The band of working glyphers enjoyed support and meeting opportunities provided by people like Elizabeth Benson and Merle Greene Robertson. Still, throughout the last 20 years some prominent archeologists continued to devise interpretations of the Pre-Columbian Maya world that studiously minimized the value of the texts—all in the name of science and sober method.

Coe treats honestly but gently the painful encounters he and others of his ilk have endured with such opponents. His own entanglements in this period revolved around the public display and intellectual promotion of inscriptions of unknown provenience painted on vases of the Classic period. The texts running as bands around the rims of these pots we now know are dedication statements, declaring the kind of vessel, the artist, the patron of the ritual, and the contents. The texts embedded in the scenes include vital information on the ceremonial activities of the Maya nobility and basic insights into Maya religion and philosophy. Coe's courageous insistence that the painted vessels were a legitimate and central source of evidence invited a campaign of professional reprisals from righteous colleagues who argue that all looted art objects from the Maya world should be ignored. No professional, least of all Coe, who is a famous field archeologist, condones the looting that has destroyed countless Maya buildings. It was the kind of smear that wounds deeply and heals slowly. Fortunately, the salve of vindication and validation heals well. The Classic Maya vessels and their texts are now fully incorporated into the inquiry by the leading scholars of our field.

As Coe's story closes in on the present, the cast of characters broadens out to include most of the principal people who actively worked to realize this last major decipherment of an ancient literature. Such impressive contributors as David Stuart, Nikolai Grube, and Barbara MacLeod receive deserved praise. Coe is especially proud of Stephen Houston and Karl Taube, Yalé students of his during the 1980s who became his teachers in this era of spectacular progress.

This is one central participant's eyewitness account; but as an archeologist working with epigraphers in the most recent years of the drama, I can attest to its general accuracy. Yet being also a participant—not one who figures in Coe's story—I naturally have some differences with him over details. He is rather categorical in his view that archeologists, with only a few important exceptions that he notes, were in opposition during the 1980s and remain there today. Actually, there have been quite a few Maya archeologists working with glyphers and glyphs over the last decade. These archeologists, publishing in major journals and books, have also paved the way for a general acceptance of the decipherment. But that story can wait. This book's story is an exciting and worthwhile one.

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Molecular Connections

Hydrogen Bonding in Biological Structures. G. A. JEFFREY and W. SAENGER. Springer-Verlag, New York, 1991. viii, 569 pp., illus. $79.

Hydrogen bonds—the interaction of a hydrogen atom bonded to an electronegative atom such as oxygen or nitrogen with an electron pair of another electronegative atom—are weak attractions, with a binding strength less than one-tenth that of a normal covalent bond. However, hydrogen bonds are of extraordinary importance; without them all wooden structures would collapse, cement would crumble, oceans would vaporize, and all living things would disintegrate into random dispersions of inert matter. The component molecules of living systems such as proteins, carbohydrates, and nucleic acids owe their unique properties in large part to inter- and intramolecular hydrogen bonding. In addition, living tissue is an aqueous environment in which hydration by and hydrogen bonding with solvent water mediate the functioning of biomolecules.

Hydrogen Bonding in Biological Systems provides an illuminating account of the role of such bonds. In their account of known crystal structures, the authors extract, condense, and clearly present a wealth of material for the benefit of the non-crystallographer. An extraordinary amount of information and interpretation is packed into the pages of this book, yet it is neither cluttered nor dense. Section by section, the clearly written text builds into a smoothly flowing whole. The numerous illustrations are chosen with care and crisply reproduced, and references are comprehensive up to 1990.

The book opens with a succinct review of the history, theory, structural parameters, metrical properties, experimental methods of study, and theoretical methods of treatment of the hydrogen bond that is valuable on its own. Discussion then proceeds to hydrogen bonding in small biological molecules such as amino acids, mono- and disaccharides, purines, pyrimidines, nucleotides, and cyclodextrins and continues with macromolecules such as polysaccharides, proteins, and nucleic acids. For each molecular type, there are discussions of intrinsic hydrogen bonding of the species (intra- and intermolecular) and hydration.

The authors place considerable emphasis on cooperativity. In extended hydrogen-bonding structures, bonds interact so that the total bonding energy of the structure is greater than the sum of an equal number of similar but isolated bonds. Cooperativity is a function of the entire hydrogen-bonding network throughout the bulk crystal.

The depiction of such patterns with conventional molecular illustrations would be difficult if not impossible. To overcome this, the authors have developed a schematic method of mapping networks that shows only donor and acceptor atoms; in effect, this lifts the hydrogen-bonding network intact out of the crystal structure. In this approach, applied most frequently to carbohydrates and nucleotides, each atom is labeled with a designating number from crystallographic studies, and codes from the Cambridge Crystallographic Data Base are

also provided. An appendix lists these codes and the references for the associated crystal structure.

But this book is more than a compendium of structural facts about biomolecules. Throughout, the authors show how analysis of the hydrogen-bonding properties of biomolecules leads to an understanding of why they are assembled from the particular subunits that compose their structures. One example is the discussion of how the allowed tautomeric forms of thymine, cytosine, adenine, and guanine control their hydrogen-bond donor-acceptor properties, which in turn determine their unique role in the flow of genetic information.

Hydrogen Bonding in Biological Systems is informative and eminently usable. It is, in a sense, a Rosetta stone that unlocks a wealth of information from the language of crystallography and makes it accessible to all scientists.

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Other Books of Interest

Phage and the Origins of Molecular Biology. JOHN CAIRNS, GUNTHER S. STENT, and JAMES D. WATSON, Eds. 2nd ed. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, 1992. xii, 366 pp., illus. $35.

One of the first salvos in the ongoing attempt to write the history of molecular biology was the famous "phage volume," put together at the Cold Spring Harbor Laboratory in 1966 to honor the 60th birthday of Max Delbrück, one of the field's founders. To that much-heralded work over 30 of Delbrück's friends and associates contributed their personal reminiscences, observations on the growth of the field, and comments on their own particular areas of research. Now the publisher has reissued it in this "expanded edition." For the new volume John Cairns, who as he puts it "had had nothing to do with the origins of molecular biology" but became involved in the project by virtue of being director of the laboratory, contributes a preface recounting some of the vicissitudes encountered in getting the original work into print. The initial editing of the manuscripts was done by Gunther Stent, who though a "punctilious and immensely skillful" editor has a "very distinctive style," so that Cairns in many cases found himself "substituting *stet* for Stent" in the interest of preserving the spirit of the occasion and minimizing authors' dismay. Another difficulty was the fear that had been instilled in the contributors by Delbrück's own exacting manner, which led them to express the need for endless revisions. Extraordinary means were required to extract manuscripts from some delinquent authors, including James Watson, then reportedly more concerned with his own larger work on the theme. Cairns concludes by proffering a photograph of Delbrück dressed as Theseus for a performance of *A Midsummer Night's Dream.* There follows a reprinting of the original 352-page collection (which was reviewed in *Science* **155**, 1091 [1967]). A final section of the volume, opening with a 1979 portrait of Delbrück, contains a 1967 review of the book by John Kendrew from *Scientific American*, Stent's 1968 essay "That was the molecular biology that was," reprinted from *Science*, and his obituary for Delbrück, first published in *Genetics* in 1982.

—Katherine Livingston

Finders, Keepers. Eight Collectors. ROSAMOND WOLFF PURCELL and STEPHEN JAY GOULD. Norton, New York, 1992. 157 pp., illus. $50.

This collaboration between a photographer (Purcell) and a writer (Gould) is devoted to the category of objects found, kept, and collected in the name of natural history. Most conspicuously the book is a lavish rendition of color photographs, and the photographer's statement of her principle of operation gives a good sense of what they are like: "Although I photograph everything just slightly out of context (fossil on a wooden chair, pigs on the floor, only parts of the ichthyosaurs), I tried as much as possible not to add inappropriate detail. Once seen, however, it is hard to separate the cigar box from the brain cast [it contains]; it is difficult to ignore blue-bleached cotton when it appears in the vicinity of a fossil shark tooth." As for the collectors, more than eight are in fact dealt with in the nine essays Gould has contributed. Figuring most prominently are Peter the Great of Russia and his Dutch supplier Frederik Ruysch, one of whose specialties was sentimentally adorned mountings of parts of human infants; Philip Franz von Siebold (1796–1866), who pursued his avocation in Japan in an era of that nation's history most difficult for foreigners; Willem Cornelis van Heurn of Leiden (1887–1972), a "taxonomist's taxonomist" who traveled the Dutch empire in search of animal, especially mammalian, specimens; Eugen Dubois, the discoverer of "Java Man"; Walter Rothschild (1868–1937), particularly fascinated by birds; the fossil-collectors John Woodward (1665–1728) and his contemporary Agostino Scilla, some of whose drawings are included in the book along with photographs of the original specimens; Thomas

Vignette: Looking Toward Calcutta

When, at sixteen, he matriculated quite by chance with a sheaf of distinctions, his teachers decided that he must go to Presidency College in Calcutta to study history. . . .

Balaram listened to them quietly, and they took his silence for acquiescence. But Balaram was not thinking of their Calcutta at all, with its philology and philosophy and history. He had his own vision of Calcutta. For him it was the city in which Ronald Ross discovered the origin of malaria, and Robert Koch, after years of effort, finally isolated the bacillus which causes typhoid. It was the Calcutta in which Jagadish Bose first demonstrated the extraordinarily life-like patterns of stress responses in metals. . . .

Balaram knew of Presidency College, too: it was there that Jagadish Bose had taught two young men—Satyen Bose, who was to appropriate half the universe of elementary particles with the publication of the Bose-Einstein statistics; and Meghnad Saha, whose formulation of the likeness between a star and an atom had laid the foundation of a whole branch of astrophysics.

And of course there was the gigantic figure of C. V. Raman, whose quiet researches in the ramshackle laboratories of the Society for the Advancement of Science, in Calcutta, had led to the discovery of the effect in the molecular scattering of light which eventually came to be named after him.

—From *The Circle of Reason*, a novel by Amitav Ghosh (Viking Penguin)