

None of the persons complaining about the date of this monograph point out that Marsh had published a private edition, with larger margins and more elegant binding. There is no reason to assume that this private edition was not released somewhat in advance of the U.S. Geological Survey edition.

The pages of the *New York Herald* were not the only place where the attacks on Marsh were made. George Baur and Erwin H. Barbour, who had been Marsh's assistants at one time, published articles in the *American Naturalist* (which was owned by one Edward Drinker Cope) (5). Baur said flatly, "that the descriptive part of the *Dinocerata* was mainly the work of Mr. O. Harger, I know." He added that Marsh wrote a review of his own monograph for the *American Journal of Science* "and asked the signature of Mr. Harger and Dr. Williston for it without success, and had to accept instead the initials of the lady typewriter." (Barbour and Meyer both tell of this in their written attacks on Marsh, also.)

Erwin H. Barbour, who later had a distinguished career with the University of Nebraska, expressed his dislike of his former employer with truly amazing bitterness. He said, "If there is any truth left under the sun then judgement must fall on the scientist who walks the halls of the Yale Museum. . . ." He specifically accused Marsh of devoting "months and years of Government time and money in beautifying his own private collections. . . ."

Barbour correctly pointed out that the restoration of "*Tinoceras*" (actually *Tetheopsis*) in a superb plate in Marsh's monograph shows hardly a missing bone. He said, "it is my distinct and positive recollection that when preparing the restoration of *Tinoceras* [Marsh] gave directions that the drawings of *Dinoceras* [*Uintatherium*] be enlarged one-fifth, and have a three-quarter view instead of side view, so that it wouldn't look too much like *Dinoceras*. . . . These facts [lead] us . . . to mirthful considerations of the unusual elasticity of conscience which a Government paleontologist must have to stick the head of one individual on the enlarged carcass of another." All this was just a warm-up, for Barbour goes on to characterize Marsh as a "scheming demagogue" who was guilty of faithlessness, trickery, plagiarism, and incompetence.

Retrospect

This intense, bitter, and very personal conflict involved many of America's geologists and zoologists, whether willingly or unwillingly. To them the affair was not amusing. Seventy years later we can view the wrangle with a detachment which may be horrified or amused. The flamboyant and reckless accusations of Cope and his cohorts seem to have been made with a disdain for the laws of libel and without some of the restraint of good taste. But they make

livelier reading than the stately and dignified replies of Marsh and Powell. It is on this account, and no other, that I have devoted more space to Cope's charges than to Marsh's denials or countercharges.

It is probably the consensus of modern opinion that Cope was the more brilliant of the two. However, Marsh was a more careful worker and unquestionably had better insight than Cope with respect to the *uintatheres*. Cope was competitive and militant, yet able to inspire the admiration and friendship of younger workers. Marsh was a reserved and formal bachelor who was jealous of his prerogatives and plainly did not inspire friendship among at least several of his assistants.

Cope and Marsh, together with Leidy, were the three great founders of vertebrate paleontology in America. The Cope-Marsh feud stands as a supremely unfortunate, but intensely interesting, part of the history of science in 19th-century America (6).

References and Notes

1. C. E. Beecher, *Am. J. Sci.* (June 1899).
2. H. F. Osborn, *Cope: Master Naturalist* (Princeton University Press, Princeton, N.J., 1931).
3. Issues of the *New York Herald* cited in this article are those of 12, 13, 19, 20, and 26 January, 1890.
4. W. H. Wheeler, "A Revision of the *Uintatheres*" (Peabody Museum of Natural History, New Haven, Conn., in press).
5. G. Baur, *Am. Naturalist* (March 1890); E. H. Barbour, *ibid.* (Apr. 1890).
6. Another publication consulted in the preparation of this article is C. Schuchert and C. M. LeVene, *O. C. Marsh, Pioneer in Paleontology* (Yale University Press, New Haven, Conn., 1940).

An Archeological Pilgrimage to Santiago de Compostela

Romanesque European ornament of the 12th century suggests the probability of Indian influences.

Millard B. Rogers

This archeological pilgrimage resulted from the chance observation that many sculptural motifs on the main portal of the priory church at Moissac (about A.D. 1115-30) (Fig. 1.) in southern

France were surprisingly similar to traditional architectural designs of the Buddhist and Hindu monuments of India. Comparisons between certain fantastic beasts at Moissac and those

from the Hindu temples of the 12th century were so close that an investigation of possible connections between the medieval Christian art of Europe and the Hindu art of India seemed obligatory. Two complicated and distinctive motifs appeared to offer the best possibilities for comparison. Both are fantastic animal forms. One, always shown in profile, has wide-open jaws, often displaying sawtooth dentures, and has a trunk-like snout curling upward from its upper lip (Fig. 1). From the mouth of this beast a vine or tendril protrudes as if it were a prolongation of the beast's tongue. At times the head appears alone without a body; more often there is a fairly heavy body with four relatively short legs.

The second beast is always shown as a face or mask in frontal view, with

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no body (Fig. 2). It is feline in character, having a decidedly grotesque human cast of features. Its eyes are bulging, characteristically it has short horns, and it is usually represented without a lower jaw. From its jawless mouth tendrils emerge that may pass along the borders of an arch or across a lintel, where they frequently enter the mouth of the grotesque creature with a curling snout. At other times this feline mask simply disgorges a few leaves, or perhaps a ribbon studded with circular bosses.

The fantastic animals in Indian art that seem to correspond to these two creatures are known as the *makara* and

kirttimukha, respectively. Both are of great antiquity in India and were among the most common symbolic motifs on Indian temples of the 12th century A.D. My observation of these similarities was not an original discovery, for in 1875 E. Viollet-le-Duc suggested that the *kirttimukha* occurred at Poitiers, a 12th-century French Romanesque cathedral (Fig. 2) (1). In a study of Indian iconography published in 1931, Ananda K. Coomaraswamy emphatically stated that the *makara* occurred frequently in medieval European art (2, p. 49). Viollet-le-Duc's statement concerning the appearance of the *kirttimukha* at Poitiers has been quoted by

various authors on Indian subjects; however, such quotations, appearing in specialized articles on Indian art and archeology, have not come to the attention of European medievalists, for, in this age of specialization and prolific publication, one seldom has an opportunity to explore the specialized literature of tangential fields. For the same reasons Coomaraswamy's statement concerning the *makara* appears to have passed unnoticed by most students of European art. Hence, two extraordinarily significant statements by two of the most distinguished scholars in the field of the history of art and architecture have been neglected.



Fig. 1 (top). Detail of the portal of the priory church at Moissac (about A.D. 1115-1130). Fig. 2 (bottom). Detail of the facade of Notre-Dame-la-Grande, Poitiers (about A.D. 1130-1145). The central figure is the *kirttimukha* form.

Origin of the Makara and Kirttimukha

To investigate this problem further one must first take into consideration the origin and development of the *kirttimukha* and the *makara* in India, a subject on which there is an extensive literature. Recently Odette Viennot has traced the origins and development of the *makara* quite thoroughly (3). The *makara* occurs in the earliest monumental sculptures of India, as early as the 3rd century B.C. (3), while the *kirttimukha* seems to have made its appearance in Indian art in the 2nd century A.D. (4, p. 322, note 70; p. 323, note 74; 5, plate 61). By the end of the Gupta period (6th century A.D.), the *kirttimukha* and *makara* had come to be associated in a composite symbol where they exchanged the lotus creeper from the mouth of the one to the mouth of the other.

The *makara* was a symbol of the waters, originally associated with Varuna, the spirit of the waters. It was composed from elements of the crocodile, elephant, and dolphin. Its primary function was that of a symbol of generation, and from its open jaws many marvelous objects were believed to have appeared. Among these wondrous and precious things generated by the *makara* the most characteristic is the "Cosmic Tree" or "Wish-fulfilling Tree." This so-called "tree" is, more properly speaking, a type of vine or tendril derived from the lotus plant, which is the most sacred vegetative symbol in Indian art, whether Buddhist, Hindu, or Jain. From the branches of this "lotus tree" and from its flowers and leaves emerge all sorts of precious things, but the most characteristic type of riches emanating from the cosmic lotus are chains of pearls which spill out of its cuplike leaves. The *makara* was thought to be closely associated with pearls, and the extraction of a pearl from the mouth of a *makara* is a proverbial example of Indian courage (2, pp. 49, 50).

The *makara* appears in a variety of places in Indian architecture, but it is characteristically located in the spandrels of a tympanum, at the ends of an architrave, or at the base of a bracket. Thus, when the *makara* is used as the root or origin of a lotus creeper we may expect to find it either at the end of a horizontal border or at the bottom of a vertical panel.

The *kirttimukha* is a mask made

from elements of the lion (which is a solar animal), the death's head (Kala), and the head of the dragon or water spirit (Rahu) (4, p. 326 ff.). From the mouth of *kirttimukha* the curling foam of the breath of life descends. This breath of life was also interpreted as the "Cosmic Tree," the lotus. The dragon or serpent component of the *kirttimukha* is responsible for his association with pearls, and chains of pearls frequently stream from his mouth. The *kirttimukha* is the "Face of Glory," a manifestation of the terrible aspect of the god whose function is to ward off the impious and to protect the devotee. The various legends concerning the *kirttimukha* seem to be associated with the concepts of lust, greed, and appetite, all of which lead to hunger and desire. These legends, presenting basic Indian philosophical concepts in the form of myth, may be arranged in two groups, one dominated by the god Vishnu, the other by the god Shiva. In both versions the demon Rahu is a principal character. Indian mythology is an extremely complicated subject, and it would be the exceptional case if any two authors presented identical accounts of the same mythological story. So it is with the stories of the *kirttimukha*. The following summaries of the two basic *kirttimukha* myths were taken from the more complete accounts given by Stella Kramrisch and Heinrich Zimmer (4, p. 324 ff.; 6, p. 180 ff.).

In the legend featuring Vishnu it is Rahu who loses his head to form the mask demon *kirttimukha*. At the beginning of time the ocean was churned to produce *amirta*, the elixir of immortality; Rahu stole this precious fluid and started to drink it. The Sun and the Moon discovered his treachery and reported it to Vishnu, who took his sword and decapitated Rahu, but not before Rahu had tasted *amirta*. Thus, the head of Rahu became immortal and wandered about the universe in quest of the Sun and Moon, his enemies. When Rahu's head, the *kirttimukha*, caught either the Sun or the Moon it swallowed the heavenly body, which soon reappeared as it passed through the demon's severed neck to freedom. This version of the story was, of course, very convenient for explaining eclipses, and on a higher philosophical plane it taught the futility of desire, which is a basic concept of Indian philosophy and theology. The Pan-Eurasiatic distribution of this myth and its contri-

bution to the history of ancient and medieval astrology has been brilliantly demonstrated by Willy Hartner (7). There can be no doubt that this Indian legend was popular with the Islamic peoples of the Near East and that it probably reached Western Europe through astrological channels. Hence, it appears probable that the builders of the medieval churches of France were acquainted with both this legend and its symbolism.

The second or Shaiva account of the *kirttimukha* story deals with Rahu as a messenger of Jalandhara, who was once a great Titan king. Jalandhara sent Rahu to demand Parvati, the lotus goddess, from Shiva. Shiva, who was about to wed Parvati, was enraged by this act of insolence and produced an explosion from his third eye. This explosion took the form of a lion-headed monster, which rushed at Rahu. Rahu, taking refuge in the all-protecting beneficence of Shiva, asked for mercy. This produced a difficult situation; Shiva immediately commanded the monster to spare the petitioner, and the half-lion was left with a painful hunger but no proper food with which to satisfy this desire. Shiva now suggested that the monster eat its own hands and feet, and driven by blind voraciousness it proceeded to consume its entire body, leaving only its head. At the completion of this incredible banquet, Shiva again showed his beneficence and declared to the lion-head, "You will be known, henceforth, as the 'Face of Glory' (*kirttimukha*) and shall abide forever at my door." Thus were explained both the origin of the monster and its most common position in the decorative scheme of the Indian temple, above the door or opening (4, p. 330; 6, pp. 176-182).

There has been much discussion concerning the origin of the *kirttimukha*, a problem too complex to be dealt with in this paper, but there seems to be ample evidence that, even though the *kirttimukha* may have been borrowed from the folklore of other peoples, the Indian form of this creature is so distinctive, both in the literature and in design, that for all practical purposes it, like the *makara*, is an indigenous Indian motif (Fig. 3).

The corresponding monsters at Moissac and Poitiers do not seem to have such a legendary history reaching far back into the prehistoric period in Western Europe. Moreover, they have been neglected in the modern literature



Fig. 3. Detail of the Hindu temple at Belur, Mysore (about A.D. 1117), showing the profuse use of the *makara*, *kirtti-mukha*, and *rinceau*. [E. B. Thomas]

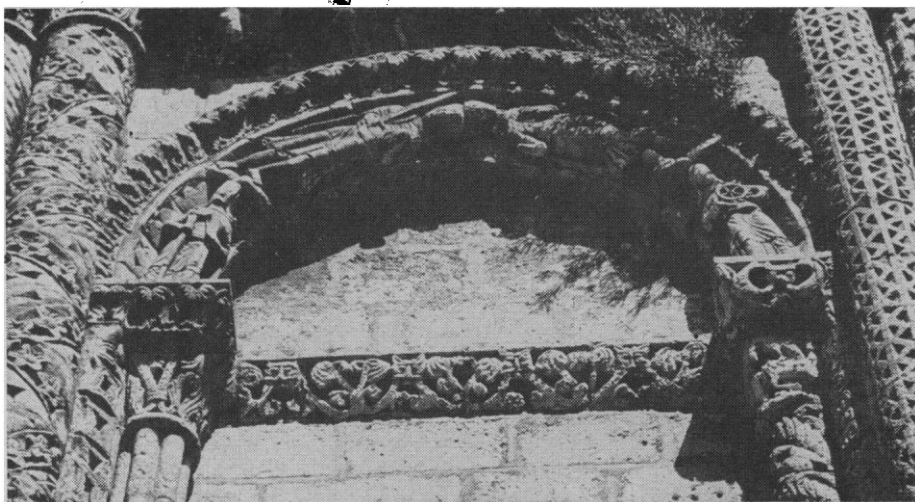


Fig. 4. Detail of the facade of the 12th-century French Romanesque church at Crome-Royal. Note the use of lion masks in a border.

and seldom appear in publications illustrating Romanesque sculptural ornament. Quite rightly European medievalists have been primarily interested in the Christian theme, and hence illustrative plates of Christian architecture and sculpture usually include only the figure compositions, not the borders and panels where the fantastic beasts and vine patterns occur. It was therefore necessary to study Romanesque architecture at first hand in order to check the statements of Viollet-le-Duc and Coomaraswamy. Since I knew that these motifs occurred at Moissac and Poitiers, both 12th-century churches located at key points on the pilgrim roads to Santiago de Compostela, it seemed reasonable to conclude that other churches along these pilgrim routes might display the same motifs.

Medieval Pilgrimages

It was believed that the relics of St. James The Greater, one of the original apostles, were enshrined at Santiago de Compostela. During the Middle Ages pilgrimages to his tomb were even more popular, and certainly more practical for people in Western Europe, than pilgrimages to the Holy Land. Saint James was the symbol of the struggle of Christianity against the Saracens in Spain, who claimed to have the relics of the True Prophet at Cordova. The rivalry between Christianity and Islam intensified interest in the pilgrimage to Santiago, which reached its greatest popularity in the 11th and 12th centuries. To accommodate the thousands of pilgrims who made this journey from various points in Europe to the shrine

of St. James in the northwestern corner of Spain it was necessary to build a great network of roads, along which hundreds of hostels, hospitals, churches, and cathedrals were constructed for the convenience and devotions of the pilgrims. The main trunk of this road network passed through northern Spain to the French border, where it fanned out in four principal branches across France, one connecting with the port cities on the English Channel, two extending northward into Germany and central Europe, and the fourth crossing southern France on the route to Italy. The construction of these roads and their accompanying structures was largely the responsibility of the monastic order of Cluny. During the latter part of the 11th century and continuing throughout the 12th, this building program reached proportions of almost unbelievable magnitude. Most of the important Romanesque churches of France and northern Spain were either a part of this building program or were in some manner related to it.

Routes Retraced

Therefore, in the spring of 1959 I made a modern pilgrimage along the four routes, studying the churches and photographing architectural details. The results were considerably more successful than I had anticipated. There can be little doubt that Coomaraswamy was correct, while Viollet-le-Duc's observation that the *kirttimukha* occurred at Poitiers was an understatement. While *makara* and *kirttimukha* (Figs. 1, 4, and 5) forms appear on the majority of French and Spanish churches built

in the 12th century, earlier Romanesque churches were not decorated with such designs. Soon after 1200 the use of these motifs was discontinued. The earliest examples of these seemingly Indian designs occur in the vicinity of Toulouse (Fig. 6), and they were very popular in all the territories ruled either by the Counts of Toulouse or by families related to Toulouse, such as the Plantagenets, whose founder Henry II married Eleanor of Aquitaine, niece of the Count of Toulouse. It should be observed that the House of Toulouse was instrumental in the founding of the Order of Cluny and that the Count of Toulouse led the First Crusade to the Holy Land. His niece Eleanor was first married to Louis Capet, King of France, who led the Second Crusade, and Eleanor's famous son, Richard Coeur de Lion, led the Third. A branch of the House of Toulouse established itself as the liege lords of Antioch. Hence, in one sense the Crusades were a family affair in which the European relatives of the House of Toulouse attempted to rescue their cousins in the Levant. Thus, Romanesque France had



Fig. 5. One of the *kirttimukha* from the south portal of St.-Etienne at Bourges (about A.D. 1160).

many connections with the East, not directly with India but with the eastern coast of the Mediterranean. Only a few miles to the east of Antioch, at Aleppo, the symbolism of Rahu was placed above the Islamic gate to the citadel (8). The Rahu design has also been preserved on a section of the old Talisman gate at Baghdad (9).

These Islamic motifs illustrating the myth of Rahu are placed over the entrances, as prescribed by the Shaiva version of the story, but the forms themselves are more closely related to the Chinese dragon than to the *kirttimukha*. The *makara* seems to have been incorporated into the dragon concept, and its traditional placement in the spandrels of the arch is sometimes indicated by the addition of a second head to the dragon at the tip of his tail. When we consider that the Romanesque *kirttimukha*, *makara*, and *rinceau* very closely parallel the 12th-century designs of India and are quite unlike the Islamic treatment of the same subject, it becomes most difficult to explain the appearance of these Indian motifs in Europe as being derived from intermediary Islamic forms. In some instances it even seems that the European artist intended to represent lotus leaves growing on his *rinceau* from whose centers clusters of spheres emerge (Figs. 3 and 6). These are not isolated examples but occur very frequently in the architectural ornament of Languedoc, Aquitaine, and Burgundy. That these spheres were not intended to be grapes is amply illustrated by well-designed grape tendrils and realistic bunches of grapes often appearing on the same church.

The *kirttimukha* associated with foliate forms seems to have migrated into England, probably taken there by the Plantagenets. A motif known as the "Green Man" appears on the Romanesque churches of some 23 English counties. Lady Raglan associated this "Green Man" with the stories of Robin Hood, alias Robin of the Wood, and associated him with the lion mask of the French Romanesque but did not realize that the motif had a possible Indian origin (10).

Parallels in Other Art Forms

It is premature to suggest the exact manner in which these exotic motifs, ultimately of Indian origin, were transmitted to Western Europe. There is some evidence suggesting that the Rahu



Fig. 6. Fragment from the cloister of St.-Etienne at Toulouse (about A.D. 1120), now in the Musée des Augustins, Toulouse.

legend was illustrated on the much-discussed Gundestrup Kettle in the Copenhagen National Museum. If this is true, the *kirttimukha* legend may have been both known and illustrated in the West as early as the second century A.D. If we accept the arguments of others, the Gundestrup Kettle would appear to be as late as the 5th or 6th century A.D. (11).

In the 12th century, however, we have seen that the *kirttimukha*, *makara*, and *rinceau* are all in the traditional Indian position above the door on the "Portals of Glory," where they are often associated with the signs of the zodiac, as on the façade of St.-Denis (12). It has been frequently noted that these 12th-century carvings on which the *kirttimukha* and *makara* appear are deeply undercut in a manner that would suggest ivory carving. An examination of the ivories either dated in the 11th and 12th centuries or assigned to that period reveals that the *kirttimukha* motif was also used in this medium. For example, on the famous ivory crucifix from S. Isidoro at León, dated 1063, the *kirttimukha* occurs with two quadruped *makara* on the back of the cross just above the "Holy Lamb." On the face of this crucifix an engraved *kirttimukha* appears beneath the left forearm of the Christ, where the jawless mouth of this *kirttimukha* disgorges the *rinceau*. The medieval artists of Europe greatly prized ivory for the manufacture of precious objects for both religious and secular use. Much of this ivory was probably imported from India, and it would seem reasonable

to conclude that some pieces were carved before shipment. It is evident that such imports of Indian workmanship arrived in Italy as early as Roman times because an Indian ivory carved at Mathura, central India, was found in the ruins of Pompeii.

One must not overlook the possibility that illustrated manuscripts—for example, works on astrology—were partly responsible for the importation of these motifs. Even Christian religious books used the *kirttimukha*, which appears in the Beatus Manuscripts of Spanish origin. The earliest known illustrated Beatus Manuscript, now in the Morgan Library, New York, is considered to have been painted shortly after the year 900 (13). Various scholars have suggested that the iconography and style of 12th-century "Portals of Glory" were either derived from the Beatus Manuscripts or from the source that gave rise to the Beatus Manuscripts. Charles Rufus Morey made a similar observation in relation to the crucifix from S. Isidoro at León. As might be expected, other aspects of the 12th-century Romanesque art have been recognized as closely paralleling Indian forms. The most famous example is the "Tree of Jesse" that is almost the exact equivalent of the trees of Varuna and Vishnu (14). Thus, the evidence seems to turn within itself, and much work will be necessary to untangle these problems. It is more than likely that further research will increase rather than diminish the number of such parallels between the 12th-century arts of India and France (15).

References and Notes

1. E. Viollet-le-Duc, *Dictionnaire Raisonné de l'Architecture Française du XI^e au XVI^e Siècle* (Morel, Paris, 1875), vol. 7, p. 187 ff.
2. A. K. Coomaraswamy, "Yaksas," *Freer Gallery of Art Publ. No. 3059* (Smithsonian Institution, Washington, D.C., 1931), pt. 2.
3. O. Viennot, "Le makara dans la décoration des monuments de l'Inde ancienne, positions et fonctions," *Arts Asiatiques* 5, 183, 272 (1958); "Topologie du makara et essai de chronologie," *ibid.* 1, 189 (1954).
4. S. Kramrisch, *The Hindu Temple* (Univ. of Calcutta, 1946), vol. 2.
5. C. Savaramamurti, "Amaravati sculptures in the Madras government museum," *Bull. of the Madras Government Museum* (1942).
6. H. Zimmer, *Myths and Symbols in Indian Art and Civilization*, J. Campbell, Ed. (Bollingen Foundation, Washington, D.C., 1946).
7. W. Hartner, "The pseudoplanetary nodes of the Moon's orbit in Hindu and Islamic iconographies," *Ars Islamica* 5, 113 (1938).
8. ———, *ibid.* 5, 113 ff., Fig. 29 (1938).
9. ———, *ibid.* 5, 113 ff., Fig. 26 (1938).
10. Lady Raglan, "The Green Man in church architecture," *Folklore* 50, 45 (1939).
11. W. Hartner, *Ars Islamica* 5, 145 (1938).
12. M. C. Sumner, *L'Abbaye Royale de Saint-Denis* (Hartmann, Paris, 1953), especially plates 4, 5, 22, 23, 24, and 25.
13. C. R. Morey, *Mediaeval Art* (Norton, New York, 1942), pp. 229-240.
- A. K. Coomaraswamy, "The Tree of Jesse and Indian parallels or sources," *Art. Bull.* 11, 217 (1929).
15. This travel was made possible by the generosity of the Seattle Art Museum, Seattle, Wash.

Notes on the Reviewing of Learned Books

Good books, bad books, scholarly books, popular books,
all pose problems for the conscientious reviewer.

George Sarton

There are many sides to every question and as far as the reviewing of books is concerned there are at least five points of view which are obviously different: the points of view of the author, of the reader, of the editor, of the publisher, of the sponsor. All of these points of view are familiar to me, for I have read innumerable books, written quite a few, edited *Isis* for thirty-six years. I am still the publisher of *Osiris* as well as its editor, and I have sponsored many books, either by contributing prefaces or in other ways.

Moreover, I realized very early the fundamental importance of good reviewing, because learning cannot progress without appreciation or criticism. Soon after beginning the editing of *Isis*, I published a little guide, *Recommandations aux collaborateurs d'Isis* (3 pp., dated Wondelgem, 19 décembre 1912), 2^e édition, revue et augmentée (8 pp., Wondelgem, juin 1914) (1). The following notes are derived partly from those *Recommandations* and part-

ly from the outline prepared by me when the matter of reviewing was discussed in my Seminar on the History of Science, in Harvard University on 30 March 1939. As I have been thinking of this subject for at least thirty-six years and have been obliged to consider it from every angle, it may be worth while to summarize the results of my experience.

Before asking oneself how to review a book, it is useful to ask a more fundamental question, "How should one read a book?" (The following remarks deal only with books of learning; books of imagination and poetry should be read in a very different way and their criticism raises many difficulties which do not concern us.) How should one read a book in order to obtain and preserve information? How should one select the books to be read, and in each book the information which may be needed, and how should one record it for further use?

If it were possible to answer such questions completely, one of the main problems of scholarship would be solved. Unfortunately, it is not possible to answer them, except perhaps, after long experience, and then only for one's

own satisfaction. Even if it were possible to answer them fully, the answers would not be intelligible or profitable to the people standing in greatest need of them.

One might, of course, publish a book entitled "How to become a scholar," but the reading of such a book would be almost as useful to the non-scholar, as a book entitled "How to become a millionaire" to the hobo. By the way, it is significant that such books as the last-named are not written by rich men, but on the contrary by poor devils, the kind of hacks whose industry publishers like to exploit.

The few indications which I now venture to give are not meant to solve the problem but simply to help the few people who are already so well prepared by their own nature and nurture that they can make the most of any guidance which is offered to them.

How does one absorb knowledge and wisdom out of books? Consider two other cases. When one looks at paintings one sees them at a glance. Of course, longer contemplation of them would reveal details in outline or color, in design, rhythm or intensity which one could not notice immediately; yet, the fundamental knowledge is obtained at once, as it were in a single intuition. Now, if one listens to a symphony, he cannot absorb its message immediately in its wholeness, because he must wait until it is unfolded, and if it be long, it may not be possible to remember the whole of it at one hearing. Examining a work of art implies a kind of spiritual involution, listening to music an evolution. Reading a book is something between the two, for if the book has a good table of contents one can appreciate the wholeness of it even before reading.

In every case, looking at a painting, listening to music, reading a book, little can be accomplished if the looking, the listening or the reading is not active, critical, creative. This requires experi-

The late author was a noted historian of science. These "Notes" appeared originally in volume 41 of *Isis* (1950). Reprints of the article as it originally appeared are available at 35 cents each from the editor of *Isis*, University of Washington, Seattle 5, Wash.