

**Bhusawal**, tn., Khandesh dist., Bombay Presidency, India, 120 m. s. of Indore. The Great Indian Peninsula Ry. has large works here. Pop. 16,500.

**Bhutan**, BOOTAN, or BHOTAN, a protected state, N. India, in the E. Himalayas, bounded on the N. by Tibet and on the s. by Eastern Bengal and Assam. Length from E. to W., 160 m.; breadth, 90 m. Area, 20,000 sq. m.; pop. est. at 250,000. The country is traversed by lofty mountains. The elephant, bear, wild boar, and rhinoceros are found in its forests. Manufactures: coarse woollen and cotton goods, and tanned buffalo leather. Buddhism of a very simple form is the prevailing faith. The government of Bhutan resembles that of Tibet, the supreme authority being divided between the Deb Raja, or the secular head, and the Dharm Raja, or the spiritual head of the state. The Bhutanese are a hardy and industrious race, but poor and ill governed. Polyandry and polygamy are common. The chief towns are Punakha, the winter capital, a place of great natural strength, and Tasichozong, the summer capital. See G. Sandberg's *Bhutan* (1898).

**Bhuvanewar**, the temple city of Siva, in Puri dist., Bengal Presidency, India, 15 m. s. of Cuttack; was the capital of the Kesari or Lion dynasty of Orissa (500-1104 A.D.); contains the ruins of five or six hundred shrines.

**Biafra**, BIGHT OF, large and deeply-indented bay on the w. coast of Africa, between the mouth of the Niger and Cape Lopez (400 m.). It receives the Niger, Old Calabar (Cross and Calabar), Rio del Rey, Kamerun, Sanaga, Campo, Gabun, and other rivers. Fernando Po, Prince's, and St. Thomas are the principal islands.

**Biala**. (1.) Town on w. border of Galicia Austria, 45 m. w. by

s. of Cracow, with cloth and other manufactures. Pop. 8,500. (2.) BIALA, or BYELA, tn. of Polish gov. of Siedlce, Russia, 50 m. by rail E.S.E. of Siedlce; hemp growing, cattle-rearing and tanneries. Pop. 13,000.

**Bialystok**, tn., Russia. See BIELOSTOK.

**Biana**, tn., Bhartpur state, Rajputana, India, 50 m. s.w. of Agra one of the oldest towns in India. Biana is a sacred spot to the Mohammedans. Pop. 7,000.

**Biancavilla**, tn., prov. Catania Sicily, on the s.w. slope of Mt. Etna, 19 m. N.W. of Catania. It was colonized by Albanians in 1480. Pop. 13,000.

**Bianchini**, FRANCESCO (1662-1729), Italian astronomer, remembered chiefly for his tracing of the meridian. He founded the Academy of the Alethophil ('lovers of truth') in 1686, and was chosen by Pope Alexander VIII. secretary of the committee for the reformation of the calendar. A native of Verona; the Latin form of his name was Bianchinus. Author of an *Istoria Universale* (1697).

**Bianco**, or BIANCHO, ANDREA, Italian cartographer, born at Venice early in the 15th century. He left a collection of hydrographical charts, in one of which, dated 1436, two islands are placed to the west of the Azores, and named Antillia and Man Santaxio. This has been regarded as indicating a knowledge of the Americas prior to Columbus's voyages.

**Biard**, FRANÇOIS (1798-1882), French painter, born at Lyons. His subjects were derived from travels in various lands, as Syria and Egypt (1833), Gold Coast of Africa, Greenland and Spitzbergen (1839), Brazil (1858), etc. He excels in comic and burlesque situations, as *Les Saltimbanques*, *Après un Bal Masqué*, *Un Concert de Famille*. Of his Greenland sketches the best known is



*A Struggle with White Bears*, now in the Leipzig museum.

**Biarritz** (Basque, 'the two rocks'), winter and summer seaside resort, dep. Basses-Pyrénées, France, 493 m. s.w. of Paris and 16 m. from Spanish frontier; on Bay of Biscay. The climate is mild, and free from extremes; and the beach, divided by two rocks into three parts, is especially fine. The castle, built by Empress Eugénie, was burnt down in 1886. Napoleon III. and his family did much to make the place famous, and it was a favourite resort of King Edward VII. There is a casino, with saline baths. Pop. 15,000.

**Bias** (c. 550 B.C.), of Priene, in Ionia, was famous as one of the Seven Wise Men of Greece.

**Bib**, POUT, or BRASSY (*Gadus luscus*), a small fish, allied to the haddock, found in the North Sea and the Arctic Ocean. During life the body is banded. The bib rarely exceeds five pounds in weight.

**Biban-el-Moluk**, valley, Upper Egypt, opposite ruins of Thebes; contains tombs of kings of the 18th, 19th, and 20th dynasties.

**Bibbiena**, tn., Italy, prov. of and 16 m. N.N.W. of Arezzo. Pop. (comm.) 7,500.

**Bibbiena**, CARDINAL (1470–1520), Italian prelate and comic writer, whose real name was Bernardo Dovizi, but who was generally called Bibbiena, from his birthplace. He was made cardinal (1513) by Leo X., whose secretary he had long been, and was a great patron of art and learning. He is the author of what is generally regarded as the earliest regular Italian comedy, the *Calandria*, which, though not acted till 1513 and not printed till 1521 (at Siena), appears to have been written about 1490. It is based on the *Menæchmi* of Plautus, and borrows numerous traits from Boccaccio's *Calandrino*. Though remarkable for indecency even in that age of loose

morals, it is still prized by reason of its natural dialogue, sparkling wit, and admirable prose. See A. Moretti's '*B. Dovizi e la Calandria*,' in the *Nuova Antologia* for June 15, 1882.

**Bibby Steamship Line**, one of the oldest steamship lines trading between England and India, founded (1807) by John Bibby. The present fleet consists of eight steamers, aggregating 80,000 tons, running between Liverpool and Colombo and Rangoon. The steamer *Lancashire* made the fastest voyage recorded between Liverpool and Rangoon, in 23 days 20 hours, in July 1891. London offices: 10 Mincing Lane, E.C.

**Biberach**, tn., Würtemberg, Germany, in the Donau circle, 23 m. s.s.w. of Ulm; has iron, toy, and other industries. Close by Moreau defeated the Austrians in 1796; and in 1800 the latter were again defeated by the French. Pop. 9,000.

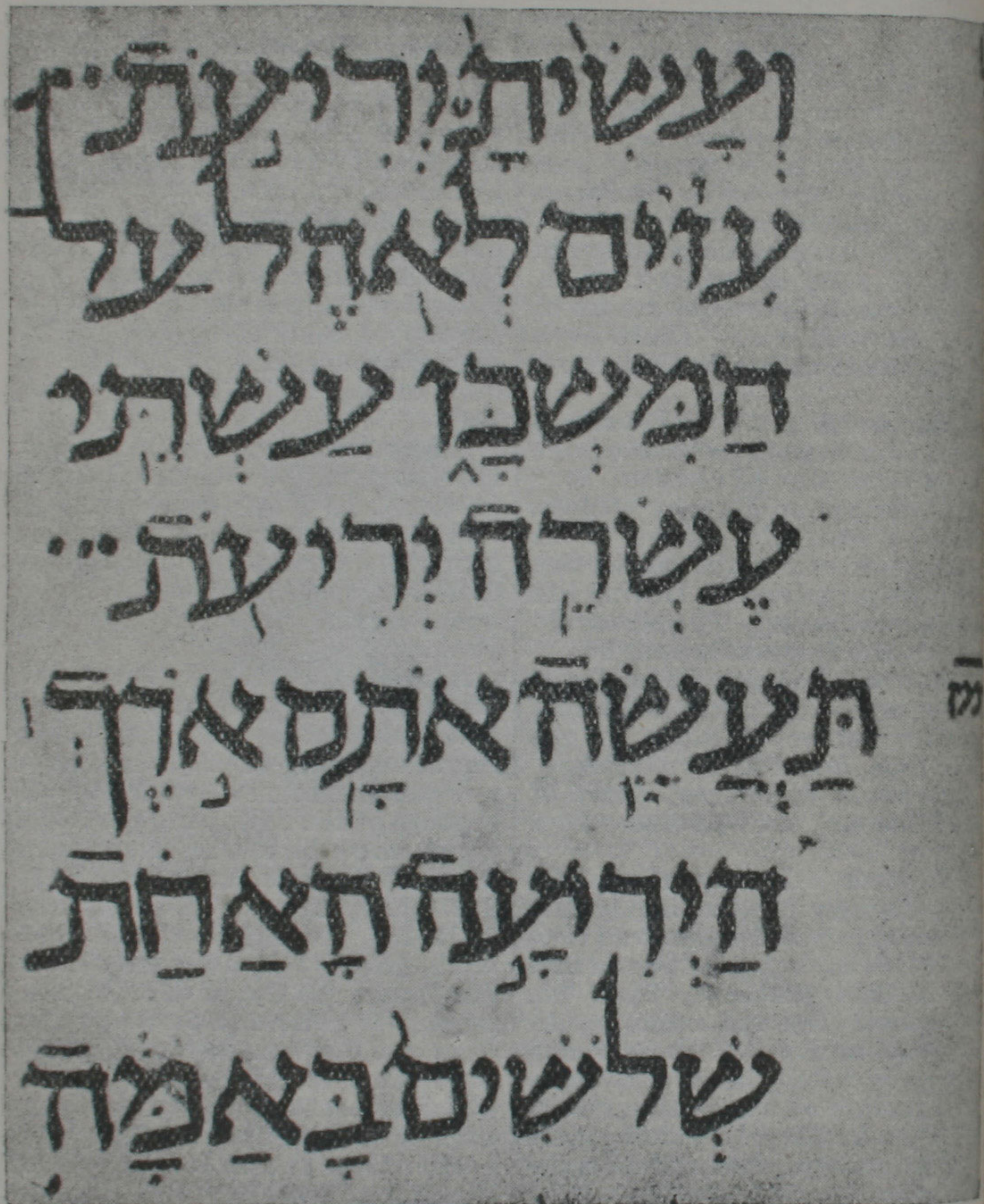
**Bibiri**. See GREENHEART.

**Bible**. *Language and Text of Old Testament*.—The Old Testament, omitting the Apocrypha, is written in Hebrew, with the exception of the following portions, which are written in Aramaic, a kindred Semitic language: Dan. 2:4–7:28; Ezra 4:8–6:18, and 7:12–26. A single verse of Jeremiah (10:11) is also written in Aramaic. No MS. of the Old Testament is reckoned to be earlier than the 9th century A.D., and it has been thought that those MSS. which are extant are all descendants of a common ancestor not earlier than the 2nd century A.D. We have, however, two sources of evidence which are of great value—the *Targums* and the *Versions*. A Targum, or oral interpretation, became necessary as soon as the sacred books were read in a language which had ceased to be the ordinary speech of the people. In course of time,



as this oral interpretation became more elaborate, it was reduced to writing; and these written Targums are among our most valu-

to difficult passages. But it is upon the *Versions*, or translations made from the Hebrew in early times, that we chiefly depend



*Portion of Manuscript (Exod. 26:7) in Square Hebrew.*

(Earliest dated Hebrew MS. in the British Museum.)

able helps, both for fixing the text as read in the Jewish synagogues, and for determining the interpretation which the Jews attached

both for the determination of the true text and for its explanation, and we proceed to give some account of these.



1. *Greek Versions.*—Of these by far the most important is the *Septuagint*, which was gradually executed in Egypt from about 300 B.C. to 150 B.C. As a translation it is of very unequal excellence, and it has come down to us in a state of great corruption. But as it is the oldest translation of the Hebrew Bible, and as all the other early translations are made from it, with the exception of the Peshito Syriac and Jerome's Vulgate, the study of it is of prime importance. It is constantly quoted by the writers of the New Testament. But the attempts which of late years have been made to reconstruct the Hebrew Bible from the Septuagint—as in, for example, Wellhausen's *Samuel* (1872), Duhm's *Jeremiah* (1901), and Cornill's *Ezekiel* (1886)—are generally vitiated by a much exaggerated estimate of its value. The remaining Greek versions belong to a later date, and the translators of them are better known. They were collected in the first half of the 3rd century by the great Christian scholar Origen, in the work he called the *Hexapla* (or sixfold), on account of the six columns into which each page was divided; and these six columns contained as follows:—

1.	2.
Hebrew text.	Hebrew text in Greek letters.
3.	4.
Translation of Aquila.	Translation of Symmachus.
5.	6.
Translation of the Seventy.	Translation of Theodotion.

If this work of Origen had come down to us, we should have had three Greek translations to com-

pare with the Septuagint. Unfortunately, there is nothing preserved beyond a number of quotations. Of the translators mentioned, Aquila was a Jewish proselyte from Pontus, who wrote in the beginning of the 2nd century. He was a very literal translator, and aimed at rendering even the untranslatable Hebrew particles. Theodotion is also said to have been a Jewish proselyte, from Ephesus; he aimed at reforming the text of the Septuagint, and his rendering of Daniel was accepted by the church as superior to that of the Seventy. His date is somewhere in the later half of the 2nd century. Symmachus, an Ebionite, belongs to the end of the 2nd century.

2. *Syriac Versions.*—The principal Syriac version, the Peshito (which means either *simple* or *vulgate*), was made (1st century) direct from the Hebrew, with occasional reference to the Septuagint. There is also another Syriac version made direct from the Septuagint as it stood in the Hexapla of Origen, hence called the *Hexaplar* (616-618 A.D.).

3. *Latin Version.*—The Old Latin, or *Itala*, was a literal translation of the Septuagint, made in the 2nd century A.D. The *Vulgate* is the revision of this, made by Jerome in Bethlehem between the years 392 and 404 A.D., with direct reference to the Hebrew, of which language he had made himself master somewhat late in life. The work of revision is very unequally done: some books underwent very little change; others were much more carefully treated. In particular the Psalter, which Jerome translated afresh from the Hebrew, had already been twice revised by him on the basis of the Septuagint; these revisions are known respectively as the Roman and Gallican Psalters.

4. Other ancient versions—such



as the *Arabic*, the *Coptic*, and the *Ethiopic*—are of less value.

*The Canon of the Old Testament.*—The whole collection of books contained in the Bible is usually spoken of as the Canon, or canonical Scripture, any single book being said to be in the Canon, or canonical. Before Origen's time, the truth recognized by the church had come to be spoken of as the canon or test of doctrine; and the books that were in accordance with the traditional rule of faith, and embodied it, were therefore said by Origen to be canonized or canonical. But since the Scriptures themselves contain in written form this standard of faith, they themselves came to be spoken of, in an active sense, as the canon, or rule by which other books or statements might be tested.

It is probable that in Israel the first religious documents were collections of laws, to be used by the priests in the instruction of the people, and records of events which had influenced the national consciousness. Later on, the prophets, or their amanuenses, wrote down the discourses they had delivered in God's name. But the first approximation to what we call the canon seems to have been the law-book, believed to have been Deuteronomy, found in the temple in the reign of Josiah (2 Kings 22, 23), which was immediately acknowledged by king, prophets, priests, and people as an authoritative record of religious law. It cannot be determined when the other elements of the Pentateuch were composed, but it would seem that all the parts were gathered in one collection by Ezra in the year 444 B.C., and accepted by the people as an exhaustive record of the *Law (Torah)*, the first great division of the canon. But by this time the chief historical books were written, as well as the

greater part of the prophetic books; and precisely to such books the attention of the thinking part of the nation would be turned for knowledge of the past history, and for instruction and consolation in their present position. Accordingly, we find that the books which, in the Hebrew Bible, immediately follow the Pentateuch are the books of Joshua, Judges, Samuel, and Kings, which give a connected history of the nation from the death of Moses to the Babylonian captivity; and all the books which we call prophetic, with the exception of Daniel. This addition to the national religious literature became known as the *Prophets*, for even the historical books were written in a prophetic spirit, and presumably by prophetic men; but we have no precise notice of the circumstances under which this new group was made. It must have been after the time of Malachi (who was somewhat later than Nehemiah), and probably a considerable time later, and when there was no longer any hope of other prophetic books being written. At all events, the earliest available notices on the subject speak of the Law and the Prophets together, or give clear indication that the prophetic books were then in the canon. After a time, though it is impossible to fix a date for the beginning of the practice, it was customary to read parts of the prophetic Scriptures in the stated worship, a section being assigned to accompany the lesson of the Law for the day. Finally, after the Law and the Prophets had been thus joined together, there remained a considerable number of books, some of which are certainly earlier in date than some of the books that had been included. These remaining works have a more diversified character



than either of the classes of Law and Prophecy, and they have never received a more definite designation than *Kethubim*, or 'writings,' and we usually apply to them the equivalent Greek name of *Hagiographa*, or 'sacred writings.' We find them referred to in the book of Ecclesiasticus (Prologue) as 'the other books that follow' the Law and the Prophets, or simply as 'the rest of the books.'

The canon, thus completed, containing precisely the books now found in the Old Testament, was, according to the Talmud, ratified by the Council of Jamnia (or Jabneel, between Joppa and Ashdod), c. 90 A.D. The three great divisions, frequently referred to in the New Testament, in varying phraseology, mark the three stages by which the collection assumed its final form. The total number of books, according to Jewish enumeration, is twenty-four, so that the whole Hebrew Bible is sometimes spoken of as 'the four and twenty.' The divisions and the enumeration are exhibited in the following table:—

	Books.
I. Law, <i>i.e.</i> the Pentateuch, or five books from Genesis to Deuteronomy . . . . .	5
II. Prophets—	
1. Former prophets: Joshua, Judges, Samuel, Kings . . . . .	4
2. Latter prophets: Isaiah, Jeremiah, Ezekiel, and the Twelve . . . . .	4
III. Writings—	
1. Three poetical books: Psalms, Proverbs, Job . . . . .	3
2. Five rolls: Song of Songs, Ruth, Lamentations, Ecclesiastes, Esther . . . . .	5
3. Three books: Daniel, Ezra-Nehemiah, Chronicles . . . . .	3
	24

The 'former prophets' are so called simply from their position, not from any assumption of their date. As already explained, they are historical books; and it is to

be noted that Samuel and Kings are reckoned each as one book; for these books, as well as Chronicles and Ezra-Nehemiah, were not divided by the Jews till the 16th Christian century. Among the latter prophets, the 'Twelve,' which are now usually termed minor prophets, have always gone together and been reckoned as one book, owing to their limited compass, which admitted of their being written on one roll. The three books, Psalms, Proverbs, and Job, are taken together and provided with a special system of accentual marks for cantillation. It is misleading to speak of them as the poetical books, for some of the other books—*e.g.* The Song of Songs and Lamentations—have an equal claim to the title, and many portions of the prophetic books are in the form of poetry.

The 'five rolls' are so denominated because each was written on a roll by itself, and they came to be associated with, and publicly read at, five great sacred seasons. Daniel, though a prophetic or rather apocalyptic book, does not come with the other prophets; the most probable explanation being that it did not exist, at least in its present form, when the other prophetic books were included in the canon.

*Connection between the Testaments.*—Between the last Old Testament writing and the rise of the New Testament literature there intervened some two hundred years. Although this period is practically a blank so far as contributions to the canonical Scriptures are concerned, there was really no cessation in the literary activity of the people. But the religious productions of this time, though indispensable for the history of Judaism, and not without value for devotional purposes, manifest neither the lofty genius of the preceding literature, nor



the inspired glow of that which was to follow. For this and for other reasons, not the least being that they were (mainly) written in Greek, the Jews never invested them with full canonical dignity. They are known as the Apocrypha of the Old Testament. The Greek fathers, as also Augustine, seem to draw but little distinction between these apocryphal writings and the accepted Scriptures, and the Council of Trent put them alongside of the Old Testament and New Testament as 'sacred and canonical;' but the reformed churches have usually regarded them as of lower rank. Their merit, particularly for purposes of edification, was not denied—was, indeed, in the modern confessions, generally asserted—and they were until the beginning of the 19th century bound up with the Bible, though the use of them as sources of doctrine was held to be illegitimate.

*The New Testament.*—The New Testament is a collection of twenty-seven distinct writings, from eight (or nine) different hands. The books are usually classed as Historical (five), Didactic (twenty-one), Prophetical (one); though the writings of the first class include much more than one-half of the entire matter. The unity of the whole is remarkable: all the books find their centre in Jesus Christ. The four gospels narrate His life on earth; the fifth historical book tells how the new life, that came from Him through the Holy Spirit, passed from Jerusalem to Rome. The epistles, written by men of varied personal character and temperament, among whom by far the most prominent and the most fertile is the apostle Paul, set forth the significance of the gospel facts as revealed to them according to our Lord's promise (John 16: 12, 13). The single prophetic book (the Revelation of

St. John, or the Apocalypse), however it is to be interpreted, shows the Lamb as King, to become victor on earth, where His church is preparing through conflict to share His triumph. In our English Bible the order of these writings is not chronological. In ancient MSS. there was much variation in position; the seven general epistles were usually placed immediately after Acts, the gospels coming first, though not always in the order now universal. The Pauline epistles seem to have been arranged according to length, so that the earliest and the latest stand together (1 and 2 Thess., with 1 and 2 Tim. and Titus). There is evidence in these writings of an advance of Christian thought toward maturity; but the progress is not along divergent lines, nor can all the books be classified according to assumed types of doctrine. Biblical theology properly discusses the theology of the several writings; but the theology of the New Testament is one, whatever progress is discernible. Moreover the advance in St. Paul's teaching, as indicated by a comparison of Thessalonians with Ephesians, is almost as marked as that between the general epistles of St. James and St. John, which are regarded as presenting the respective extremes in the progress of doctrine. The gospels cannot be classified by any such principle; for while that of St. John, from its purpose, presents the most mature statements, there is no appreciable advance in doctrine from St. Matthew to St. Luke. The same Lord Jesus Christ was apprehended by all the writers in substantially the same way. See also GOSPELS and PAUL.

*Language and Text of the New Testament.*—The New Testament is written entirely in the Greek language. The existence of



number of various readings in the text of the New Testament necessitates an inquiry into the materials from which the text is derived, and into the causes which have produced the divergent readings. Most of these divergences are mere trifles, caused by careless copying and insufficient correction. The materials of textual criticism are usually reckoned under the heads of Copies, Versions, and Fathers, which might be grouped as—(1) Copies + Patristic Citations from Copies; (2) Versions + Patristic Citations from Versions. For convenience the books are grouped under the heads of Gospels, Acts and Catholic Epistles, Pauline Epistles, and Apocalypse; and the enumeration of authorities is made *de novo* with each group. Sometimes this is indicated by writing a few letters above the sign representing the MS., as D<sup>Paul</sup>, E<sup>Acts</sup>, or by adding a subscript numeral, as D<sub>2</sub>, E<sub>2</sub>. Only a few fragments of the New Testament exist written on papyrus. It is, however, almost certain that that was the primitive material on which the apostolic documents were written (cf. 2 John 12: 'I did not wish to write with paper and ink'). Of MSS. written on vellum, the most important are those belonging to the 4th and 5th centuries, which pass under the name of the 'Five Great Uncials.' They are as follows:—1. **Α** (Aleph; 4th century)—the Codex Sinaiticus, discovered by Tischendorf in 1844 (and 1859), in the monastery of St. Catherine, on Mt. Sinai. The greater part of this MS. is now in St. Petersburg. It contains the whole of the New Testament complete, together with the Epistle of Barnabas, and a large part of the Shepherd of Hermas. The last twelve verses of Mark are wanting; but it is suspicious that the page where they should occur ap-

pears to be a cancel. 2. **B** (Vaticanus; 4th century) is in the Vatican Library at Rome. It contains the New Testament as far as the middle of Heb. 9:14; but the rest of Hebrews, as well as the Pastoral Epistles and the Apocalypse, are wanting. **Β** and **B** probably proceeded from a common workshop, perhaps the library at Cæsarea; and this may explain why both lack the last twelve verses of Mark. 3. **A** (Alexandrinus; 5th century) is now in the British Museum. There seems no reason to doubt the tradition which assigns it to Alexandria. This MS. contains the first Epistle of Clement and a part of the second Epistle. 4. **C** (Ephræmi Syri rescriptus; 5th century) derives its name from the fact that the original text of its Greek Bible was washed out in the 12th century, in order to make room for a Greek translation of some works of St. Ephrem the Syrian. The MS. is now in Paris, but almost nothing is known of its origin and history. About three-fifths of the New Testament have been recovered from its pages. 5. **D** (Codex Bezae; 5th century) derives its name from Beza the reformer, who presented it in 1581 to the University of Cambridge, in whose public library it is exposed to view. This MS. is a bilingual, containing, besides the Greek text of the Gospels and Acts, a parallel Latin version of great antiquity. The whole number of Uncial MSS. known to the critical world is estimated at something over 120; but in this enumeration a number of MSS. are counted more than once. The Cursive MSS. are, as might be expected on account of their later dates, much more numerous; probably we might set their number at between 2,400 and 2,500 (the numeration being repeated for the different groups of books as



before). Of all this number, only a very few have been rendered available for criticism by exact collation; a fact which is much to be regretted, as there are preserved in Cursive MSS. many rare and curious readings which are of great antiquity, and yet have no attestation in Uncial MSS. It is not meant that all Cursive MSS. deserve complete and exhaustive collation, but most of them merit a more careful study than they have hitherto received. It is also readily to be admitted that they are, relatively to the Uncial MSS. and the versions, of much less value in the determination of the text. But we must bear in mind that the texts of Cursive MSS. are merely the descendants of lost Uncial MSS., and that the maxim that 'all various readings are early' applies to them as well as to the more imposing Uncial MSS. Where a number of Cursive MSS. can be proved to come from a common lost original, it is often possible to restore the lost (Uncial) ancestor by a critical comparison of the texts that are descended from it.

A word must be said in passing of *Lectionaries*, or copies of the Gospels, or the Acts and Epistles, arranged for reading in churches. They are very numerous, and almost unknown as to text; but enough is known to enable us to affirm with certainty that they often contain fragments of very early texts. When the lectionary is made up out of lessons from the Gospels, it is commonly called an *Evangelistarium*; when the lessons are taken from the Acts and Epistles, it is known as an *Apostolos* or *Praxapostolos*.

We come now to *Versions*, a class of witnesses to which greater weight is continually being assigned in the determination of the text. The great value of the versions lies in the evidence which they furnish as to the state

of the New Testament text at the time when it was translated, though it must be borne in mind that, as they are only copies in a foreign language, they are subject to the same changes and accidents as are ordinary Greek MSS. We may divide the earliest versions into the following groups—1. SYRIAC VERSIONS; 2. LATIN VERSIONS; 3. EGYPTIAN VERSIONS.

Each of these versions is believed to go back in some form to the 2nd century; and this may be taken as proved for the first two groups. The third group has not yet been adequately studied.

1. SYRIAC VERSIONS.—The Syriac New Testament is known to us in the following forms:—(1.) *Old Syriac* (Lewis's Syriac) from Mt. Sinai, discovered in palimpsest in 1892 by Mrs. Lewis. (2.) *Old Syriac*, from the Nitrian Desert (commonly called Cureton's Syriac after its discoverer, who detected it amongst the treasures brought from the Syrian convent in the Nitrian Desert to the British Museum). This is so nearly the same text with the Sinai version, that they must stand in some close genealogical relation. (3.) *Tatian's Harmony* of the Four Gospels must be considered with the two foregoing versions; for although it is not extant in the original Syriac, but only in Armenian, and in Arabic version derived from it, yet it is certain that it was in close agreement with the old Syriac version. (4.) The *Peshito* is the next stage in the history of the version. This is a revision of the Old Syriac in order to bring it into closer agreement with the Greek text, as well as, no doubt, to improve the diction and clear it of harsh or ungrammatical forms. The result of the revision is a version of such beauty that it has been often called the queen of the versions. (5.) The *Philoxenian Syriac* is a Syriac version, made apparently



in the interests of literal translation by Philoxenus of Mabug in 508 A.D. Its first form appears to have been lost, but we possess it in a later recension made by Thomas of Heraclea in 616 A.D. From him it is often known as the Harklean or Heracleian version. (6.) The *Jerusalem* or *Palestinian Syriac*. The history of this version is still a problem, but enough of the text has come to light to show that, while it is influenced by the Peshito, it generally follows the Greek closely.

2. THE LATIN VERSION is known to us in a variety of forms, of which the principal are as follows:—(1.) *Old Latin*, an African version made in the 2nd century. (2.) The *Vulgate*. The Old Latin was revised by Jerome during the last quarter of the 4th century, and this revision, known as the Vulgate, is to-day the final authority of the whole Roman Catholic Church.

3. THE EGYPTIAN NEW TESTAMENT appears in a number of translations and dialects, of which the chief are:—(1.) The Coptic or Memphitic version of Lower Egypt, sometimes called Bohairic (2nd to 3rd century). (2.) The Thebaic or Sahidic version of Upper Egypt, slightly later than the Memphitic. Many scholars count the Bohairic the later of the two. (3.) The Fayyûm version, of which fragments are reported to have recently been recovered.

Besides the above there are the *Ethiopic*, translated from the Greek; the *Armenian*, derived from the Syriac; the *Gothic* (Ulphilas); the *Arabic*; the *Slavonic*, etc.

*The Fathers*.—As we have already said, the Greek copies of the New Testament, as well as the versions made from the Greek, derive great collateral confirmation from the citations made by the fathers of the church. And here we have

the advantage that almost every quotation made by a patristic writer is a dated landmark in the history of the text; so that from a study of Origen's works we recover large portions of the MSS. which he used in the 3rd century, and so on. But we are as yet only at the beginning of the studies which would enable us to make proper use of such valuable material.

*New Testament Canon*.—Previous to the middle of the 2nd century after Christ, the church found its final authority in the scriptures of the Old Testament and in the words of Jesus. Various gospels were already in circulation, and there seems to have existed also a large mass of oral tradition regarding the teaching and work of Jesus; and both written and verbal material was used as the source of information and doctrine. But the apostles having been long dead, as also most of those who had known them, the church began to feel the need of a better defined and a more stable standard of religious truth. This was found in the four gospels, Matthew, Mark, Luke, and John; these accordingly were declared to have the authority of Scripture, and to be worthy of co-ordination with the Old Testament. This canon of the gospels had received such universal recognition before the close of the 2nd century, that Irenæus is found giving reasons why it should consist precisely of *four*. The second stage, the canonization of the epistles, etc., followed almost immediately, though many years elapsed ere the church reached unanimity regarding some of them. The conditioning circumstance of the rise of an accredited collection of the epistles was the spread of heresy, particularly of Gnosticism, within the church. To combat this it was found necessary to make appeal to the apostolic



teaching regarding Christ, and as this had, unsystematically but with wonderful fulness, been set forth in letters, etc., from various men of apostolic standing, a collection of these was made, and their regulative character declared. Considerable doubts existed at first about the admission of certain books—*e.g.* Hebrews, the Apocalypse, and some of the smaller epistles—as it was questioned whether these were from apostolic hands; but in course of time something like unanimity was reached, and the New Testament as we have it became the accepted standard of the whole church.

*The English Bible.*—Portions of Scripture were translated into Anglo-Saxon as early as the 8th century, but the first complete rendering into what may be called English was made by Wycliffe about 1382. It is, however, to Wm. Tyndale that we owe the first printed New Testament, issued at Worms in 1525. Tyndale translated also the Pentateuch, printed at Marburg, Hesse, in 1530. The first *complete* printed English Bible was that of Miles Coverdale, a folio volume of the highest bibliographical value, printed in 1535, probably at Zürich, and based upon the Swiss-German edition (6 vols. Zürich, 1527-9). Next we have Matthew's Bible (1537), which largely utilizes the versions of Tyndale and Coverdale. The Great Bible (so named from the large size of its pages) was prepared at the suggestion of Cromwell, Earl of Essex, and finally issued from London in 1539. The Geneva Bible (often called the 'Breeches Bible,' from its rendering of Gen. 3:7), the work of Wm. Whittingham and others, with notes of a distinctly, even aggressively, Calvinistic trend, was issued in 1560, and was held in high favour for three-quarters of a century thereafter.

The Bishops' Bible (called also the 'Treacle Bible,' from its translation of Jer. 8:22) was executed as a kind of offset to the last named, under the supervision of Archbishop Parker, and published in 1568. Then came the Catholic Rheims New Testament (1582) and the Douay Old Testament (1609). But meanwhile, in consequence of the Hampton Court Conference of 1604, the preparation of what is now known as the Authorized Version was in progress. The Bishops' Bible was adopted as its basis, but most of the above-named translations, particularly the Rheims and the Geneva, were made use of, and the work was finally given to the public in 1611. This edition has exercised an outstanding influence on English thought and literature, and might well have been considered final, had not the recent science of textual criticism shown that its Greek original was itself frequently unsound. This fact, together with the admitted want of uniformity in its language, led scholars to propose a further revision; and when the Houses of Convocation in 1870 sanctioned the proposal, steps were immediately taken to carry it out. Scholars representing widely different sections of the church were invited to take part in the work, and at length in 1881, the Revised New Testament was issued, the Old Testament following four years later. Interesting particulars regarding the methods and labours of the revisers are given in the published prefaces to their work.

*The American Standard Revised Bible*, published in 1901 (copyright, Thomas Nelson and Sons), is the latest revision of the Bible in English. The American revisers who collaborated with the British revisers made a large number of emendations, which were not incorporated in the text.



# INCĪLIBIOB



IR CRAT  
INTERRA  
hus

Nomine Iob et erat  
uir ille simplex et rectus  
Ac mensam et recedens  
Amulo. Viresque sunt et septem  
filii et tres filiae. Et fuit  
possessio eius septem milia ouium  
& tria milia camelorū. Quinqua-  
ginta quoque iuga bouum et quingenti

Asinae ac familia multarum. Eratque vir ille  
magnus inter omnes orientales et ibant filii eius  
et faciebant conuiuium per domos uniusquisque in die  
suo. Et erant tres uocabantur tres sorores suas ut come-  
derent et biberent cum eis. Cūque uir bene transisset  
dies conuiuium mittebat ad eos Iob et seificabat illos  
Consurgensque dilaculis offerrebat holocausta pro singu-  
los. Dicebat enim. Ne forte peccauerint filii mei  
et benedixerint domino in cordibus suis. Sic faciebat Iob  
cunctis diebus.

**Q**uadā autē die cum uenissent filii ad  
rent coram domino. Adfuit inter eos etiam Sathan.  
Cui dixit dominus. Unde uenisti? Qui respondens ait. Circumui-  
terra et per ambulacra. Dixitque dominus ad eum.  
Nūquid considerasti seruum meum Iob quod non sit



of the English revision, but were published as an appendix which formed part of every copy issued during a term of fourteen years from the date of publication. Immediately after the publication of the English Revised Version, the English Revision Committee disbanded; but the American Committee kept up their organization, and continued, throughout the whole period of fourteen years, to revise not only the appendix, but the entire Bible, and in 1901 this new version (the *American Standard*) was published.

*The Twentieth Century New Testament* (Horace Marshall and Sons, 1904) is a translation into modern English from the text of Westcott and Hort. Several Bibles are published expressly for children's reading.

*Bible Publishing.*—The right to publish the Authorized Version in England is vested in the King's Printers (Eyre and Spottiswoode) and the Universities of Oxford and Cambridge. Other publishers must obtain a licence (granted gratuitously) and conform to certain regulations. The issue of Bibles in Scotland is authorized under licence of the Bible Board for Scotland.

Translations into other modern languages have become too numerous even for mention here. They have been to a large extent the work of the agents of the British and Foreign Bible Society. The history of Bible translation in the chief European languages runs parallel to that of the English Bible. One of the finest of modern renderings, comparable in its literary and religious influence to the English Authorized Version alone, is Luther's German Bible (1534). Excellent translations exist also in Dutch (authorized by the Synod of Dort, 1637), Swedish (1774), Danish (1607, revised 1647), French (by Olivetan, 1545, revised by Calvin and by

Beza), and other languages, but the history of some of these is from want of contemporary evidence, often somewhat difficult to trace.

*Literature.*—The literature in all departments of Biblical study is enormous, and additions are constantly being made. Germany, perhaps, takes the lead in productivity, but England (with America) has been making giant strides of late. We can only indicate a few of the most prominent or most accessible books. General.—Bible Dictionaries by Smith, Hastings, Cheyne and Black. The *King's Printer's Aids*, the *Cambridge Companion*, and Nelson's *Bible Treasury* are useful to non-professional students. Introduction.—Old Testament: Driver, C. H. H. Wright (with excellent bibliographies), Cornill (Ger.); New Testament: Moffat (*Historical New Testament*), Dods, Weiss (trans.), Holtzmann, Jülicher (Ger.). Commentaries.—*International Critical Commentary* (O.T. and N.T., appearing), Cambridge Bible for Schools, vols. in Clark's Handbooks for Bible Classes, Temple Bible (including Apocrypha), Century Bible (N.T. complete). Concise German.—*Kurzer Hand-Commentar zum Alten Testament* (issuing), and *Hand-Commentar zum Neuen Testament* (Holtzmann, Schmiedel, Von Soden, etc.). Theology.—Schultz (O.T. trans.), G. B. Stevens (N.T.). Canon.—Ryle (O.T.), Reuss (N.T. trans.). Original Text.—Hebrew: Van der Hooght, Baer-Delitzsch, Kittel, Sacred Books of the O.T.; Greek: Westcott and Hort, Revisers' Text. Textual Criticism.—Buhl, T. H. Weir (O.T.); Hammond, Scrivener, Tischendorf-Caspari (N.T.).

**Bible Christians.** See METHUENISM.

**Bible Communists.** See PERFECTIONISTS.



**Bible Societies**, societies formed for the printing and distribution of the Bible. The first Bible society was the Canstein Bible Institute, in the Orphans' Home in Halle, founded by the Marquis of Canstein in 1710, which distributed, before 1719, 40,600 Bibles and 100,000 New Testaments. In the year 1879 the copies printed by the institute had reached the enormous number of 6,100,000. The British and Foreign Bible Society was founded in 1804, with the object of encouraging a wider dispersion of the Scriptures both at home and abroad, the first year's subscriptions reaching £5,600. This organization was followed by the American Bible Society in New York in 1816, although similar societies had previously been formed on the Continent, at Basel (1804), Berlin and Ratisbon (1805), with two in Africa, five in Asia, and others in Nova Scotia, Canada, and the W. Indies. The British and Foreign Bible Society is the largest in the world. It has 1,200 auxiliaries and branches, with upwards of 3,000 Bible associations in connection, mainly conducted by women. Nearly 16,000 smaller organizations are connected with the two principal Bible societies of the world—those of London and New York. The third institute in importance is the National Bible Society of Scotland, which was formed in 1861, and has issued since that time more than eleven million copies or portions of the Scriptures.

In 1836 the American and Foreign Bible Society was founded in New York by the Baptist denomination, 'to endeavour to ascertain the exact meaning of the original text of the Bible, to express that meaning as literally as the nature of the languages into which they should translate the Bible would permit, and to transfer no words which were capable

of being literally translated.' In 1850 the American Bible Union was formed—a society which was instituted with the object of publishing revised versions of the Bible in conformity with the principles of the Baptists, that the word βαπτίζειν should be translated as 'to immerse.' With this exception, the various Bible societies have worked in harmony with each other. See W. Canton's *Hist. of the Brit. and Foreign Bible Society* (1904); W. P. Strickland's *Hist. of American Bible Society* (1849).

**Biblia Pauperum**, or POOR MEN'S BIBLE, the name given by modern writers to a series of MSS. and printed books containing illustrations of events in the life of Christ, with the corresponding Old Testament prefigurations or types, and a small amount of explanatory text in rhyming Latin verse. As early as 1181, fifteen subjects from the life of Christ, each with two Old Testament parallels, were executed in enamels on an antependium, or altar-front, in the Leopold Chapel of Klosterneuburg in Austria. The earliest known MS. containing this triple arrangement dates from the beginning of the 14th century, and is preserved at St. Florian, Austria. The text, as well as the pictures, was cut in wood, and the books contain from thirty to forty leaves, printed on one side only. See Heineken's *Idée Générale d'une Collection d'Estampes* (1771), in which the fantastic name *Biblia Pauperum* was first used; Sotheby's *Principia Typographica* (1858); Schreiber's *Manuel de l'Amateur de la Gravure* (1891-95); and an article by Sir E. M. Thompson, 'On a Manuscript of the *Biblia Pauperum*,' in *Bibliographica*, vol. iii. (1897). See also BLOCK-BOOKS.

**Bibliography**. Derived from the Greek βιβλιογραφία, which



means 'the writing of books,' and used in the 17th century in England in this sense, the word bibliography was reintroduced in the early years of the 19th century to denote the writing, not of books, but about books, and this in two different shades of meaning which correspond roughly with their form and their matter. One school of bibliographers, whose interests are reflected in the publications of the Bibliographical Society, which has its headquarters in London, the Edinburgh Bibliographical Society, etc., the Grolier Club of New York, etc., concerns itself chiefly with the accidents of the production of books—*e.g.* the history of handwriting, of printing, book-binding, paper-making, book-selling, publishing, book illustrations, book-collecting, book plates, book stamps, and kindred topics. Information on each of these subjects is given under its own heading. No very good general treatises on them exist, but reference may be made to the publications of the societies already named, to numerous periodicals (mostly short-lived), such as the *Bookworm* (1888-94), the *Library* (begun in 1889) *Bibliographica* (1895-7), *The International Bibliographer* (1910), *Le Livre* (1880-9), *La Bibliographie Moderne* (begun in 1897), *Zeitschrift für Bücherfreunde* (1897); and to such works as E. Rouveyre's *Connaissances Nécessaires à un Bibliophile* (5th ed. 1899), *The Library*, by Andrew Lang (1893), and *The Printed Book*, translated from the French of Henri Bouchot by E. C. Bigmore (1890). The titles and descriptions, with notes of former prices (now quite out of date), of a large number of books which collectors value for various reasons, will be found in Brunet's *Manuel du Libraire et de l'Amateur des Livres* (5th ed. 1860-80), Graesse's *Trésor de*

*Livres Rares et Precieux* (1850-69), and in Lowndes's *Bibliographer's Manual of Eng. Lit.*, these being chiefly English (1857-64); also in the annual volumes of Slater's *Book Prices Current* (begun in 1887).

In the sense in which it concerns itself chiefly with the matter of books as opposed to their form, bibliography aims at enumerating all the books of a given author or group of authors, or those published in a given period, or in a given country, province, county, or town, or those dealing with any given subject, or such selected books as may be especially useful to students of such subject or subjects. Information as to special bibliographies of this kind will here be found under the articles that deal with the subjects to which they refer, but the following short list of general works may be found useful:—1. Bibliographies of bibliographies.—Petzholdt's *Bibliotheca Bibliographica* (1866); Vallée's *Bibliographie des Bibliographies* (1883-7); Fortescue's *List of Bibliographical Works in the Reading Room of the Brit. Museum* (1889); Stein's *Manuel de Bibliographie Générale* (1897); Ferguson's *Some Aspects of Bibliography* (1900). 2. General catalogues.—*General Catalogue of the Brit. Museum Library* (1881, etc. copies presented to most of the larger public libraries of the United Kingdom); *Subject Index to the Modern Works added to the Brit. Museum* (since 1880-1905); Sonnenschein's *The Best Books: a Reader's Guide to the Choice of the Best Available Books in every Department of Science, Art, and Literature* (1891, 1895, re-issue in progress 1910); Baker's *Guide to the Best Fiction* (1903). 3. National bibliographies.—Watt's *Bibliotheca Britannica* (1824); Low's *Brit. Cat.* (1837-52), and *Eng. Cat.* (1864, etc.).



S. A. Allibone's *Critical Dict. of Eng. Lit.* (1859; Supplement, 1891); Roorbach's *Bibliotheca Americana* (1852-61); Kelly's *American Cat. of Books published in the U.S. from January 1861* (1866, etc.); Leypoldt's *The American Cat.* (1880, etc.); Fletcher's *Library Index* (1892-1909); Quérard's *La France Littéraire* (1829-39; Supplement, 1854-64), and *La Littérature Française Contemporaine* (1842-57); Lorenz's *Catalogue de la Librairie Française*, from 1840 (1877, etc.); Kayser's *Index Locupletissimus Librorum: Vollständiges Bücher-Lexikon, enthaltend alle von 1750 in Deutschland gedruckten Bücher* (1834, etc.); Courtney's *A Register of National Bibliography* (2 vols. 1905). A selected and annotated bibliography of the chief works in all departments of knowledge is published by Nelson under the title of *Standard Books* (1910, 4 vols.).

**Bibliomancy**, divination by means of opening the Bible and noting the first passage which the eye lights on, or by entering a church and observing the first words of the Bible which are heard. It was in extensive practice for centuries, especially in the case of the election of bishops.

**Bibliothèque Nationale**, the great library and museum in Paris. The magnificent edifice in which it is now housed was put up under the direction of Labrousse (1854-75). It includes five departments—(1) printed books; (2) manuscripts; (3) prints, etc.; (4) maps; (5) coins and medals. Of printed books there are 3,500,000, and the number grows by about 70,000 annually; of MSS. there are more than 100,000; of maps, 250,000; of prints, etc., over 300,000; and of coins and medals, about 400,000.

**Bibulus**, M. CALPURNIUS, a Roman of the aristocratic party, son-in-law of Cato, best known as

Cæsar's inactive colleague in the consulship in 59 B.C. In the civil war he commanded Pompey's fleet, and died off Corcyra in 48 B.C. See Mommsen's *Roman History*, iv. 510-11 (ed. 1894).

**Bicarbonate**, an old name for acid carbonate. The bicarbonates differ from the normal carbonates, inasmuch as they contain part of the hydrogen of the hypothetical carbonic acid unreplaced by the metal; for example, the normal carbonate of soda has the formula  $\text{Na}_2\text{CO}_3$ , whereas the bicarbonate is  $\text{NaHCO}_3$ . Calcium bicarbonate,  $\text{Ca}(\text{HCO}_3)_2$ , is sparingly soluble, and forms the temporary hardness of chalky waters.

**Bice** (Fr. *bis*, *bise*, 'grayish blue'), a pigment of which there are two colours—blue, obtained from the native blue carbonate of copper; and green, prepared from blue bice, with yellow orpiment added. Both paints are very durable.

**Biceps** ('two-headed'), an anatomical term, known popularly in connection with the muscle on the front of the upper arm, which flexes the elbow, and which has two separate attachments above. This is the *biceps flexor cubiti*. The *biceps flexor cruris*, one of the three hamstring muscles, runs the full length of the back of the thigh, and bends the knee.

**Bicester**, par. and mrkt. tn., Oxfordshire, England, on branch of L. & N.W.R., 13 m. N.E. of Oxford; comprises the two parishes of Bicester King's End and Bicester Market End; has a brewery and cattle fairs. Once famous for its Augustinian priory, founded by Gilbert de Basset in 1182. The Bicester and Warden Hill Hunt has existed from 1800. Pop. 3,000.

**Bicêtre**, suburb of Paris to the S.S.E. Its castle, built in 1285 by the archbishop of Winchester



(whence the name), was rebuilt in the 17th century, and became successively a hospital for retired soldiers, a prison, a poorhouse, and a lunatic asylum. It is called officially Kremlin-Bicêtre. Pop. 8,700.

**Bichat, MARIE FRANÇOIS XAVIER** (1771-1802), French anatomist and physiologist. Appointed in 1797 to lecture on anatomy, surgery, and experimental physiology, and in 1800 as physician at the Hôtel-Dieu, he was preparing at the same time his *Recherches Physiologiques sur la Vie et la Mort* (1800), and his *Anatomie Générale, appliquée à la Physiologie et à la Médecine* (1801), as well as a *Traité des Membranes* (1800).

**Bichromate Cell.** See CELL, VOLTAIC.

**Bickerdyke, JOHN**, *nom de plume* of CHARLES HENRY COOK (1858), English novelist, journalist, and writer on angling and other sports; born in London; has published *Angling in Salt Water* (1887); *Days in Thule with Rod, Gun, and Camera* (1894); *Sea Fishing* (Badminton Library, 1895); *Wild Sports in Ireland* (1897); *The Book of the All-round Angler* (1900); *How to buy Fishing Tackle* (1904).

**Bickerstaff, ISAAC**, a pseudonym used by Dean Swift when he burlesqued Partridge in 1709; also used by Steele in the *Tatler*.

**Bickerstaffe, ISAAC** (c. 1735-1812), dramatist, was a native of Ireland. His most successful works were *Love in a Village* (1762), a comic opera; and *Maid of the Mill* (1765), an after-piece. See *Biographia Dramatica*, ed. Stephen Jones (1812).

**Bickersteth, EDWARD** (1850-97), Anglican divine and missionary, born at Banningham, Norfolk; founded Cambridge Mission at Delhi, and left in 1877 to be its first head. He returned to England in 1882, and from that

date till 1886 was rector of Framlingham in Suffolk. From 1886 to 1896 he was bishop of Tokyo, Japan. See *Life and Letters*, by S. Bickersteth (1901).

**Bickerton, SIR RICHARD HUSSEY** (1759-1832), English admiral. He became commander in 1779; was posted in 1781, and was captain of the *Invincible* in the action off Martinique in the same year. After promotion to flag rank, in 1799, he took part in the Egyptian operations of 1801 under Lord Keith, who left him as commander-in-chief at Alexandria after the capture of that town. He was again in the Mediterranean from 1804 onwards, as second in command to Lord Nelson. Promoted to the rank of admiral in 1810; commander-in-chief at Portsmouth (1812); K.C.B. (1815).

**Bicycle.** See CYCLE.

**Bida, tn.**, W. Africa, in the Northern Nigeria Protectorate, 20 m. from the l. bk. of the Niger, in about 9° 10' N. and 6° 5' E.; is the capital of the native kingdom of Nupe.

**Bidar, tn.**, Nizam's Dominions, Haidarabad, 72 m. N.W. of Haidarabad, India. Noted for the metalware to which it has given its name. Pop. 11,000.

**Bidassoa**, a small riv., Spain, entering the Bay of Biscay; forms part of the frontier with France. On the Isle of Pheasants, in mid stream, the treaty of the Pyrenees was signed (1659) between France and Spain.

**Biddeford**, city, York co., Maine, U.S.A., situated on the Saco R., 16 m. S.W. of Portland; has cotton, woollen, and lumber mills, and exports granite. Pop. 16,000.

**Bidder, GEORGE PARKER** (1806-78), English engineer, born near Dartmoor. He early developed a genius for calculation, and was exhibited as a prodigy. Proceeding to Edinburgh University,



he was prizeman in higher mathematics in 1822. He assisted Stephenson in 1834 in the London to Birmingham railway, and constructed several lines at home (especially on what is now the Great Eastern system) and abroad (*e.g.* Denmark, Norway, India). He planned the Victoria Docks, London, invented the railway swing bridge, and was one of the founders of the first electrical telegraph company. He was exceptionally skilful in steering engineering schemes through parliamentary committees, and in opposing them.

**Bidding Prayer**, a formula of public prayer contained in the oldest Greek, Gallican, and English liturgies, in which the priest details what the congregation are to pray for, ending with the Lord's Prayer. In the canons of 1603 it is laid down that the bidding prayer shall be used before every sermon, lecture, or homily. A collect, or the invocation 'In the name of the Father, and of the Son, and of the Holy Ghost. Amen,' is now generally substituted; but in cathedrals, at university sermons, and in charitable and other foundations, distinctive bidding prayers are used regularly. In the Surtees Society volume, *Manuale* (1874), forms will be found of bidding prayers from the 11th to the 15th century. See D. Rock's *Church of our Fathers* (1849-53), and Wheatley's *Bidding of Prayers before Sermons* (1845).

**Biddle**, JOHN (1615-62), English Unitarian, was the son of a tailor of Wotton-under-Edge, Gloucestershire. In 1645 he published his *Twelve Arguments* against the deity of the Holy Spirit. From that date much of his life was spent in prison. In 1648, despite an ordinance inflicting the death penalty upon Unitarians, he issued his *Confession of Faith touching the Holy Trinity accord-*

*ing to Scripture*, and soon afterwards his *Testimonies* of the early fathers. He used his freedom under the Act of Oblivion, 1652, to produce his *Twofold Catechism*, and was again put in prison, where he died. See *Life* by Toulmin (1791).

**Bideford**, par. (3,194 ac.), munic. bor., seapt., and mrkt. tn., near mouth of Torridge, 8 m. s.w. of Barnstaple, N. Devon, England, on the L. & S.W.R. Has potteries, collar factories, tanneries, and sail lofts. Was the birthplace of Sir Richard Grenville (of Tennyson's *Revenge*). Here Kingsley wrote part of his *Westward Ho!* Pop. of tn. 8,800. See Granville's *History of Bideford* (1883), and Worthy's *Notes* (1884).

**Bidpai**, otherwise PILPAY, BAIDABA, and SENDEBAR, formerly assumed to have been an ancient Indian philosopher, whose collection of apologues, known as *The Fables of Bidpai*, has been widely read throughout the Old World. But this philosopher is now believed to have had no more real existence than the Scheherazade of the *Arabian Nights*. It would appear that Sâkya-Muni, or Buddha, is most probably the author, if the collection is indeed the work of one author. The researches of such scholars as Benfey and Rhys-Davids have established very clearly the fact that these early Indian 'beast-fables' inculcate the Buddhist teaching in precisely the same manner as the *Jatakas* and certain of the *Fables of Æsop*—these last being also traced back to Buddha. The lower animals converse like human beings, and the tendency of the stories is to inculcate certain morals.

The earliest translation from Sanskrit of the stories attributed to Bidpai was made in 570 A.D., by a Persian physician (Barzoi), who rendered them into Pehlevi,



under the title of *Kalilah wa Dimnah*; and this version is noticed by Firdausi in his *Shâh-Nâmeh*. Thereafter the Pehlevi version was retranslated into Old Syriac, and again into Arabic, about 750 A.D., by Abdullah al-Mokaffa, from whose version all the later translations descend. The earliest English translation is that by Sir Thomas North, made (1570) from the Italian version of 1552 by Antonio Doni. In 1888 this was reprinted, with introduction by Joseph Jacobs. Of later English translations there have been twenty since the latter part of the 18th century.

**Biebrich**, or BIEBRICH-MOSBACH, tn. in the Prussian prov. of Hesse-Nassau; stands on the r. bk. of the Rhine, 3 m. s. of Wiesbaden; has a palace (1704-6) of the Grand-duke of Luxemburg; cement, wool, artificial manure, and iron are produced. Pop. 19,000.

**Biel** (Fr. *Bienne*), industrial tn. (watchmaking) in the Swiss canton of Bern, at the N.E. end of the Lake of Biel or Bienne (16 sq. m. in area, 1,417 ft. above the sea-level, and 246 ft. in depth). The town is 21 m. by rail N.W. of Bern. In the lake are remains of a prehistoric lake village, and the Ile de St. Pierre, inhabited in 1765 by Rousseau. The Musée Schwab contains many antiquities. Funicular railways connect the town with the two Jura air-cures, Macolin or Magglingen, and Evilard or Leubringen. Pop. 22,000.

**Biela**, WILHELM, BARON VON (1782-1856), German astronomer, born at Rossla, near Stalberg, in the Harz Mts. He entered the Austrian army (1805), but devoting his leisure to the study of astronomy, discovered on Feb. 28, 1826, the comet to which his name was given. Its period was 6.61 years, and it reappeared in 1832, 1839, 1845, 1852; since then it has

not appeared, but its course has been marked by brilliant meteoric displays on several of the dates at which it was expected.

**Bielaya**, riv., Russia, rising in the Ural Mts., Orenburg gov., and flowing s.w. then N. and N.W. to join the Kama. Length, 450 m.

**Bielaya-Tserkov** (Pol. *Bialacerkiew*), tn., Russia, gov. of and 47 m. s.w. of Kiev, on an affluent of the Dnieper. Has grain, cattle, and beer trade. Celebrated by Pushkin in his *Poltava*. Pop. 21,000.

**Bielefeld**, tn., prov. Westphalia, dist. Minden, Prussia, at the N. foot of the Teutoburger Forest, 28 m. s.e. of Osnabrück; is the centre of the Westphalian linen industry, and also manufactures damask, silk, plush, cement, and sewing-machines. Bleaching is also an active industry. The most notable edifice is the old castle of Sparrenburg or Sparenberg. Seven miles from Bielefeld is the colony known as Bethel, described as a 'colony of mercy' by Julie Sutter. See her book under this title (1904). It began as a home for epileptics, and now also includes a mother-house for the training of deaconesses, a brotherhood of men engaged in similar work, a labour colony (Wilhelmsdorf), and an association workman's home for grappling with social distress. The town dates from the beginning of the 11th century. Pop. 72,000.

**Bielena**, tn., near the N.E. point of Bosnia, 75 m. N.E. of Sarajevo. Pop. 10,000.

**Bielev**, or BYELEV, tn., Tula gov., Russia, on l. bk. of Oka, 65 m. s.w. of Tula. Trade in grain, soap, pottery, hides; river port. Pop. 10,000.

**Bielgorod**, or BELGOROD ('White City' = 'Belgrad'), tn., Kursk gov., Russia, on the upper Donetz (Don basin), 90 m. s.s.e. of Kursk; seat of archbishopric; station on Kursk-Kharkov Ry.



Three annual fairs. Bee culture; soap, candle, and brick manufactories; tanneries and potteries. Two cathedrals. The earthen rampart running 200 m. between Don and Vorskla, and called the Lines of Bielgorod, was erected between 1633 and 1740. Pop. 22,000.

**Bieli Kliuch** ('White Well'), summer resort, Transcaucasia, Russia, beside the river Khram, on the Abure plateau, 22 m. s.w. of Tiflis. Pop. 20,000.

**Bielitz**, tn. in extreme E. of Silesia, Austria, 59 m. w.s.w. of Cracow; one of the chief seats of the woollen industry in the empire. It also makes machinery and rails. Pop. 17,000.

**Biella**, tn. and episcopal see, prov. Novara, Italy, 46 m. N.N.E. of Turin; has a cathedral (which, with its baptistery, dates from the 9th century), and manufactures cloth, paper, and ironware. Pop. tn. 3,500, comm. 20,000.

**Bielo-ozero** ('White Lake'), lake (25 m. by 20 m.), Novgorod gov., Russia; overflows by the Sheksna into the Volga; is connected by canal with Lake Onega. The ancient town of Bielozersk stands on the s. shore. Pop. 6,000.

**Bielopol**, or BYELOPOLYE, tn. in N.W. of Kharkov gov., Russia, 170 m. by rail E. of Kiev; has distilleries, brickworks, tanneries. Founded 1672. Pop. 15,000.

**Bielostok**, or BYELOSTOK (Pol. *Bialystok*), tn., Grodno gov., Russia, 50 m. by rail s.w. of Grodno city. Rapidly growing industrial centre: cloth, silk, hat, and other manufactories; grain and wood trade. Scene of a terrible massacre of Jews in 1906. Pop. 80,000.

**Bielschowitz**, tn., Oppeln dist., Prussian Silesia; has anthracite mining. Pop. 10,000.

**Bielski**, MARTIN (1495-1576), Polish historian, the first to write history in the Polish language. Chief works: *Kronika Sviata*, or

*Universal Hist.* (1550); *Kronika Polska*, or *Hist. of Poland* (1597), continued and published by his son Joachim.

**Bieltsi**, BIELTZY, or BELTSI, tn., Bessarabia, Russia, 65 m. N.W. of Kishinev, on ry. line from Czernowitz to Odessa. Manufacture of bricks, soap, and candles; horse and cattle trade. Annexed 1812. Pop. 20,000.

**Bien-Hoa**, cap. of the arrondissement of Bien-Hoa, in Lower Cochin-China, on the Donnaï, emptying into the China Sea, 14 m. N.E. of Saigon; manufactures furniture. Pop. 20,000.

**Bienne**, and BIENNE, LAKE. See BIEL.

**Biennial**, in gardening, is strictly a flowering plant that does not flower until the year following that in which it emerged from its seed coverings, and does not live beyond the year in which it first flowers. A plant which is biennial in England is sometimes merely annual when grown in a country with a longer summer. The gardener uses the word with a somewhat wider meaning, for often he includes as biennials all those plants which are at their best in the year following the sowing of the seed. Hollyhocks, mulleins, foxgloves, campanulas (certain species and varieties), sweet-williams, Chinese pinks, wallflowers, biennial stocks, rockets, some of the evening primroses, honesty, and sweet scabious are among the best-known garden biennials. Biennials should be sown about the middle of May in drills, on soil which is thoroughly dry, moderately enriched, and finely pulverized. The seeds should be but lightly covered with fine soil, and if necessary, a considerable sprinkling of water from a fine-rosed watering-pot should be given. Evaporation of this water should be checked by means of boughs or fine netting. The



seedlings should be transplanted at an early age, and again moved a month later, ample space for individual development being given at every stage. At Michaelmas the plants should be placed in rich, well-cultivated ground, where they are intended to flower in the following year.

**Bierley**, NORTH, par. in Shipley div., 2 m. S.E. of Bradford, W. Riding, Yorkshire, England; has coal mines and iron works. Pop. 16,000.

**Bier's Congestion Treatment.** In the last few years the new method of treatment known as the congestion treatment, introduced by the distinguished surgeon Bier of Bonn, has attracted considerable attention, and sufficient time has elapsed to enable us to say that the treatment constitutes an important advance in practical therapeutics. In 1910 the Edinburgh University awarded the Cameron prize in therapeutics to Professor Bier, the award being given for the most important advance in therapeutics in the preceding five years. The basis of the treatment is the production of obstructive hyperæmia. It is brought about usually by the application of a tight rubber bandage to the part, the bandage being applied above the part where the hyperæmia is desired. The veins of the part become dilated because of the decreased outflow from it, the blood pressure and oxidation processes becoming relatively increased. The continual congestion leads to improved nutrition of the part, a process of reactive inflammation is set up, which inhibits the action of, or destroys outright, the bacteria in the diseased joint or tissues below the constricted part. The obstruction to the flow of venous blood must not be so great as to block the lymphatic return. It must suffice only to produce a hyper-

æmia in which the skin is uniformly red. The patient should not experience any pain or discomfort from the treatment. The several methods employed in this hyperæmia treatment all aim at artificially increasing the signs of inflammation, and consequently raising the resistance of the tissues to infection. The remarkably successful results recorded by Bier, and subsequently obtained by many clinicians in all parts of the world, mark a distinct advance in modern therapeutics. There are three methods employed—(1) the constriction bandage; (2) the suction apparatus; (3) the employment of hot air. Common to all these methods is the fact that during treatment a more than usual quantity of blood is present in the affected region, the arterial blood flow, however, never being interfered with.

*Treatment by constriction* is effected by means of a thin rubber band  $2\frac{1}{2}$  in. wide, applied six or eight times around the limb above the diseased part, the bandage being left on for six to twelve hours at a time. The bandage must be firmly but not too tightly applied. It must not be so tight as to arrest the arterial circulation, and the treatment should be quite painless and free from discomfort. The indications for treatment by this method are, specially, tuberculous disease of joints and acute inflammation of the joints, more particularly gonorrhœal arthritis.

*Treatment by suction* is employed in all circumscribed inflammatory areas where it is impossible to apply the constriction bandage. Here an application must be employed which produces hyperæmia simultaneously with aspiration of secretion from the affected area. The commonest form of suction apparatus is the simple cupping-glass, which



has now been widely used as a means of inducing hyperæmia. In addition to the ordinary bell-shaped cupping-glass, bottle-shaped glasses are sometimes employed so that sections of limbs—fingers, arms, feet, or head—can be subjected to treatment. The special indications for treatment by this method are chronic inflammation of the breasts of puerperal women (puerperal mastitis), suppurating glands from tuberculous or other causes, in situations not readily admitting the constriction bandage.

*Treatment by Hot Air.*—The third form of hyperæmia introduced by Bier is the hot-air treatment. By this means we have in the hot-air douche an excellent means of allaying pain in different forms of neuralgia. For this method the so-called hot-air chamber is employed. This consists in a large wooden box, made with a lid, and in the side an iron mouthpiece through which a funnel conducts the hot air, the latter being produced by a spirit or gas flame. In the side of the box there is an opening to admit the limb to be treated, the part being completely enveloped in a piece of felt. The box should maintain an even temperature of about 100° C., or 212° F. This high temperature possesses great healing power, but can only be borne when there is free circulation in the air, so that the evaporation of the sweat is not prevented. This process also should be entirely free from discomfort. This method of treatment is of special value for sciatica, lumbago, neuralgia, and chronic rheumatic affections.

**Bierstadt**, ALBERT (1830-1902), American painter, studied at Düsseldorf and Rome, and returned to settle in New York State. He became a National Academician in 1860, and his representation of the scenery of

the western states, to which he chiefly devoted himself, was of high merit, in spite of some deficiencies in colouring. Among his best works are *Rocky Mountains* (1863), *North Fork of the Platte* (1864), *Eruption of Vesuvius* (1868), *Valley of Kern's River* (1875), and *Discovery of the Hudson River*, painted for the Capitol at Washington.

**Biesbosch** (i.e. 'rush bush' or 'rush land'), a district of the Netherlands, lying between the provinces of S. Holland and N. Brabant. It consists of an intricate agglomeration of islands, waterways, and marshes, some 70 to 80 sq. m. in extent, and originated in consequence of the bursting of a dam in the Maas in 1421. About one-half of the land then overwhelmed by the waters has since been reclaimed. The Haringvliet and Hollandsch Diep connect the Biesbosch with the North Sea.

**Biezhetzk**, tn., Russia, gov. of and 70 m. N.N.E. of Tver. Pop. 9,000.

**Bifrost**, or ASBRO, in Scandinavian mythology, the bridge between earth and heaven over which the gods daily pass to Doomstead, the hall of the Fates or Norns, and the judgment seat under the mystic ash tree Yggdrasil. The keeper of the bridge is Heimdall. The rainbow is the evident origin of the myth.

**Bigamy** is the offence of going through a form of marriage during the existence of a former marriage, and in Great Britain is punishable by seven years' penal servitude under section 57 of the offences against the Person Act, 1861. It makes no difference that the second marriage took place abroad, provided the offender was a British subject, or that it was *ab initio* void; but it is essential that the first marriage should be good. A person is not guilty of bigamy who remarries



when she or he has not heard of a first husband or wife for seven years, and does not know him or her to be alive. After seven years' silence it is for the prosecution to prove knowledge. A decree of divorce by the court of the country of domicile is a good defence. *Bona fide* belief in the death of a husband or wife, even though seven years have not expired, is a good defence.

**Bigelow, JOHN** (1817), American statesman and author, born at Malden, New York, was admitted to the bar in 1839, and in 1849 became joint-proprietor with W. C. Bryant, and managing editor, of *New York Evening Post*. Minister to the court of France (1864-7); secretary of state of New York (1875-7). Publications: *Life of Benjamin Franklin* (1875), whose works he also edited in 1888; *The Wit and Wisdom of the Haytians* (1875); *Molinos the Quietist* (1882); *Life of William Cullen Bryant* (1893); *Life of Samuel J. Tilden* (1895), whose *Writings and Speeches* he edited in 1885; *The Mystery of Sleep* (1896); *The Useful Life a Crown to the Simple Life* (1905); *Peace Given as the World Giveth* (1907); *The Panama Canal*; and *The Daughters of Danaus* (1908).

**Bigelow, POULTNEY** (1855), American journalist and author, born in New York, and brought up at Potsdam, where he became intimate with the Crown Prince William of Prussia, now Emperor William II. He is known for his voyages in a canoe on European rivers, of one of which a bright account appears in his *Paddles and Politics down the Danube* (1892). Other books are *The Borderland of Czar and Kaiser* (1893), *White Man's Africa* (1898), and *Children of the Nations* (1901). His interest in Germany finds expression in *Hist. of the German Struggle for Liberty* (1896-1905).

**Bigg.** See BARLEY.

**Big-Game Shooting.** Africa, from the days of Cotton Oswell, has been the chief centre of big-game shooting. The list of African big game at the present time comprises the giraffe, buffalo, eland, elephant, rhinoceros, and many other beasts still fairly plentiful. To-day, indeed, in British E. Africa alone, at least thirty-eight species of antelope and gazelle are hunted. The African elephant shows good sport, but is a much less dangerous beast to tackle than the African buffalo; the latter is considered by experienced hunters to be one of the most formidable of all wild beasts, and is found in great numbers over a large area. Lions are still fairly numerous in some parts of Africa, notably in Masailand, around Lake Rudolf, and in the Congo Free State. Rhinoceroses are as plentiful in E. Africa to-day as they ever were, owing partly to the fact that they suffer comparatively little from disease, and partly also to the fact that they afford such indifferent sport that few men shoot many of them. The same may be said of the hippopotamus, which abounds in E. Africa wherever water is plentiful, and frequents the Nile in great numbers, especially just above and just below Ripon Falls.

Other favourite resorts of the big-game hunter are in N. America. In many parts of Canada, antelope, deer, moose, and other kinds of game are plentiful. Of late years, however, big game has become comparatively scarce in the eastern section of the Dominion, owing to the facilities afforded by the Canadian Pacific Railway. In British Columbia big game still abounds, especially in the Kootenay district. In the northern regions of British Columbia musk-ox are fairly plentiful, and still farther north bison are found in large numbers. Good sport is to



be had in parts of California; at one time grizzly bears abounded throughout the mountainous districts of this and the adjoining states, but they have gradually been driven farther and farther in-country. In several of the western states various other bears exist, but they offer comparatively poor sport.

In parts of S. America, also, excellent shooting is to be had, especially in the north, though but a comparatively small section of that vast area has yet been opened up for sportsmen. An American sporting syndicate is surveying several tracts in Paraguay and Patagonia, with a view to opening up those countries by supplying maps and other information. The S. American game list includes the guanaco, six kinds of deer, the rhea, jaguar, puma, and tapir, in addition to wild cattle and various sorts of wild pig.

Arctic big-game shooting has few votaries, chiefly because it demands a constitution of iron to face the severe hardships; but its attractions seem to be irresistible to the sportsman who has once shot in northern latitudes. Walrus are sufficiently plentiful in places to afford good sport, though they have been thinned down regularly almost since the close of the 16th century. They breed rapidly, however, and they are able to get away into regions wholly inaccessible to the hunter. The best sport obtainable at the present day is to be found about Spitzbergen and Novaya Zemlya, and to the north and east of those regions. Opinions differ as to the weapon best adapted for walrus-shooting, but it is generally agreed that nothing smaller should be used than a '450 Express with a solid hardened bullet. Several men experienced in walrus-shooting about Cape Leigh Smith and N.E. Cape de-

clare that in those parts a '500 Express is not too heavy a weapon to use. Walrus-harpooning is taken up by many sportsmen, who declare that it is infinitely better sport than shooting. The harpoon commonly used is 12 ft. long and 1½ in. thick. Polar-bear shooting, of which so much has been written, is looked upon with contempt by the majority of big-game shooters.

Forty years ago India used to be regarded as the paradise of the big-game hunter, and though excellent sport is still to be had there, it is fully ten times harder to obtain. Kashmir has many advantages in this respect, especially in the north and east. In the Himalayas big game remains very plentiful, in spite of many hundreds of head being killed there annually. Not many years ago the lion of India used to be killed in fairly large numbers, but to-day he is almost extinct, save in one district near Bombay. On the other hand, tigers are plentiful enough. Some tigers prey, as a rule, upon cattle; others live upon game alone; while a third class, fortunately the least numerous, often prey upon human beings. Tiger-shooting is conducted in three ways—shooting from elephants; driving with beaters to guns posted in trees; and decoying to 'bait' during the night, while the sportsman waits in concealment. In the high jungles of the Tarai, at the south foot of the Himalayas, shooting from elephants is the method commonly adopted. Opinions differ as to whether the panther, still plentiful in parts of India, is or is not a sporting beast. He is most plentiful in Burma, though found in considerable numbers in Ceylon. The methods employed for tiger-shooting are also adopted for panther-shooting; but driving seldom proves satisfactory, owing to the



quarry's habit of lying close until the beaters have all passed, when he quietly doubles back. One of the most favoured districts for elephant lies along the base of the Himalayas; they are far less numerous in Ceylon now than they were. Buffaloes have multiplied in Assam and Burma within the last few years, and several well-known sportsmen have lately engaged in hunting expeditions there. Other districts in which buffaloes may generally be found in good numbers are the north of Ceylon and the Central Provinces of India; in S. India buffaloes are so scarce that many hunters have been misled into believing that they no longer exist there.

Very good shooting is to be had in many parts of Europe, notably in the Caucasus Mts., which take rank among the best big-game regions of the world. The number of sportsmen who go there increases annually; and the cost of obtaining sport is also increasing, as indeed it is all the world over. Wild boars are exceedingly numerous in the Caucasus, though regularly shot in great numbers. They give excellent sport, being even gamer and more cunning beasts than the wild boars of India. In this region are also to be found ibex, bear, antelope, chamois, goat, and many other animals, though deer are growing somewhat scarce. Chamois are more plentiful in the Swiss and Austrian Alps, and are also fairly numerous in many of the high mountain systems of Central and S. Europe, and in the Tyrol, where driving is the most popular method. First-rate shooting is obtainable in many parts of Spain, though the expense is enormous: it is estimated that every ibex shot in the Spanish highlands by British sportsmen costs £100.

As to the weapons best adapted

for big game, opinions vary considerably, though it may be taken as an axiom that a big animal needs a big bullet, whether the tactics adopted be tracking, driving, or stalking. A .450 Express may be considered a good all-round weapon. In the Himalayas a .500 Express is most often employed for soft-skinned animals, and a 12-bore for the thick-skinned animals, while many very practical men advocate an 8-bore for big and unusually ferocious beasts. On the other hand, a .400 Express is sufficiently powerful for gazelle, antelope, etc.; and for wild boar, the 12-bore Paradox, which is rifled at the muzzle, and shoots a fairly heavy ball up to a hundred yards with great accuracy, is an excellent weapon. The small-bore long-distance rifles, such as the sporting Mauser, Männlicher, and Lee-Metford, are ousting the heavier Express with many hunters; but it should be remembered that, since they fire a much smaller bullet, they are less able to stop dangerous animals.

In almost every part of the world big game is gradually becoming scarcer, owing chiefly to the increase in the number of hunters, and to the universal spread of civilization. In many countries it is protected by law, the laws in Norway and Sweden being exceedingly strict. (See PRESERVATION OF GAME.)

A large collection of works on big-game shooting in every part of the world may be consulted at Mr. Rowland Ward's, 166 Piccadilly, London. See also Rowland Ward's *Records of Big Game* (1899); F. C. Selous's *A Hunter's Wanderings in S. Africa* (2nd ed. 1890); Captain H. G. Swayne, R.E., *Seventeen Trips through Somaliland* (1895); Henry Zouch Darrah's *Sport in the Highlands of Kashmir* (1898); Alfred Clark's *Sport in the Low Country of Cey-*



lon (1896); Arthur H. Neumann's *Elephant-Hunting in E. Equatorial Africa* (1898); E. P. Demidov's *Hunting Trips in the Caucasus* (1898); H. A. Bryden's *Great and Small Game of Africa* (1899); F. Vaughan Kirby's *Sport in E. Central Africa* (1899); R. Lydeker's *Great and Small Game of India, Burma, and Thibet* (1901); Sir S. Baker's *Wild Beasts and their Ways* (1891); T. S. Van Dyke's *The Still Hunter* (1902); W. A. Baillie-Grohman's *Tyrol and the Tyrolese* (2nd ed. 1877); *Big-Game Shooting*, in the Badminton Library (1885, etc.); Colonel Kinloch's *Large-Game Shooting* (1885); Rowland Ward's *Handbook* (1900); Pease's *Travels and Sport in Africa* (1902); Finlay's *Big Game and Travel in S.E. Africa* (1903); Hutchinson's *Big-Game Shooting* (1905); Stigand's *Big Game of East Africa* (1909); and Roosevelt's account of his African shooting trip, *African Game Trails* (1910). See also DEER-STALKING.

**Biggar**, par. and tn. on Biggar Water, E. Lanarkshire, Scotland, on C.R., 12 m. E.S.E. of Lanark. Dr. John Brown, author of *Rab and his Friends*, was born here in 1810. Pop. 2,000.

**Biggarsberg Mountains**, a mountain range of S. Africa, branching E. from the Drakenberg Mts., and separating Newcastle district and the N. corner of Natal from the rest of the colony.

**Biggleswade**, mrkt. tn. and par., Bedfordshire, England, 10 m. E.S.E. of Bedford, on G.N.R., and on the Ivel; is a centre of market gardening, pickling vegetables being especially cultivated. Pop. 5,000.

**Bigha**, tn., Turkey in Asia, 100 m. N. of Brusa. Pop. about 10,000.

**Big Horn**. (1.) Group of mts. in N. Wyoming, U.S.A.; consists of an uplift mainly of plateau-like character, from the higher parts

of which the stratified beds have been removed, exposing the granites, and these even have been subject to considerable erosion. In other places Cambrian beds extend across the summit, while all around the range the younger beds lie up against its flanks in high, steep hog-backs. The highest summit, known as Cloud Peak, has an altitude of 13,165 ft. (2.) River of Wyoming and Montana, U.S.A.; rises as Wind R. in the Wind River Mts., Wyoming, flows nearly N. to its junction with the Yellowstone; length, 450 m. In the valley of its chief tributary, the Little Big Horn, General Custer and his troop were massacred in 1876.

**Bight**, geographical term for a narrow bay or recess on the sea coast between comparatively distant headlands—e.g. the Bight of Benin and the Great Australian Bight.

**Bigland**, JOHN (1750–1832), miscellaneous writer, born at Skirlaw, Yorkshire; acted as village schoolmaster until the publication of his first work, *Reflections on the Resurrection and Ascension of Christ* (1803), when he devoted himself to literary work. Besides continuing Lord Lyttelton's and Goldsmith's histories of England, he compiled histories of Spain (1810), Europe (1811), England (1815), France (1818), and the Jews (1820), together with *Letters on Natural History* (1806), and geographical works.

**Bignonia**, a genus composed of about a hundred species of evergreen scandent shrubs, of which *B. capreolata*, the trumpet flower, is the best known in Britain. Though often grown under glass, this species is hardy enough to be grown in sheltered situations against walls in the warmer parts of Britain. If given favourable conditions, including rich, well-dug soil, it reaches a height of 30 or 40 ft., and, with its



heart-shaped leaves, presents a noble effect. It bears orange campanulate flowers in June. Unless root-growth be somewhat checked, however, but few flowers will be produced. The weaker shoots should be so thinned out, and the more vigorous shoots so trained, as to admit sufficient air and sunlight thoroughly to ripen the wood. In early spring all the remaining shoots should be shortened with some boldness. Propagation is effected in late spring by cuttings placed in sand and subjected to bottom heat. The cuttings take about two months to root. Each cutting should be taken with three joints.

Among the more valuable of the species and varieties which should only be grown in Britain under glass may be mentioned *B. cherere* (*B. buccinatoria*), with orange tubular flowers about 3 in. long, borne throughout the summer in a cool greenhouse; *B. clematis*, requiring a warm greenhouse, and bearing white-and-yellow flowers in June and July; *B. speciosa*, requiring a similar temperature, and bearing yellow-and-lilac bell-shaped flowers in May and June; and *B. venusta*, a stone climber, profusely blooming through autumn and early winter, its long, funnel-shaped corollas being of a yellowish crimson. *B. Chamberlaynii*, a beautiful yellow-flowered stone climber, is now generally known as *Anemopægma Chamberlaynii*.

**Bigod**, SIR FRANCIS (1508-37), of Settrington and Mulgrave Castle, in Yorkshire, succeeded his grandfather in 1515; entered the service of Cardinal Wolsey in 1527, and was knighted about 1529. Under Thomas Cromwell he was engaged in Yorkshire in church reform, but became implicated in the Pilgrimage of Grace (1536-7), for which he was hanged at Tyburn on June 2, 1537.

**Bigorre**, former subdivision of

Gascony, now the dep. Hautes-Pyrénées, France. See Colomez's *Histoire*..... (1886), and Troi-dom's *Mémoire*..... (1892).

**Big Rapids**, co. seat of Mecosta co., Michigan, U.S.A., 52 m. N. by w. of Grand Rapids, on the Muskegon R.; has great water-power supplies utilized in mills, furniture factories, foundries, and machine shops. Pop. 5,000.

**Big Sandy**, river of the Eastern States, U.S.A., a l. bk. trib. of the Ohio. It rises in S.W. Virginia and W. Virginia, and joins the Ohio at Catlettsburg.

**Bigtrees**, vil., Calaveros co., California, U.S.A., 70 m. E.S.E. of Sacramento. Here is the most northerly grove of *Sequoia gigantea*, the Californian big trees.

**Bihac**, tn. in N.W. of Bosnia, in the Balkan Peninsula, on the Una, 64 m. w. of Banjaluka; was the cap. of the ancient Croatian kings. Pop. 4,500.

**Bihar**, or BEHAR. (1.) One of the four provs. of the Bengal Presidency; formed part of the ancient kingdom of Magadha, which flourished from the 4th century B.C. to the 5th century A.D. From the 13th century until 1765 it was under Mohammedan rule. (2.) Chief tn. of above prov., 36 m. S.E. of Patna; has considerable trade in silk, cotton, and muslin goods. Pop. 45,000.

**Bihari**, ALEXANDER (1856-1906), Hungarian painter, was born at Grosswardein; studied at Vienna, and at Paris under J. P. Laurens. His productions are chiefly genre pictures of Hungarian life, especially the region round Szolnok, which forms the subject of his first great work, *Gypsies with the Broken Violin before the Country Justice* (1886), now in the possession of the Austrian emperor. Other notable works are *A Pleasure Trip on the Zagyva*, *Peasants at Supper on the Puszta*, and *A Roumanian Funeral*.



**Bihe**, isolated vil. and *concelho* on the plateau of Benguella, Angola, Portuguese W. Africa, with a climate sufficiently moderate for European settlement, and for the cultivation of corn and other crops of the temperate zone.

**Bijapur**, tn., Bombay Presidency, India, 245 m. S.E. of Bombay; was until 1686 the capital of a powerful Mohammedan kingdom. During the early part of the 18th century it passed to the Marathas, and became British in 1848. Its mosques and palaces are of great architectural beauty. Pop. 24,000. See Cousen's *Bijapur* (1889), and Fergusson's *Indian Architecture* (1867).

**Bijawar**, feudatory state in Bundelkhand, Central India. Area, 974 sq. m. Pop. 110,000. During the Mutiny the ruler rendered signal service to the British. Placed under British administration 1901. Chief tn. is Bijawar, 80 m. S.E. of Jhansi. Pop. 5,200.

**Bijayanagar**, or HAMPI, ruined city in Bellary dist., Madras, India; destroyed in 1564.

**Bijbahar**, or BIJBHARU, tn. in Kashmir, India, 25 m. S.E. of Srinagar.

**Bijnaur**, or BIJNOR, the N. district of Rohilkhand div., United Provinces, India; area, 1,875 sq. m. Bijnaur, the capital, is 45 m. N.E. of Meerut. Sugar and cotton cloth are the chief manufactures. Pop. of dist. 780,000; of tn. 17,600.

**Bijouterie**, articles made of metal (iron, bronze, gold, steel, tin, etc.), intended chiefly for ornamental purposes, and generally set with amber, jet, mother-of-pearl, tortoise-shell, coral, pearls, enamel, etc., and even costly jewels. Previous to 1870 the almost exclusive centre of the manufacture was Paris, but *bijouterie* is now also made at Vienna, Budapest, Prague, Geneva, Berlin, Nuremberg, Stuttgart, Esslingen, Hanau, and

Pforzheim. See Fontenay's *Les Bijoux Anciens et Modernes* (1887), and Rogermilès's *La Bijouterie* (1894).

**Bikaner**, or BIKANEER. (1.) Feudatory state in Rajputana, India; has an area of 23,311 sq. m. The greater part of the state is a dreary, waterless plain. The climate is extreme. Pop. 585,000. (2.) Capital of the above state, 240 m. W. by S. of Delhi; within a battlemented wall  $3\frac{1}{2}$  m. in circuit; contains several Jain monasteries. Pottery and carving. Pop. 53,000.

**Bikelas**, DIMITRIOS (1835-1908), Greek poet and historian, born at Hermoupolis, on the island of Syra. He published *Stichoi* (1862), a collection of poems; *Loukis Laras* (1879; Eng. trans. 1881), a novel dealing with the war of Greek independence; *Tales from the Aegean*, a book of travel (1885; Eng. trans. 1894). As historian he has published *Peri Byzantinōn* (1864; Eng. trans., *Seven Essays on Christian Greece*, 1890), and a work on Byzantine and modern Greece (1893). He has also translated several of Shakespeare's plays (1876-87).

**Bikh**, BISH, or VISH, a native Indian word meaning poison, and applied to the extract of *Aconitum ferox*, which grows in the Himalayas and in Nepal. The extract was used to poison arrows.

**Bikrampur**, anc. tn., Dacca dist., Bengal, India. For several centuries it was the centre of government under the Hindu kings of Bengal, and a seat of learning.

**Bilara**, tn., Rajputana, India, 45 m. E. by S. of Jodhpur. Pop. 11,000.

**Bilaspur**, or KAHLUR, chief tn., Bilaspur dist., Central Provinces, India, 250 m. by rail N.E. of Nagpur. Pop. 20,000.

**Bilbao**, cap., prov. of Biscay, Spain, 50 m. W. of San Sebastian, on R. Nervion, near the sea; a busy, prosperous seaport, the



centre of a great mining district, exporting iron, lead, and copper ore (about four million tons a year—mostly to Great Britain); other exports are pig iron and wine. Large quantities of coal and coke are imported for its smelting works and foundries. The town is finely situated, well built, and healthy, and has handsome public buildings. The town was heroically defended against the Carlists (1836 and 1873-4). Pop. 100,000.

**Bilberry.** See VACCINIUM.

**Bilbilis** (mod. *Calatayud*), tn. of ancient Spain (*Hispania*), famous for the manufacture of the finest sword-blades and other steel weapons used by the Roman and Carthaginian armies.

**Bilboes**, fetters fastened to a bar of iron, carried by the Spanish Armada for using upon the men of the English fleet.

**Bilderdijk, WILLEM** (1756-1831), Dutch poet, born at Amsterdam, and studied at Leyden (1780). He practised law at the Hague till 1786, then went to Germany and England, where he resided some time with Southey, whose *Roderick* his second wife translated (1823-4). Returning to Holland in 1806, after spending the preceding nine years at Brunswick, he was appointed president of the Institute of Holland by Louis Napoleon; but after the abdication of the latter he left Amsterdam, and settled first at Leyden (1817), and in 1827 at Haarlem, where he died. He left ninety volumes, including an incomplete history of Holland (1832-51). His poems show little originality, though his lyrics are distinguished for mastery of form. The chief are *Buitenleven* ('Rural Life'), *Die Ziekte der Geleerden* ('Maladies of the Learned'), in 1807; and his celebrated epic, *Die Ondergang der Eerste Wæreld* ('Destruction of the First World'), in 1809. See collected edition of

his poems by Da Costa (1856-9), and *Lives* by Da Costa (1859) and Kollewijn (1891).

**Bile** is the secretion from the liver, and is discharged into the duodenum. It is a yellow, reddish, or green fluid, its colour depending on the proportions of the pigments bilirubin and biliverdin. It is bitter, and either neutral or slightly alkaline; its sp. gr. is 1.026 to 1.032; the amount secreted daily is from 18 to 36 fluid ounces in the adult. Bile contains certain salts, taurocholate and glycocholate of soda, which are of special service in the emulsification, solution, and diffusion of fatty substances in the food. Bile also acts as an antiseptic, and by increasing the turbidity of the chyme (the form in which food passes down the duodenum) it hinders its progress through the intestine, and so assists absorption. Bile is stored in the gall bladder, whence it is discharged on the passage of food. Drugs which increase the secretion of bile are hepatic stimulants (euonymin, sodium benzoate, etc.); those which act on the bile-expelling mechanism are cholagogues (calomel, etc.).

Fraser has shown that the bile of venomous serpents, when mixed with their poison, prevents an otherwise fatal dose of the latter from causing death; and the same property is possessed, though in a less degree, by the bile of non-venomous serpents, and, in a still less degree, by that of all animals. This antidote has long been known to African natives.

Calculi, or concretions in the gall bladder or gall duct, are discussed under GALL STONES. Certain fevers, with which biliary symptoms are associated, are sometimes called *bilious remittent fever*, *hæmoglobinuric fever*, or *hæmaturic fever*. For these, see BLACKWATER FEVER. See also GALL BLADDER, DISEASES OF.



**Bilejik**, tn., vilayet Brusa, Asia Minor, 50 m. E. of Brusa; has a trade in silk cocoons. It was taken by the Turks in 1299, in their first victory over the Byzantines. Pop. 10,000.

**Bilge.** See SHIPBUILDING.

**Bilgram**, tn., United Provinces, India, 52 m. N.W. of Cawnpur; contains remains of an old fort and temple of Srinagar, built by Sri Ram. Pop. 11,000.

**Bilharzia**, a genus of trematodes or flukes, including in *B. hæmatobius* a dangerous parasite of man, which has been prevalent in Egypt since very early times. It infests the abdominal and urinary blood-vessels, and causes hæmaturia, inflammation, and so on. The exact cause of infection, as in many similar instances, is still uncertain, but it is probable that it occurs through drinking impure water. Both sexes are found within the body of the host, the male carrying the female in a groove or gynæcophoric canal, and the embryos escape with the urine.

**Bilin.** (1.) Town and spa of Austria, in Bohemia, 15 m. S.W. of Aussig; exports alkaline mineral waters, Bilin pastilles, etc. Fruit is grown, and sugar manufactured. Pop. 8,000. (2.) River of Lower Burma; flows over 280 m. between the Salwin and the Sittaung to the Gulf of Martaban.

**Biliousness.** A popular term for a form of gastric duodenal catarrh characterized by nausea, retching, and sickness, with vomiting of bile. It frequently occurs in association with migraine. Treatment consists in one or two days' starvation, rest, and a dose of calomel (3 to 5 grains), followed by a morning saline.

**Bill**, or BEAK (of birds). This consists of an upper and under jaw, clothed in a horny sheath or rhamphotheca, which is sometimes undivided and sometimes

composed of several pieces. The bill varies greatly in shape and appearance in different groups of birds, and was much relied upon as a diagnostic character in the earlier classification. As striking peculiarities should be noticed the *raptorial* beak of the birds of prey; the flattened bill of the ducks and geese, with its transverse lamellæ, which act as a sifting apparatus; the *fisso-rostral* beak of swallows, swifts, and goatsuckers, which is short and wide and fringed posteriorly with bristles; the slender (*tenuirostral*) bills of sun-birds and others.

**Bill**, in legislation, see ACT OF PARLIAMENT; in criminal prosecution, see INDICTMENT.

**Billardiera**, a genus of Australian plants named after Jacques Julien Labillardière (1755-1834), a French botanist. The plant is of the order Pittosporaceæ or Pittosporads, and is known in English as appleberry. The fruit is generally bluish when ripe.

**Billaud-Varenne**, JEAN NICOLAS (1756-1819), French revolutionist, born at La Rochelle, the son of an attorney. His book, *Le Despotisme des Ministres de France* (3 vols. 1789), marked him as a leading spirit in the movement, in which he was one of the most extreme and bloodthirsty enemies of the royal family and of the bourgeoisie. He served as president of the Convention, and was on the Committee of Public Safety. With Tallien and Vadier he destroyed the dictator Robespierre (1794), but was in the following year transported to Cayenne, whence he escaped in 1816, and died at Port au Prince. His genuine *Mémoires* were issued by Begis in 1893; those published in 1821 were spurious.

**Bill Chamber**, a department of the Court of Session, Scotland, presided over by the junior Lord Ordinary during the sittings of



the court, and by the judges in rotation during vacation. Cases brought before this court are generally of a summary nature—*e.g.* cases of interdict and suspension. Application for sequestration may be made either in the Bill Chamber or in the sheriff court. During the vacation many of the powers of the Court of Session are exercised by the Bill Chamber.

**Bille**, STEEN ANDERSEN (1797–1883), Danish vice-admiral, made in 1845 a voyage round the world in the *Galatea* for scientific and commercial investigations, an account of which he issued in 1849–51. Bille was minister of marine in 1852–3, and again in 1860–8.

**Billet**, in architecture, an ornament having the appearance of a moulding cut through at equal intervals, from which every alternate piece has been removed.

**Billet**, in heraldry, a small brick-shaped charge. BILLETE, or BILLETY, said of a shield *semée*, or strewn with an indefinite number of billets.

**Billeting**. The practice of billeting or quartering troops on the civil population is in Great Britain illegal, except to the extent expressly allowed by the Army Act, and so long only as that act is kept in operation by an Army Annual Act which specifies the prices to be paid for billets. Billeting otherwise than as aforesaid is still forbidden by the Petition of Right, 1628, and by an Act of 1679. The most common form of billeting is when troops are marching from one military station to another. By previous arrangement with the local police, officers and men are distributed among the licensed houses at the halting-place. Officers must be provided with a room and attendance for the sum of 2s., but pay the normal prices for their meals; the men are lodged and fed at a fixed inclusive rate, which

leaves little margin for profit. In war, billeting is the most advantageous method of feeding the troops. It is calculated that an average agricultural district can support an army twice the strength of its own population for about a week.

**Billiards**. The origin of billiards is not clearly established nor is it known in what country it was first played. England, France and Italy seem to have about equal claims, though Bouillet, a French writer in the *Académie des Jeux*, ascribes the invention to England. According to Reilly's English translation of the Abbé M'Geoghegan's *History of Ireland*, there is a reference to billiards in the will of Cathire More, a sub-king of Ireland, who died in the early part of the 2nd century. Cotton in the *Complete Gamester* (1674) describes billiards as then played. The game was played with two white ivory balls, and heavy curved sticks made of Brazil wood or *lignum vitæ*, one end being much broader than the other. These sticks, called 'maces,' were held in the hand at about the middle of their lengths, and the broad end was made to strike the ball by a sort of jabbing action, whilst the thin end or staff passed over the player's shoulder. The cannon, or *carom* as it was called at one time, is an introduction of the 18th century, brought about by the addition of a third (red) ball, called the *carambole* or 'rover,' the player's ball being made to strike both balls in the same stroke, either successively or together. In the early part of the 18th century the use of the 'cue,' with its small, tapering striking end and thicker butt, was first advocated in lieu of the mace, which is now discarded. The wooden end of the cue was sometimes roughed and chalked to get a better grip of the ball, but it was not until 1807 that



Captain Mingaud invented the use of a leather tip. This simple device revolutionized billiards, and brought in the modern game.

The first great exponent of English billiards was William Kentfield, whose book (1839) describes the improvements brought about by himself and John Thurston, the famous maker of tables and accessories. Slate was used for the bed of the table, and the framework was rendered sufficiently substantial to carry the extra weight. Fine green cloth covered the bed, and india-rubber was used as a substitute for the list cushions.

Billiards is played in England on an oblong table, 12 ft. long by 6 ft. broad. There are six pockets—one at each corner, and one in the centre of each side. The cushions are of india-rubber (vulcanized india-rubber is now used, as it is not affected by the weather), and are pitched low enough to enable the player to strike the ball with freedom when it is situated close to the cushion. At 29 in. from the bottom cushion of the table, and parallel to it, a line, the 'balk,' is drawn right across from cushion to cushion. The centre of this line is marked by a 'spot,' and at a distance of  $11\frac{1}{2}$  in. each way from this, on the balk-line, are placed two other spots, from which a hoop or half-circle, called the 'D,' is lined out below the balk-line, forming the space from which the players begin the game, or play when their ball is in hand—*i.e.* off the table. In a direct line with the centre of the table, at  $12\frac{3}{4}$  in. from the top cushion, is affixed the 'red spot,' upon which the red ball is placed or spotted at the beginning of the game, or when it is driven into a pocket or off the table. After two consecutive winning hazards off the spot, provided no cannon or other score is made by the same stroke, the

red ball is spotted in the centre of the table on a spot midway between the two side pockets; and midway between this central spot and the centre of the top cushion is another spot, commonly called the 'pyramid spot,' that being the spot on which the marker places the point ball of the fifteen red balls used in the game of pyramids. (See POOL AND PYRAMIDS.)

A set of billiard balls consists of three balls of ivory or composite substitutes for ivory, two white and one red. To distinguish the white balls one from the other, one is marked with a black spot, and is called 'spot;' and the other is unmarked, and is called 'plain.' The regulation match balls are made to measure two and one-sixteenth inches in diameter. For ordinary playing balls these measurements are not so strictly observed, but in every case it is essential that the three balls of a set should correspond in size and weight.

Long cues are required for use when the striker's ball is out of the reach of the ordinary cue; these long cues are called the 'long butt,' and the 'half butt.' 'Rests' for use with all cues are also provided. The scoring board should mark up to 100.

The game of billiards is played somewhat differently in different countries. On the continent of Europe and in America the cannon game is played, with three large balls—plain, spot, and red—upon smaller tables constructed without pockets. One point is scored for every cannon, and the breaks do not approach those of the hazard game in magnitude.

Billiards is usually played by two persons, the game being fixed at 50 or 100 up, or, in the case of matches between first-class players, at several thousands, sometimes to as many as 24,000, played in twelve days, at an average progress of 2,000 per day.



Sometimes four players may be engaged in a game, two against two as partners, each player playing alternately; the ordinary game is then often 63, or 126, or more, as agreed by the players. In opening the game the players string for choice of balls and option of breaking. This is done by the two players driving a ball each simultaneously to the top cushion in such a way that they shall return towards the bottom cushion; and the ball which stops nearest to the bottom cushion wins the string. The red ball is then spotted. The first player then places his ball anywhere within the D, and plays out of balk—*i.e.* above the balk-line. It is usual to give a miss, counting one to the opponent, by playing the ball against the side cushion, striking it a little above the balk-line with sufficient 'side' to draw the ball into the protection of the balk-line. To play at the red and bring both balls down the table into the protection of balk is very effective when brought off, but it is too risky an opening to be played by an inexperienced player. The other player next places his ball in the D, and gives a miss also by sending his ball to one of the side cushions, or where, in his judgment, it will be giving his opponent the least chance of scoring. The object of the player is to score, or to leave the balls inconvenient for his adversary; and he may either play for the cannon, or for a losing or winning hazard with the red or white ball. When a player makes his own ball strike both the others he scores a cannon. When with his ball he pockets another he makes a winning hazard; when he pockets his own ball after contact with another he makes a losing hazard. The score is reckoned as follows:—A winning or losing hazard with the white ball scores 2, and a winning or

losing hazard with the red ball scores 3. A cannon scores 2. If both winner and loser are played in the same stroke and a cannon also, they all count; so that it is possible to make at one stroke a winning and losing red hazard, scoring 6; a winning white hazard, scoring 2; and a cannon, also scoring 2— or 10 in all. Besides the scoring strokes which count in favour of the striker, there are also forfeits which score to his opponent. If the player strikes his ball and it misses both the others, this scores 1 to the other player; if his ball goes into the pocket without striking another ball, this counts 3 to the opponent; and if it is forced off the table, it counts 2. When a ball is forced off the table after striking another or being struck, if no score has been made by the stroke, the ball off the table is 'in hand,' and if the red ball is off it is spotted; but if a score has been made first, it has no scoring value.

When two balls touch, the red is spotted on its own spot, and the adversary's ball is spotted on the central spot, the player continuing his break from balk. Should the striker push the ball instead of striking it, he commits a foul, and loses his turn, or should he move a ball with any part of the cue or person before or during the stroke in a manner not properly a part of the stroke, or should he, by leaning over the table, raise both feet from the ground, he commits a foul, and loses his turn if he plays with the red ball he forfeits the game. At one time the strokes were made by the players alternately, whether the player scored or not, the art in those days being to score and by the same stroke to leave the balls inconvenient for the next player. Nowadays the making of a stroke entitles the



player to continue playing till he fails to score. The efforts of the modern player are directed to making runs of scoring, called 'breaks,' and thus to gain 'position' has come to be regarded as the secret of billiards.

The best way to learn is to practise strokes from a book, or under the tuition of an experienced player. There are no regulations as to the weight or size of cues; their weight varies from thirteen to eighteen ounces. The tip should fit exactly without overlapping, and the face of it should be comparatively flat. The player will not obtain an accurate aim until he has learned to keep his eye upon the object ball, and not upon the ball he is striking, especially at the actual moment of the stroke. This is a *sine quâ non* of good billiards.

Another important study is the angle of reflection given by the cushions, which corresponds with the direct line of incidence; but when the player uses the side stroke, the angle will, in a measure, depend upon that. If the impact of the cue is directly in the centre, the ball rolls forward without spin. Should the point of the cue strike the ball on either side of its vertical axis, the ball will travel forward in the line directed by the cue, but will spin in the direction struck. This spin constitutes the side stroke, which is called left or right side, as the case may be. Struck high, the ball follows on; struck low, it tends to stop dead; but by a peculiar smart tap it can be made to run directly back towards the striker, or to curve or screw off to the right or left, according to the spot on which the cue-ball is struck and the point of its impact on the object ball.

One consequence of the study of 'position' has been the red winning hazard from the spot.

By dint of practice this hazard has been made as many as six hundred and thirty-three times running, which led to its ultimately being 'barred.' In addition to the 'spot stroke,' as these red hazards off the spot are called, 'nursery' cannons found great favour, the player getting the balls together and scoring a succession of cannons, mostly effected by a push stroke. The barring of the push stroke has materially interfered with the nursery cannons, so that the game as played now is of the most open and general character. In the days of the spot stroke and nursery cannons, the writer, W. J. Peall, in a match with C. Dawson, registered a record break of 3,304. With spot barred, John Roberts, jun., has made a record break of 1,392. Among other famous players who have made remarkable breaks are W. Cook, C. Dawson, H. H. Stevenson, W. Mitchell, and E. Diggle. Under the revised rules of the Billiard Association, adopted 1898, the best breaks have been made by George Gray of Melbourne. Gray is still (1911) under twenty. See *Billiards for Beginners* (1901), by John Roberts, jun.—a very useful elementary text-book; *Billiards*, by W. Mitchell (1897); *Hints on Billiards* (1895), by J. P. Buchanan; the 1894 edition of *Billiards*, by J. Bennett (ed. Cavendish); and *Art of Practical Billiards for Amateurs*, by A. W. Drayson (1889), specially approved by W. J. Peall. *Le Billard* (1895), by Vignaux, deals exhaustively with the French or cannon game. See also the Badminton Library *Billiards*, and the works of Dawson, Cook, and others. Perhaps the best book of all for beginners is *How to Make Breaks*, published by Burroughes and Watts.

**Billing**, ARCHIBALD (1791-1881), Irish physician, born at Cromlyn, Co. Dublin; author of



*First Principles of Medicine* (1831), works on *Asiatic Cholera* (1848) and *Lung Diseases* (1852), also *The Science of Gems* (1867), a treatise on engraved jewels.

**Billings, JOSH.** See SHAW, HENRY W.

**Billings, ROBERT WILLIAM** (1813-74), English draughtsman, architect, and author, was born in London, and was taught his art in the office of John Britton. He published several books on the practice of architecture, and works, illustrated by himself, on the Temple Church (1838), Carlisle and Durham Cathedrals (1840 and 1843), etc. But his fame chiefly rests on the *Baronial and Ecclesiastical Antiquities of Scotland* (4 vols. 1845-52). See *The Builder* (1874), xxxii. 982-1035.

**Billings, city, Montana, U.S.A.,** co. seat of Yellowstone co., on the Yellowstone River, 235 m. E. by s. of Helena, in the centre of a vast stock-raising district, with coal, marble, and limestone deposits in the vicinity. Pop. 4,000.

**Billingsgate,** a wharf and fish-market on l. bk. of the Thames, below London Bridge. The market was established in the reign of Queen Elizabeth, and was made free in 1699. The present buildings date from 1874. The name is often applied to the foul language characteristic of such places.

**Billington, ELIZABETH,** *née* WEICHSEL (c. 1768-1818), famous vocalist, born in London, died in Italy. Her father was a Saxon musician, and her husband an English contrabassist. She made her début in Dublin in 1783, and in 1786 was engaged for Covent Garden at the then large salary of £1,000. She left London in 1794, and toured as a 'star' in Italy; then returning to London, she sang there from 1801 to 1811. Her voice had an extensive compass of three octaves, and she excelled in florid passages. She

was a striking beauty, and Joshua Reynolds painted a fine portrait of her as St. Cecilia. Details of her career may be read in *Memoirs of Mrs. Billington* (1792), a suppressed work, to which she replied in *An Answer to the Memoirs of Mrs. Billington* (1792).

**Billiton, BLITUNG, or BILTON,** an island of the Dutch E. Indies lies between Banka and the west coast of Borneo, with an infertile soil and heavy rainfall (100 to 120 in. annually). Tin occurs almost everywhere; the annual output is 5,000 to 6,000 tons. Other products are iron, gums, scented wood, sago, trepang, pepper, and tortoise-shell. Its area is 1,877 sq. m., and its pop. 40,000, including 12,000 Chinese.

**Bill of Adventure,** a writing under the hand of a shipper of goods or a common carrier, showing that the shipment is the venture of another person, and that the shipper or carrier is responsible for nothing more than delivery of the cargo as consigned.

**Bill of Costs** is an account of fees, charges, and disbursements by a solicitor in a legal business transacted for a client.

**Bill of Exchange,** an unconditional order in writing addressed by A to B, signed by A, requiring B to pay on demand or at a fixed or determinate future time a sum certain in money to or to the order of C or to bearer. A is the drawer, B is the drawee, C is the payee. The drawee may accept the bill by signing his name across it, and may add any conditions as to time, place, or amount (the bill then becomes an acceptance). But the payee may refuse to accept the conditions. An accommodation bill is one drawn and accepted for which no real value has been given. It is usually an arrangement between two parties for securing temporary financial accommodation by getting the document discounted at a bank.



A bill may be made payable on demand, or at a future date or on the happening of an event which is certain to happen, but not on a contingency. A bill payable on demand must be presented to the drawee within a reasonable time. A bill payable at a future date must be presented when it falls due. A bill is, unless a contrary intention is expressed, a negotiable instrument transferable by indorsement. The drawee having accepted a bill, is bound to pay it, when it falls due, to the payee or any subsequent transferee. If the drawee dishonours a bill either by non-acceptance or non-payment, the drawer is liable to the payee or any subsequent transferee, provided that notice of dishonour has been given to him. A payee or a transferee is liable to a subsequent transferee, provided that notice has been given. A transferee of a bill is called the holder; and a holder in due course is one who receives the bill for value before it is overdue, and without notice of dishonour. A transferee or payee may 'restrictively' indorse a bill by writing that payment must be made to a particular person and no one else. This prevents a further transfer. If a payee's name is misspelt, he should indorse the bill according to the mistake, but he may add the true spelling if he likes. If the drawer and the drawee are the same person, the holder may treat the instrument at his option as a bill or a promissory note. When a bill is not payable on demand, three days of grace are allowed for its payment after it becomes due. An inland bill is one drawn and payable within the British Isles, or drawn within upon a resident in the British Isles. All other bills are foreign. A bill as to form is governed by the law of the place of issue, and as to subsequent transactions (*e.g.* indorsement) by the place of such

transaction. A foreign bill is not invalid in England because the foreign stamp is insufficient. All bills require to be stamped according to their amount. See CHEQUE, PROMISSORY NOTE; also Bills of Exchange Act, 1882; Sir J. B. Byles, *On Bills of Exchange* (15th ed. 1891); M. D. Chalmers, *On Laws of Bills of Exchange* (7th ed. 1909).

**Bill of Health.** Every ship, on arrival at port, must produce her bill of health, a document obtained from the authorities of her last port, stating whether or no there is any infectious or contagious disease on board. A clean bill is given when there is no disease, a suspected bill when there is a prospect of disease, and a foul bill when there is disease.

**Bill of Lading.** A bill of lading performs three functions. First, it is a receipt given by the shipowner to the shipper for goods shipped on board his ship. Secondly, it is evidence of the contract of carriage between the shipper and the shipowner. Thirdly, it is a document of title to the goods shipped, and the ownership may be transferred by indorsement and delivery of the bill of lading to a third party. As to the first two functions, it is important to note that a bill of lading, unlike other documents, is not conclusive against the parties who sign it. If the shipowner or his agent—who is usually the master, but, in the case of steamships, generally the ship's broker—signs a receipt, say, for 1,000 tons of coal, such a receipt is not conclusive, in the absence of a provision to the contrary, if the shipowner can in fact show that only 800 tons were shipped. But by the Bills of Lading Act, 1855, such a statement is conclusive in favour of an indorsee for value. It is a disputed point whether a bill of lading is a contract—as it is described in the Bills of Lad-



ing Act—or evidence of a contract. But at any rate a bill of lading is not usually signed till part of the contract has been completed—*i.e.* till the goods are on board; and in many cases it does not contain all the terms of the contract. As a document of title, a bill of lading may be transferred by indorsement either by way of mortgage, sale, or mere bailment. But the indorsee takes the bill *cum onere*—*i.e.* he is not entitled to the goods until he has performed the shipper's share of the contract, paid the freight, etc. A bill of lading generally contains a statement that the goods are shipped 'in good order and condition,' and the shipowner will be bound to deliver in the same condition. This is called a clean bill of lading; but, of course, the shipowner may refuse to be responsible for order or condition. Certain perils are generally excepted, so that the shipowner will not be responsible for losses occasioned by these. These are: the act of God and the king's enemies, at common law; and perils of the sea, dangers and accidents, stranding, collision, thieves, robbers, leakage, rust, barratry, capture, arrest, embargo, jettison, fire, and restraint of princes, by special agreement. There is a controversy as to whether negligence should be excepted. The American courts refuse to recognize the exception. See Scrutton. *On Charter Parties and Bills of Lading* (1904).

**Bill of Mortality.** The weekly bills of mortality in London were prepared and issued by the company of parish clerks, formerly called the fraternity of St. Nicholas, incorporated by letters patent of Henry III. in 1233, and again by patent of James I. in 1611—a grant which was renewed by Charles I. in 1636. One object of these bills of mortality was to warn the court at Whitehall and the nobles of the Strand to leave London

when the plague became more fatal than usual. The charter of Charles I. incorporated not only the clerks of the parishes of the city of London within and without the walls, but also those of the parishes of the city of Westminster, the borough of Southwark and of the fifteen out-parishes adjacent; and other parishes were added from time to time until after the plague ceased to visit England. The last appearance of the plague as a cause of death in the bills of mortality is in 1679. They were ultimately superseded by the Registrar-general's tables of mortality, which were commenced in 1840, although the old bills continued to be issued for over twenty years after that date.

**Bill of Rights** is the name commonly given to the statute in which is embodied the Declaration of Rights presented by both houses of the Convention to the Prince and Princess of Orange in 1689. After declaring the late King James II. to have done various acts contrary to the laws of the realm, and to have abdicated the government, the Bill of Rights proceeds to enact in detail the celebrated declaration as to the rights and liberties of the English people. It was laid down that the crown had no power to suspend or dispense with the ordinary laws, or form judicial courts, or levy money without parliamentary sanction. The raising or keeping of a standing army within the kingdom in time of peace, unless with the consent of Parliament, was declared to be unlawful. Freedom of election for members of Parliament, freedom of speech in debate, and the right of the subject to petition the crown, were alike maintained. The act recognized William and Mary as the holders of the crown for their joint and separate lives, but with the administration of the government



during their joint lives in William alone, and regulated the subsequent succession. A clause was finally added that the sovereign should take the test in the first parliament of his reign, and that if any king or queen should embrace the Roman Catholic religion, or intermarry with a Roman Catholic, their subjects should be absolved of their allegiance. See *Political History of England*, vol. viii. (1910); *Green's Short History of the English People*, ch. ix.

**Bill of Sale**, a document by which personal goods and chattels are assigned either absolutely or by way of security. The goods may be left in the possession of the assignor, and creditors may thus be misled by a false appearance of prosperity. Again, bills of sale, especially of furniture and stock in trade, are frequently the only security a struggling householder or small shopkeeper can give to a money-lender, who formerly often inserted unfair conditions as to forfeiture on failure to repay a single instalment of a loan, and extortionate terms as to interest so disguised as to conceal the real rate charged. To remedy these evils—the deception of creditors and the oppression of borrowers—the Bills of Sale Acts were passed. The earlier acts were for the protection of creditors. They attempted to define bills of sale, not very successfully, and provided for registration. The Act of 1882, which applies only to bills of sale given as security, was principally for the protection of the borrowers. It provided for registration within seven days of execution; that the bill of sale should express the true consideration, which must not be less than £30, must be in a form given in the schedule, and must contain an inventory of the goods comprised in it; and it restricted the money-lender's power of seizing

the goods to certain specified cases. The acts in force are those of 1878, 1882, and 1891. They have led to much litigation, and have certainly not fully achieved their object. There are no bills of sale in Scotland.

**Bill of Sight**, a form of entry at the custom house, by the best description that can be given of goods which, upon importation, cannot be adequately or correctly described by the importer or his agent.

**Bill of Store**, a custom-house document, which may be issued by the searcher, permitting goods which had been shipped for foreign ports, but not sold there, to be reimported duty free, at any time within five years of exportation.

**Bill of Victualling**, or VICTUALLING BILL, a list of stores shipped from bond, or for drawback on ships bound for foreign ports. The list is signed by the broker, and countersigned by the collector. By the Merchant Shipping Act of 1883 stores not on the list may be destroyed.

**Billom**, tn., dep. Puy-de-Dôme, France, 15 m. E.S.E. of Clermont. The church of St. Cerneuf dates from the 10th century. There is a hydropathic establishment, and the town trades in thread, linen, corn, and cattle. Pop. 4,000.

**Billon** (Fr. 'debased coin'), a term in numismatics for an alloy of silver with a large quantity of copper, used in making medals and coins.

**Billot**, JEAN BAPTISTE (1828-1907), French general and senator, born at Chaumeil, Corrèze dep. After a distinguished career in Africa, he was given the command of the 18th Army Corps during the Franco-German war (1870-1). Elected in 1871 to the National Assembly, he was largely responsible for a bill to reorganize the staff of the French army in 1878. In 1882 he became



minister of war, but his refusal to deprive the Orleans family of military rank led to his resignation in 1883. He was minister of war again in 1896-8, when he took a prominent part in the Dreyfus affair of 1897.

**Billroth**, ALBRECHT CHRISTIAN THEODOR (1829-94), German surgeon, born at Bergen, on the island of Rügen; was appointed professor of surgery at Zürich in 1860, and at Vienna in 1867. He was the first to operate for cancer of the stomach, and to him is largely due the modern ambulance system. His eminence as a surgeon, and his services during the Franco-German war (1870-1), were recognized by an appointment to the Austrian Upper House in 1887. His works include *General Surgical Pathology and Therapeutics* (trans. 1879; Ger. 1st ed. 1863, and 15th ed. 1893); *Ueber den Transport der im Feld Verwundeten und Kranken* (1874); *Care of the Sick at Home and in the Hospital* (trans. 6th ed. 1899; Ger. 1st ed. 1892, and 9th ed. 1899).

**Bilma**, the s. and most important portion of the Kavar oasis, Central Sahara, Africa, in the Tibbu country. Garu (Bilma proper) has rich salt mines.

**Bilney**, THOMAS (d. 1531), English martyr, was born in Norfolk about 1495, and was ordained priest at Ely in 1519. He preached against the mediation of saints, and was arrested in 1527. He abjured, and after a year's imprisonment returned to Cambridge, and resumed public preaching (1531). Arrested and tried, he suffered death by fire, Aug. 19, 1531. See Foxe's *Acts and Monuments*, iv. (1877); Cooper and Thompson's *Athencæ Cantabrigienses*, i. 42 (1858-61).

**Biloxi**, tn. and wat.-pl., Harrison co., Mississippi, U.S.A., on Biloxi Bay, Gulf of Mexico, 80 m. E. by N. of New Orleans.

Near this spot the first settlement by the French on the gulf was made in 1699. Pop. 5,500.

**Bilse**, OSWALD FRITZ (1878), born at Kirn, near Koblenz; a lieutenant in the German army, who wrote a book (1903) entitled *Aus einer Kleinen Garnison* (Eng. trans. *Life in a Garrison Town*), throwing a lurid light on garrison life in the provincial town of Forbach. The book was suppressed, and the author sentenced to six months' imprisonment and dismissal from the service. Other works: *Warheit* (1904), a drama; *Das blaue Schloss* (1904), a novel; *Fallobst* (1905), a drama; and *Dear Fatherland* (Eng. trans. 1905).

**Bilston**, par. (1,845 ac.) and mrkt. tn., 2 m. S.E. of Wolverhampton, W. Staffordshire, England. It is a typical 'black country' town. Coal, iron, and casting-sand are plentiful in the neighbourhood, and there are many blast-furnaces, foundries, and hardware factories. Its grindstones are famous. Pop. of tn. 25,000.

**Biltong**. See BILLITON.

**Bima**, seapt. tn. and cap. of sultanate of Bima, on N. coast of Sumbawa I., Dutch E. Indies; exports horses and timber.

**Bimana** ('two-handed'), in zoology, an order established by Cuvier for the reception of man, as distinct from the Quadrumana, or four-handed apes and monkeys. More recent research has shown that, structurally, man so resembles the apes and monkeys that he must logically be placed in the same order as they are, and the old order Bimana is therefore dropped, man being placed in the family Hominidæ, of the order Primates.

**Bimetallism**. The monetary system of Great Britain (see MONEY) is monometallic. Gold alone is freely received at the Mint and turned into coin; and



gold alone is legal tender, without limit, in the payment of debt. The coins of silver and bronze form a subsidiary or token coinage. They are only valid for the discharge of debts of small amounts, and the quantity coined is restricted, depending on the discretionary power of the Mint, advised by the Bank of England. Under a system of bimetallism, by contrast, the two metals gold and silver would indifferently be legal tender in the payment of debt, and would equally be received at the Mint without restriction. In some more recent proposals it is not considered necessary that standard coins of both metals should be in current use. It is generally admitted that existing token or subsidiary coinages might be left unaltered. All that would be needed would be that the standard should consist of the two metals jointly instead of one alone; and the standard might possibly be only a reserve in bullion or coin kept as the basis of an issue of paper money. A ratio would be fixed between the two metals, and at this ratio they would be accepted at the Mint, and given validity as tender in the final payment of debt. Two chief advantages are claimed for the system. One is the maintenance of a par of value between the two metals, and a consequent steadiness of exchange between gold-using and silver-using countries. Owing to the greater importance of demand in determining the value of money (see PRICES, MONEY), the legal ratio recognized at the bimetallic mints exerts a controlling influence over the market ratio, and is sufficiently powerful to counteract great changes in supply. Slight fluctuations in the market value are met by a tendency to bring the cheaper metal in larger quantities to the Mint, and to melt

into bullion the dearer metal obtained in exchange. Historical experience shows that at the time of the Californian and Australian discoveries of gold in the middle of the 19th century, revolutionary changes in the supplies of the metals were accompanied by trifling fluctuations in their relative value; and it is not disputed that the suspension of the free coinage of silver at the Paris Mint in 1873 was followed by large fluctuations in the exchanges between England and India, by which trade was disturbed, and the government of India, raising its revenue in silver and paying interest in gold on its debt, was embarrassed to an extent unknown before. A further advantage claimed for bimetallism rests on the argument that a joint standard is likely to be more stable than a single standard. The fluctuations, it is true, in the value of the two metals taken separately may be greater or more in number than those of only one; but, taken jointly, they may more probably be found to mitigate than intensify one another. In any event, the standard rests on a broader basis, and a fall of prices is less likely to occur, or at least would be less severe and rapid. On the other hand, it is argued that the system presents more complications and is more artificial than monometallism; that it was tried for long periods in the past by individual nations, and caused great inconvenience, owing to the one or the other metal leaving the country from time to time in search of some place where it was rated higher; that, granting that these difficulties might be overcome by the substitution of international bimetallism, it would yet not be easy to secure agreement on the ratio to be chosen, or to prevent afterwards the secession of one



or more of the contracting parties. The suspension of the free coinage of silver at the Paris Mint in 1873 rendered the French bimetallic system one of imperfect or, as it has been called, halting or limping bimetallicism. The controversy cannot be said to be settled, but the drift of practical policy has lately turned away from bimetallicism rather than set towards it.

F. A. Walker's *International Bimetallicism* (1896) states the question from the bimetallic standpoint. Sir R. Giffen's *Case against Bimetallicism* (1892) is written from the opposite side. Major L. Darwin's *Bimetallicism* (1897) is an attempt to conduct an impartial examination of the arguments of both parties. The *Reports of the Gold and Silver Commission*, of the International Monetary Conference at Brussels in 1892, and of the Indian Currency Committees (mentioned under PRICES) should be consulted as evidence of the state of the discussion and the facts at different periods in recent times. See also Laughlin's *History of Bimetallicism in U.S.A.* (1897); H. D. Macleod's *Bimetallicism* (1894); Lord Aldenham's *Colloquy on Currency* (1900); and Lord Farrer's *Studies in Currency* (1898).

**Bimlipatam**, seapt., Vizagapatam dist., Madras Presidency, India, 15 m. E.N.E. of Vizagapatam. In the 17th century the Dutch established a factory here, which was ceded to the British E. India Company in 1825. Pop. 10,000.

**Binab**, tn., N.W. Persia, 55 m. s. by w. of Tabriz. Pop. 10,000.

**Binan**, or VINAN, tn. in prov. of Laguna, Luzon, Philippine Is., on w. shore of Laguna de Bay; the dist. produces rice and timber. Pop. 10,000.

**Binary Nomenclature** of plants is the application of two names (a generic followed by a

specific) to each plant—e.g. *Rosa canina*, dog-rose. Kaspar Bauhin (1560-1624) introduced the system in 1598 in his *Pinax*. Linnaeus (1707-78) extended the binary nomenclature to the whole of the vegetable and animal kingdoms.

**Binary Theory**, the chemical theory, originated by Davy, that salts always consist of but two elements—a basic or electro-positive, and an acid or electro-negative element. It has long been known that this theory is insufficient.

**Binche**, tn., prov. Hainault, Belgium, 10 m. E.S.E. of Mons; makes lace and pottery. Pop. 12,000.

**Bindraban**. See BRINDABAN.

**Bindusara**, surnamed AMITRAGHATA, emperor of India from 297 to 272 B.C., when he was succeeded by his son Asoka.

**Bindweed**. See CONVULVULUS.

**Bingen** (anc. *Bingium*, or *Vincum*), tn., grand-duchy of Hesse prov. Rhenish Hesse, Germany, at the confluence of the Nahe with the Rhine, on the l. bk. of the latter, 16 m. w. of Mainz; carries on a large trade in wine, and manufactures tobacco, leather, etc. Thousands of people resort here for the popular festival of St. Rochus (the first Sunday after August 16). The *Nibelungen* treasure is said to be sunk in the Rhine near Bingen; and opposite the town, in the middle of the stream, is the 'Mouse Tower,' which legend associates with Hatto II., archbishop of Mainz (d. 970). Pop. 10,000.

The BINGERLOCH, opposite Bingen, is composed of rapids, through which a passage was cut by the Romans, and an effective waterway constructed in 1832.

**Binger**, LOUIS GUSTAV (1856), French African explorer, born at Strassburg, made journeys to the Senegal and Sudan, and published studies on the language of the Bambara. At the beginning



of 1887 he undertook a long journey from Senegal to the river Niger, by which he filled a great gap in the map of that region. This journey he described in *Du Niger au Golfe de Guinée par le Pays de Kong et le Mossi* (2 vols. 1891). He has also published *Le Serment de l'explorateur* (1905), *Le Péril de l'Islam* (1906), and *Héros d'Alsace* (1907). In 1892 he went again to the Guinea coast, to superintend the delimitation of the boundaries of the British and French spheres of influence, became governor of the French territory on the Ivory Coast (1896), and director of the French Colonial Department (1898-1907).

**Bingerville**, formerly ADJAME, tn., French West Africa, and, since 1900, the seat of administration for the Ivory Coast territory, a few miles w. of Grand Bassam.

**Bingham, JOSEPH** (1668-1723), author of the *Origines Ecclesiasticæ*, or the *Antiquities of the Christian Church*, was born at Wakefield. In 1695 an unjust imputation of heresy caused him to resign his fellowship at Oxford. Thereafter he held successively the livings of Headbourne Worthy, near Winchester, and Havant, near Portsmouth. His great work appeared in 10 vols. (1708-22). Among his other writings were *Three Sermons on the Trinity*, and *The French Church's Apology for the Church of England* (1706).

**Binghamton**, city, New York, U.S.A., the co. seat of Broome co., on the Susquehanna R., 80 m. s. by E. of Syracuse; noted for its dairy products. It has a great variety of manufactures. Pop. (1910) 48,443.

**Bingley**, par. and mrkt. tn. on Aire R., 5 m. N.W. of Bradford, W. Riding, Yorkshire, England; has station on M.R. Worsted, cotton, paper, and prepared join-

ery are manufactured. There are extensive stone quarries in the parish. Pop. 18,000.

**Binh-Dinh**, tn., Annam, French Indo-China, 205 m S.S.E. of Hué. Pop. 75,000. Eleven miles to the s. is the town of Kwinhon, or Quinon, its port on the China Sea.

**Binh-Thuan**, small tn., Annam, French Indo-China, cap. of prov. Nha-Trang, 130 m. E. by N. of Saigon.

**Binnacle** (originally *bittacle*, from Fr. *habitacle*) was formerly a rectangular wooden locker with several compartments, to contain respectively the compasses, log-glasses, watch-glasses, and lights to show the compass at night. This case contained three compartments with sliding shutters, the two side ones holding a lamp or candle in each, and the middle compartment having a compass suspended by a gimbal ring, which is also shipped or placed into ears that are fastened to the side of the compartment. The modern binnacle, besides supporting the compass and containing arrangements for the illumination of it, is fitted with various devices whereby the magnetic needle is protected against the effects of shock and vibration, as also against the permanent and induced magnetism of the vessel in which it is placed. See also COMPASS.

**Binney, EDWARD WILLIAM** (1812-81), English geologist, born at Morton, Nottinghamshire; practised as solicitor in Manchester (1836), and founded the Manchester Geological Society, of which he was first joint honorary secretary (1838), and president (1857-9 and 1865-7). In papers on *Sigillaria and its Roots*, he demonstrated that all coal seams rest on old soils composed of vegetable matter. He also wrote on bituminous shale, and helped James Young to the discovery of the Bathgate shale seams.



**Binney, THOMAS** (1798-1874), English nonconformist divine, born at Newcastle; was Congregational minister at Bedford; Newport, Isle of Wight (1824); and Weigh House, London (1829-69); and for a time professor in the Congregational New College. His most popular work is, *Is it Possible to Make the Best of Both Worlds?* (1853.) See *Life* by Paxton Hood (1874).

**Binnie, SIR ALEXANDER RICHARDSON** (1839), chief engineer of the London County Council since 1890; was engaged in the Public Works Department of India (1868-74), and designed and constructed the whole of the Nagpur waterworks. He was chief engineer of Bradford (1875-90), and for the London County Council (1890-1901), and constructed Bradford waterworks, also Blackwall Tunnel, Barking Road Bridge, and other important London works. He was knighted in 1897.

**Binocular Instrument**, an apparatus for viewing an object with both eyes by the use of two tubes, as in a binocular telescope or microscope or field-glasses. See OPTICS.

**Binomial** (Lat. *bis*, 'twice;' *nomen*, 'a name'), an algebraical expression containing two terms. By the binomial theorem any power of a binomial can be expanded into a series. The formula is—

$$(x + a)^n = x^n + nax^{n-1} + \frac{n \cdot n - 1}{1 \cdot 2} a^2 x^{n-2} + \dots + \frac{n \cdot n - 1 \cdot \dots \cdot n - r + 1}{1 \cdot 2 \cdot 3 \cdot \dots \cdot r} a^r x^{n-r} + \frac{n \cdot n - 1}{1 \cdot 2} a^{n-2} x^2 + na^{n-1} x + a^n.$$

*Ex.*  $(x + a)^5 = x^5 + 5ax^4 + 10a^2x^3 + 10a^3x^2 + 5a^4x + a^5.$

**Bintang**, isl., Dutch E. Indies, off Singapore; was acquired by

the Netherlands in 1823. Produces spices, sago, rice, sugar, etc. Area, 450 sq. m. Pop. about 18,000, almost entirely Malays and Chinese.

**Binturong** (*Arctitis binturong*), a civet-like carnivore, a native of the E. Indies, arboreal and nocturnal in its habits, with a long, prehensile tail, tufted ears, and bristly fur.

**Binue.** See BENUE.

**Binyon, LAURENCE** (1869), English poet and writer on art. He won the Newdigate prize in 1891 (the subject of the poem being 'Persephone'), and became assistant in the British Museum, first (1892) in the department of printed books, and subsequently (1895) in that of prints and drawings. His poetry, the note of which is a lyrical quietism, first gained attention in his *London Visions* (two series, 1895 and 1898). His finest work is displayed in his *Odes* (1900). His other volumes include *Lyric Poems* (1894), *Poems* (1895), *The Praise of Life* (1896), *Porphyrion* (1898), monographs on *Dutch Etchers* (1895), *John Crome and John Sell Cotman* (1897), *Western Flanders* (1898), *Thomas Girtin* (1900); *Penthesilea and Dream Come True*, poems (1905), *William Blake* (1906), *Painting in the Far East* (1908), *England and other Poems* (1909); and a *Catalogue of English Drawings in the British Museum* (vol. i. 1898, vol. ii. 1900, vol. iii. 1902, vol. iv. 1907). He has also produced the plays *Paris and Enone* (1906), and *Attila* (1907).

**Biobio.** (1.) River of Chile, rising in the Andes, and flowing in a N.W. direction through the prov. of Biobio, enters the Pacific at Concepcion, after a course of 250 m. The mouth is 2 m. wide, and the river is navigable for 100 m. (2.) Province of Chile, with an area of 5,245 sq. m., and a pop. of 100,000. Cap. Los Angeles (pop. 8,500).



**Biogenesis**, a term used by Huxley in his *Lay Sermons* for what he defines as 'the hypothesis that living matter always arises by the agency of pre-existing living matter.' The term for the opposing doctrine is *abiogenesis*. See BIOLOGY.

**Biograph.** See CINEMATOGRAPH.

**Biography** is the art of presenting a life-work in full and significant delineation. Memorial tributes are an early feature in literature. Even the aged Nestor utilized the privilege of the panegyrist when he harangued his juniors on the tented field; and there is a similar attitude in Plato's delineation of Socrates. Xenophon, another Socratic disciple, writes *Memorabilia* of his master; and though the same author's *Cyropædia* is romantic and fanciful, and his *Agesilaus* is a panegyric, he works them round genuine individual greatness. This is the rudimentary memoir, and, somewhat later, the lament of Moschus over Bion set an elegiac example that has had momentous results. Several Latin writers have merit as biographers. Cicero shows abundantly that he might have written lives with high success. Cornelius Nepos, Sallust, Quintus Curtius, and Tacitus all contribute to this department of literature. The *Agricola* of Tacitus is an admirable presentation of life and character. Suetonius is inartistic, but not without merit. The *Anabasis Alexandrou* of Arrian is valuable both for matter and style. But Plutarch, who lived in the reign of Domitian, is the first great biographer in the world's history. His *Parallel Lives* comprises forty-six biographies in pairs, a Greek and a Roman alternately, and several separate sketches, the whole constituting a work of sovereign value. It has been often translated, and North's English

version of 1579 introduced Shakespeare to this gallery of noble characters.

Now and again in the middle ages there are notable products of biographical impulse. The Venerable Bede (673-735) wrote the *Life of St. Cuthbert*. St. Adamnan (d. 704) produced in his *Vita Sancti Columbæ* a genuine memoir, edited in 1857 by Dr. Reeves. A real and worthy life-study presents itself in Eginhard's *Vita Caroli Magni*—the life of Charlemagne (c. 820). Of this there are various editions, and an English version was published by Mr. W. Glaister in 1877. Alfred the Great was also fortunate in his contemporary biographer, Asser Menevensis, a monk whom the king appointed bishop of Sherborne. First published in 1572 by Archbishop Parker, the best edition of it is that of Wise (1722). Six early biographies of St. Dunstan (960-988) were edited by Bishop Stubbs in his *Memorials of St. Dunstan* (1875). Ælfric's *St. Guthlac* and William of Malmesbury's *Wulfstan* both deserve mention. The biographical work of the middle ages fitly culminates in Boccaccio's reminiscences of Dante, this happy connection, as has been aptly said, supplying 'a great man to describe a greater.'

Formal biographers were somewhat late in appearing in English literature. In the 14th and 15th centuries there were choice opportunities, but the literary bias was towards other ideals. Sir Thomas Malory, Lord Berners, and Caxton might have been biographers under other conditions, for they had direct sympathy with personalities; and Caxton's devotion to earlier men of letters helped materially to establish their importance. Prose style steadily developed in the 15th century, and is well illustrated in the work of 'saintly Fisher and unbending More.' Fisher's prose is



strong and not inartistic, and the funeral sermon on Henry VII. shows a capacity for a memorial record. More's *Richard III.* (1513) is more than a merely biographical study, but it recognizes the importance of grouping historical facts round an individual career. A lurid record of the times is Foxe's *Acts and Monuments of the Church*, or the *Book of Martyrs*, published at Basel in 1559 (Eng. ed. 1563). William Roper, who died in 1577, wrote the *Life of Sir Thomas More*, edited by S. W. Singer in 1817.

There are still few biographies in the Elizabethan age. Cavendish's *Life of Cardinal Wolsey*, written about 1557, and first printed in 1641, is a striking little book, which was undoubtedly used in the composition of Shakespeare's *Henry VIII.* The somewhat unsatisfactory *Life of Sir Philip Sidney* by Lord Brooke, published in 1652, has supplied points that have been constantly used by subsequent biographers of the perfect, gentle knight. There is room for regret that Ben Jonson did not write a life of Shakespeare. How much it might have told, and what fatuous speculations it might have prevented! Jonson's memorial tributes are admirable, but a biography would have enhanced his literary reputation, and earned lasting gratitude. Bacon, whose *Henry VII.* has certain biographical merits, fared somewhat better than Shakespeare. Various biographies, *Baconiana*, etc., duly followed the *Life* by Rawley, published in 1657. Passing reference must be made to the biographical material in Drummond of Hawthornden's *Notes of Ben Jonson's Conversation* (Shakespeare Society Papers, 1842). Sometimes irrelevant and occasionally indiscreet, these records mark a unique episode. Milton's *Life*, by his nephew, Edward Phillips, appeared in 1694, and

another was published by Toland in 1699. Both were useful, but have small literary merit. Fuller's *Worthies of England* (1662) is an attractive miscellany. Mrs. Hutchinson (1620-64) produced, in her *Life of Colonel Hutchinson*, a work of uncommon merit, which was not published till 1806. Clarendon's *History of the Rebellion* has interesting biographical features; it appeared in 1704-7. But the foremost biographer of the age is Izaak Walton, whose *Lives of Donne, Wotton, Hooker, Herbert and Sanderson* appeared, in the order named, between 1640 and 1678. A volume containing the first four was published in 1670, and the complete set was edited in 1796, with a *Life of Walton* by Dr. Thomas Zouch. Unaffected in style, and radiant with the author's genial personality, these biographies have an enduring charm. John Evelyn (1620-1706) produced a pleasing *Memoir of Margaret Blagge*, wife of Godolphin, the lord treasurer (ed. Bishop Wilberforce, 1848). Anthony à Wood's *Athenæ Oxonienses* (1691) is a storehouse of information and gossip about Oxford men. To 1691 belongs also Langbaine's *English Dramatic Poets*, an explicit and faithful record. John Aubrey (1626-97) wrote curious and valuable 'Minutes of Lives' (Bacon, Milton, Hobbes, etc.), first published in *Letters by Eminent Persons* (1813). Gilbert Burnet, biographer of Matthew Hale, has much good matter in the *History of his own Time*.

Literary accomplishment marks the biography of the 18th century. Steele's tribute to Addison (*The Theatre*, 1720) makes a good beginning. Roger North (1653-1734) wrote lives of himself and his brothers, and the engaging *Lives of the Norths* appeared in 1742-44. Middleton's *Cicero* (1741) and Jortin's *Erasmus* (1758) are standard works. Theophilus Cibber's



*Poets and his Actors and Actresses*, both dated 1753, help to mark the onward movement. Literary grace and charm were given to biography by the illuminating pen of Goldsmith. His *Voltaire* (1759) utilizes his personal knowledge, and displays his narrative and descriptive resources. In 1762, after a sojourn in Bath, he produced his inimitable mock-heroic *Life of Beau Nash*, conferring immortality on a marionette of supreme quality. His *Parnell* and *Bolingbroke*, published in 1768 and 1770 respectively, are less important. It is an easy transition from Goldsmith to Dr. Johnson, whose *Lives of the Poets* (1779) remains, after all possible deductions, an admirable specimen of literary biography. Some of the best are those of the smaller men, some are manifest results of mere journey-work, and some—those, for example, of Milton and Gray—exhibit strong prejudice. In all, the independent critic works steadily, heedless of results. In the *Life of Dr. Johnson*, published in 1791, James Boswell took the foremost place among British biographers. His artlessness is the secret of his success. His genial affability recalls the method of Walton. 'An inspired idiot' he may have been, but he was a superb artist in biographical narration. The high character of the 18th-century biography is well sustained by William Roscoe in his strong and picturesque *Lorenzo de' Medici* (1796).

The development of the biographer's art made great advance in the 19th century, as may readily be seen from a comparison of a work like Hayley's *Cowper* (1803) with the elaborate studies of later days. Books such as Hayley's give more minute and more skilful biographers a fresh opportunity. The same thing may be said of the work of Dr. Thomas M'Crie, whose *Life of Knox* appeared in

1811, and *Life of Andrew Melville* in 1819. Whatever Sir Walter Scott wrote has value. His small biographies have interest and charm, and his *Life of Dryden* (1808) maintains its authoritative position. His elaborate work on Napoleon, produced later in life, was the result of the most serious and elaborate preparation, but it was done at a time when Scott was unable to devote to his materials those great and apparently inexhaustible powers that had so long done marvellous service. Southey was an ideal biographer, whose mastery of his art did not always imply exact and detailed knowledge of the subject under discussion. His *Life of Nelson* (1813) is one of the most readable books in the language, and he is hardly less successful with his *Life of Wesley* (1820) and his *Life of Bunyan* (1830). His *Cromwell* and his *Dr. Andrew Bell*, both published in 1844, are not important; for in the one case the subject is too great for the treatment it receives, while in the other there could never be more than a temporary interest involved. Hazlitt, like Scott, failed with *Napoleon* (1828), but his *Conversations with James Northcote* (1830) is a personal record of unique and stimulating interest. Moore's *Byron* (1830) might well have been other than it is—it would have been somewhat less amorphous had Moore been possessed of stronger critical powers—but it has indubitable qualities of greatness. The *Life of Crabbe* (1834), by his son, does justice to a very worthy subject. With Lockhart we reach one of the literary heights and resting-places of the century. His *Burns* (1828) has strength, tone, and style; and after all that has been written on the poet, it maintains its authoritative value. With his other study Lockhart was most happily fitted. He was closer to Scott than even Bos-



well was to Johnson, and his *Life of Scott* (1837-9) competes with Boswell's great work for the first position among English biographies.

With Carlyle the survey makes a fresh start. A unique figure in literary history, he touched nothing on which he did not leave strong marks of his personality. His lectures on *Heroes and Hero-worship* have much interest for the student of biography. His *French Revolution* is a brilliant picture gallery, that leaves, by its numerous representative delineations, impressions of the most vivid and powerful character. His *Past and Present* is a continuous and fascinating study of personal merit or demerit and the consequent moral influence. His ideal of the true and sincere man he finds in the lofty poet, as in Schiller; in the comparatively unimportant man of letters—good and great if only he be worthy—as in John Sterling; and in the statesman and the ruler, as in Cromwell and Frederick the Great. Probably Carlyle has not said the last word on his poet and his men of action—other studies of Cromwell have already appeared, Carlyle's own treatment is found to need supplementing, and the *Frederick* is not immaculate—but on John Sterling he is definite and final. Him he has firmly placed with those literary friends who are commemorated in *Lycidas* and *Thyrsis*, and this consideration marks an important feature in biographical work. Carlyle's *Sterling* shows that the biographer discovers and reveals essential greatness, being himself a prophet or seer. *Schiller* in its first form appeared in 1825, *Oliver Cromwell's Letters and Speeches* in 1845, *John Sterling* in 1851, and *Frederick the Great* in 1858-65.

Meanwhile other biographers were at work, making contri-

butions to their subject that in some respects fell hardly short of even Carlyle's achievement. Dean Stanley's *Life of Dr. Arnold* (1844) at once asserted its claim to recognition as a performance of rare excellence; and the same may be said of Hill Burton's *Life and Correspondence of Hume* (1847). John Forster is one of those whose exceptionally excellent results seem to prove the saying that, like the poet, the biographer is born, not made. His *Goldsmith* (1848) was most elaborately refined into its ultimate beauty of form and feature. His *Landor* (1868) and *Dickens* (1872-4), hardly less well done, are both works of very fine quality. His *Swift* remains a promising fragment. Mrs. Gaskell's *Charlotte Brontë* (1857) has distinguished grace and charm—the author, herself an eminent novelist, being able to work with ready sympathy on her deeply suggestive subject. In his *Life of Goethe* (1859) George Henry Lewes produced a singularly bright and substantial work, giving in it one of the best studies of a foreign author made by an Englishman. The Rev. Stopford Brooke's *Frederick W. Robertson* (1865) is, on the other hand, a most successful delineation of one great English preacher by another, whose position was destined to be high in pure literature as well as in the studies peculiar to his profession. James Spedding's *Bacon* (1857-74) is the result of long and special application to his subject, and has monumental significance. By far the greatest work of Mark Pattison is his *Life of Casaubon* (1875), the author fully mastering the inherent difficulties of his task, and producing a book of high and enduring quality. Sir Theodore Martin's *Life of the Prince Consort* (1874-80) happily weaves contemporary history about a personality of unaffected dignity and attractive-



ness, his somewhat delicate undertaking being accomplished with spirit, tact, and thoroughness. Sir Theodore had qualified as biographer with his bright memoir of his friend Professor Aytoun in 1867, and he gave further illustration of his rare skill, sympathy, and personal devotion in his *Lord Lyndhurst* (1883) and *Helen Faucit, Lady Martin* (1900). Sir George Trevelyan's *Macaulay* appeared in 1876, and at once became a classic. Professor Masson's *Life of Milton* (1859-80) combines history with biography on a most extensive plan, and challenges criticism of its bulk while presenting the results of wide investigation and practised literary skill. Froude's *Carlyle* (1882-84), lacking in the reticence desired by some, has the countervailing recommendations of comprehensiveness and style. His *Julius Cæsar* (1886) is a sound and brilliant little book. Mrs. Oliphant, who proved her biographical competency in the *Edward Irving* of 1862, further illustrated it in her *St. Francis of Assisi* (1870), *Montalembert* (1872), *Principal Tulloch* (1888), and her volumes on Florence and Venice. In 1897 she produced the first two volumes of *William Blackwood and Sons: Annals of a Publishing House*. Mr. John Morley's (Lord Morley) *Edmund Burke* (1867; new ed. 1879), *Voltaire* (1872), *Rousseau* (1876), *Diderot* (1878), *Richard Cobden* (1881), and *Life of Gladstone* (1903), are all standard works of distinguished character. An equally distinguished place is to be assigned to Sir Leslie Stephen's *Henry Fawcett* (1885) and Professor Dowden's *Shelley* (1886). The late 19th century did all possible justice to Shakespeare. The outstanding biographies are Halliwell-Phillips's *Outlines* (7th ed. 1887) and Mr. Sidney Lee's minute, exhaustive, and skilful *Life of William*

*Shakespeare* (1899; new ed. 1908). Among the most important of recent biographies are Maitland's monograph on Sir Leslie Stephen, Mr. Winston Churchill's *Life of his father*, and Mr. W. F. Monypenny's *Disraeli*.

Of American biographies there may be mentioned:—J. Marshall's *George Washington* (3rd ed. 1839); W. Irving's *Life and Voyages of Christopher Columbus* (new ed. 1893); R. W. Griswold's *Poe* (1850); J. Parton's *Thomas Jefferson* (1894) and *General Jackson* (1892); P. M. Irving's *Washington Irving* (new ed. 1880); J. R. Gilmore's *President Garfield* (1880); *Story of Garrison's Life* (1885-9); J. E. Cabot's *R. W. Emerson* (1887); J. Hawthorne's *Nathaniel Hawthorne and his Wife* (1885); T. R. Lounsbury's *James Fenimore Cooper* (1881); W. S. Kennedy's *O. W. Holmes* (1883); S. Longfellow's *Longfellow* (1886); E. E. Hale's *J. R. Lowell and his Friends* (1898); Professor A. V. G. Allen's *Phillips Brookes* (1900).

Some representative works and biographers of Italy, France, and Germany are the following. For Italy there are Vasari's *Painters, Sculptors, and Architects* (1550); Muratori's *Rerum Italicarum Scriptores* (1723-51); *Life of Boccaccio*, by Baldelli and by Tiraboschi; *Machiavelli e i suoi Tempi* (Eng. trans. 1890); Castiglione's *Raphael*, etc. The *Vie de Saint Louis* of Joinville (1309) has distinct literary importance, and so have Brantôme's outspoken and vivid *Memoirs* (1659). The *Mémoires* of Saint-Simon (1675-1755) are a rich mine of history and biography. Later French biographers are Voltaire, Cousin, Guizot, Montalembert, and Sainte-Beuve (*Portraits Littéraires, Port Royal, Causeries du Lundi*, etc.). German writers include Förster, Schröckh, Herder, Bruhns, Guhrauer, Klein, Fischer, Varnhagen von Ense, Barthold, Haym, Otto



Jahn, Ranke, Düntzer, Köstlin, Zeller, Brandl.

Cyclopædic biographical works have been frequently compiled. These include: *Acta Sanctorum* of the Bollandists (1643-1794); Bayle's *Dictionnaire Historique et Critique* (1697, etc.); *Biographia Ecclesiastica* (1704); *Biographia Britannica* (1747-66, ed. Dr. Kippis; with additions, 1777-93); *Biographica Classica* (1778); *Biographical Dictionary, New and General* (1798); Michaud's *Biographie Universelle* (1811-28, new ed. 1870, etc.); Chalmers's *Biographical Dictionary* (1812-17); Rose's *New General Biographical Dictionary* (1829-47); Chambers's *Biographical Dictionary of Eminent Scotsmen* (1835; new ed. 1859); *English Cyclopædia*, with biographical section (1856); *Nouvelle Biographie Générale* (1857-1866); *Das geistige Deutschland: Deutsches Künstler-Lexikon der Gegenwart* (1898); Sparks's *American Biography* (1834); Appleton's *Cyclopædia of American Biography* (1888). National dictionaries, in whole or in part, have been produced in Sweden, Holland, Austria, Germany, Norway, Italy, Spain, and Belgium. The *English Dictionary of National Biography*, one of the most comprehensive and thorough of such enterprises, was edited in 66 volumes by Sir Leslie Stephen and Mr. Sidney Lee (1885-1901; re-issue 1908-9). The first cast of Mr. Lee's important biography of Shakespeare was in this work, and its concluding volume contains his full and authentic life of Queen Victoria, which was subsequently published separately. On a lesser scale may be noted *Who's Who*, a standard annual dictionary of contemporary men and women of note in science, literature, art, politics, etc.

Individual writers have produced groups of biographies, of which these are examples:—Allan

Cunningham's *British Painters, Sculptors, and Architects* (1829-33); Agnes Strickland's *Queens of England* (1840-8), *Queens of Scotland* (1850-9); Mrs. Jameson's *Early Italian Painters* (1845); Campbell's *Lord Chancellors* (1845-7) and *Chief-Justices* (1849-57); Lord Lindsay's *Lives of the Lindsays* (1849); Hook's *Archbishops of Canterbury* (1861-76); Smiles's *Engineers* (1862); Dr. Doran's *Their Majesties' Servants* (1864), biographies of English actors and actresses; Grove's *Dictionary of Musicians* (1879-85); Bryan's *Dictionary of Painters* (new ed. 1903); Sir William Fraser's *Scotts of Buccleuch* (1879), and other similar works on noble houses; Miss Thackeray's *Book of Sibyls* (1883); Hamilton's *Poets Laureate of England* (1888); Dean Burgon's *Twelve Good Men* (1888).

Many valuable monographs have been contributed to various series, which have multiplied in great profusion. Some of these are:—Ancient Classics, Foreign Classics, and Philosophical Classics for English readers; English Men of Letters, a most admirable biographical library, edited by Mr. John Morley (Lord Morley); English Worthies; English Men of Action; English Men of Science; English Statesmen, containing Lord Rosebery's monograph on Pitt; Eminent Women; The Queen's Prime Ministers; Famous Scots; Great Writers; Heroes of the Nations; Great Craftsmen; Modern English Writers; Westminster Biographies; Makers of British Art; Great Educators; The World's Epoch-makers; American Men of Letters. See, further, AUTOBIOGRAPHY.

**Biology.** This term, which literally means 'life-lore,' was first used by Lamarck in a work which appeared in 1801; and it was also used in the following year, to all appearance independ-



ently, by Treviranus. From the first its usage was twofold—(a) to include *all the departments of science which have to do with living creatures* as such, or in particular aspects (e.g. botany, zoology, anatomy, physiology, and embryology); and (b) as a convenient term for *the study of the general problems concerning the nature and origin, continuance and progress of organic life*. There seems little justification for a third usage, especially common in Germany, to include the study of habits and interrelations. For this important department of biology some other word, such as bionomics or ethology, is decidedly to be preferred.

Biology, in the second sense above defined, has the same relation to the more specific inquiries, such as botany and zoology, that the fundamental principles of chemistry and physics have to astronomy, meteorology, mineralogy, and the like. For biology has to do with the general phenomena of life, most of which are common to plants and animals; and it should be fundamental to all the specialized departments. It will become so when a larger number of foundation-stones have been securely laid.

On the other hand, it should be noted that while biology in the second sense is concerned with generalities, it necessarily rests upon biology in the first sense—*i.e.* on the detailed descriptions furnished by all the specialized inquiries. Its office is to formulate and unify the results of these, and there is no item of anatomical or physiological analysis which may not have its import in relation to the general theory of life. For this reason it seems well that the double usage of the term should continue, reminding us, on the one hand, that there can be no safe generalizing except on the basis of par-

ticulars, and, on the other hand, that the full import of particulars is not appreciable until they are summed up in general formulæ.

*Subdivisions of Biology.*—The term biology, in its widest significance, includes all life-lore; but life-lore obviously admits of numerous subdivisions, and these should be referable either to a logical or to a practical scheme. One natural basis of subdivision is according to subject-matter, but this is rather a matter of convenience than a logical classification. Thus, since Claude Bernard's classic book on the *Phenomena common to the Life of Plants and Animals* (1879), no one has seriously attempted to maintain that the distinction between botany and zoology is more than one of convenience. Plants and animals are equally alive, though the expressions of their life are divergent—even Linnæus united them under the common title 'Organisata'—and there is no good reason for separating botany and zoology, except that the distinction is useful to our limited intelligence. Difference in subject-matter would also justify the establishment of a special science of protistology for the study of those simple living creatures (*Protistæ*), which lie, as it were, at the base of the V-shaped genealogical tree, having taken no decisive steps towards either an animal or a vegetable mode of life. It is evident, then, that the subdivisions of biology according to subject-matter present no particular difficulty. They may tend to become embarrassingly numerous, they may sometimes obscure the unity of the science, but they seem to give *dignity* to particular lines of study, and some of them are very convenient. Thus we have not only ornithology but oology (the study of birds' eggs), not only entomology but dipterology (the study of flies), not to



speak of ichthyology (of fishes) and conchology (of shells), bryology (of mosses) and lichenology (of lichens), and scores of other subdivisions, some of which border on the grotesque.

But there is another more logical plan of subdivision, which requires more explanation. It is that which recognizes that living creatures may be studied scientifically from several different points of view—as regards (1) their form and structure, (2) their habits and functions, (3) their development and history, and (4) the causes which have operated in that history or evolution. In other words, we may ask four complementary questions in regard to a living creature: (1) What is this, as a whole and in its parts? (2) How does this living mechanism work? (3) Whence has this form of life arisen, as an individual and as a member of a race? (4) What has been the mode of its historical origin, what have been the factors in its evolution?

1. The study of form and structure, conveniently termed *morphology*, includes all description of external features, all anatomical analysis, the study of minute structure in general (*histology*), and of cells in particular (*cytology*). Whether we dissect the animal or the plant or simply draw it, whether we use only our own living lenses or put glass ones in front of them, we are morphological in our inquiry so long as we do not raise questions as to how the creature we are studying lives and grows and has been evolved. These questions are or may be in the background of consciousness while we are pursuing our morphological study, but they are not for the moment relevant. The morphologist does not study activity; the organism is to him like a watch that has stopped. In other words, he has to do with statical, not with dynamical, re-

lations. The history of this inquiry, especially through the 19th century, shows a gradually deepening analysis. The morphologist passed from the study of externals to a dissection of the internal organs—*e.g.* Cuvier; thence to an unravelling of their component tissues (nervous, muscular, connective, glandular, etc.)—*e.g.* Bichat; thence, with a better microscope, to a description of the minuter component units or cells—*e.g.* Schwann and Schleiden; and he has in recent years been in part occupied with an inquiry into the visible microscopic structure of the material which is regarded as the physical basis of life—*e.g.* Bütschli. At each of the five levels—the intact creature, its organs, its tissues, its cells, the living substance—there remains much work to be done; and it should also be noted that morphology loses half its interest unless it is studied comparatively, and misses its aim unless it forms the basis of a natural classification (*taxonomy*). It should be carefully observed that the morphologist is not restricted to the study of individuals; thus it is at present one of his most urgent tasks to re-define a species by precise statistical observations on the range of variability which each specific type exhibits.

2. The second question, 'How does this work, as a whole and in each of its parts?' is the fundamental question of *physiology*. The habits and behaviour of the organism, all its relations to the environment, both animate and inanimate, its modes of nutrition and reproduction, are as much part of physiology as inquiries into circulation of the blood or the movement of sap. If we say that the morphologist is concerned with statical relations, we may likewise say that the physiologist deals with dynamical relations. His fundamental prob-



lem is vital activity or function; and here again the history shows, especially through the 19th century, a gradually deepening analysis. The physiologist passed from general studies of habit and temperament to more precise inquiries into the functions of particular organs, thence to a study of the properties of tissues (*e.g.* Bichat) and the phases of cell life (*e.g.* Schwann, Schleiden, Goodsir, Virchow), while much attention has also been given to the chemical and physical changes occurring in the complex substances which form the physical basis of life (*e.g.* Claude Bernard). On each level, as with morphology, there is still much to do. Moreover, the work is only at its first stage until synthesis reverses the method of analysis, and a vigorous attempt is made to use the analytical results—let us say, the study of protoplasmic metabolism—in a deeper interpretation of the general life of the creature. It seems likely, however, that the analytic method must be followed to much more precise conclusions than have been hitherto reached before there can be stable success in the complementary synthetic interpretation.

3. The third biological question, 'Whence is this?' requires a double answer. There is the *development of the individual* through a succession of stages, from the fertilized egg-cell to the embryo, and thence onwards to adolescence along a path often complicated by larval stages, when what arises from the egg, be it caterpillar or tadpole, is very unlike the finished form. In the case of many plants, the relations of sporophyte and gamophyte introduce equally important complications. There is, on the other hand, *the history of the race* to which the organism belongs—its affiliation through related forms, either living or extinct, to a more generalized stock.

The first answer is given by *embryology*, the second by *palæontology*; but both are concerned with processes of growth or 'becoming,' though it is convenient to keep the word development for the individual life-history, and the word evolution for the progress of the race. In more technical language, the answer to the historical question is to be found in a study of ontogeny (individual development) on the one hand, and of phylogeny (racial evolution) on the other. It would be convenient to have a term like 'geneology' to include both.

4. The fourth biological question is, 'How has the organism come to be what, where, and as it is?' This is an inquiry into historical causes, into the factors of evolution; and the answers, still far from complete, are often comprised under the term *ætiology*. The objection has been raised that the evolutionary question indicates rather a point of view than a distinct department, and it is no doubt true that the question should always be on the lips of biological students—anatomist and physiologist, embryologist and palæontologist alike. At the same time, it must be borne in mind that *all* the departments imply artificial abstractions: morphology and physiology are complementary, both need the historical setting afforded by embryology and palæontology, and all are illumined by the light of the evolution idea, and by the results of concrete inquiries into the factors in the evolution process. To sum up, biology may be subdivided, according to the particular aspect emphasized, into (a) morphology, (b) physiology, (c) geneology (embryology and palæontology), and (d) ætiology.

*Problems of Biology.*—We see a seed germinating, a frog's egg dividing, a young bird creeping out of the egg, a child growing



up; we find evidence that since the earth became fit to be a home of life many races of organisms have come and gone, and that more and more complex forms have successively emerged; we see marvellous intricacy of organic structure from the lowest to the highest, and amid the manifoldness an adherence to a few main types of organic architecture; we see the behaviour of young creatures to one another and to the immediate environment, a great variety in the modes of nutrition and reproduction, the abundance of multiplication, the diverse expressions of nervous and muscular activity, the subsidiary processes of digestion, absorption, respiration, excretion, and so on, which keep the two master activities of moving and feeling in progress; we study the endless problem of balancing income and expenditure; and behind all we see the fact of death. No one can contemplate these and other phenomena without being impressed with the magnitude of the problems of biology. It is our object in what follows to indicate what the chief biological problems are, and to arrange them in a rational order. The selected bibliography at the end of this article will show how the study may be pursued.

*Characteristics of a Living Organism.*—Like an engine, an organism is a material system which transforms matter and energy; but it is, within limits, a self-stoking, self-repairing engine; and it is further distinguished by its powers of growth and reproduction. Moreover, as Professor Joly indicates, from the physicist's point of view there is this further difference between the inanimate and the animate system, that while transfer of energy into the former (*e.g.* heating a bar of iron or charging a Leyden jar) is attended with effects conducive to

dissipation and retardative of further transfer, the opposite seems to be true of the living creature, which has an extraordinary capacity for accumulating potential energy, for accumulating it even acceleratively. So striking is this, as evidenced when an organism, in virtue of its stores, lives or works for days without food or rest, that some have doubted whether the doctrine of the conservation of energy was really applicable to living creatures. But there is no sound warrant for doubting the universal applicability of the physicist's axiom. An actively living organism is continually undergoing physical and chemical change (or *metabolism*); matter and energy pass in, matter and energy pass out; yet, like a whirlpool in a river, the animate system manages to retain an approximate integrity of form, in spite of the ceaseless flux. The pill of potassium, placed on a pool of water, dances about like a water sprite on the surface, fizzing and flaring here, there, and everywhere; but its activity is soon at an end, and in a minute or two it has ceased to exist as such. On the other hand, the whirligig beetle, which darts about in a similar fashion, has a power of persistence which excites our admiration: if it can secure food and periods of rest, it can go on for months, or even years. This power of persistence, associated with periodic recuperation and rest, is part of the secret of the living organism. A crystal of alum dropped into a saturated solution of alum grows before our eyes: its growth illustrates both differentiation and integration—that is to say, it becomes more complex and more thoroughly unified; it has also a notable power of regenerating lost parts; and there are phenomena which dimly suggest the capacities of adjustment to surround-



ings, and of reproducing their like, which characterize living creatures. But it is obvious that the crystal grows only at the expense of material similar to itself, whereas the living creature grows at the expense of food-material different—and it may be, as in the case of plants, very different—from its own substance. Nor is there, as yet, any decisive evidence that crystals ever exhibit that effectiveness or adaptiveness of response to surrounding influences which is characteristic of even the simplest living organisms.

The method of those who insist upon pressing chemical formulæ into the service of biology (to which there can be no objection so long as false abstractions are not made) may be illustrated by a case taken from a work recently published, by Dr. Giglio Tos—*Les Problèmes de la Vie* (1900). We are asked to 'feed' two molecules of acetic acid with perchloride of phosphorus, and the resulting chloride of acetyl with zinc ethyl; we are asked to subject the resulting methyl-ethyl ketone to oxidation; and the result is that from the two original molecules of acetic acid we get four. This is supposed to illustrate the phenomena of assimilation and reproduction; but the plain fact is that we cannot at present correlate this chemical experiment in any tangible way with the processes of assimilation and reproduction as they occur even in the simplest organisms. However desirable we may be to carry the lessons and results of the inorganic world into biology, we cannot shut our eyes to the magnitude of the steps between this coercive treatment of acetic acid and the nutritive and reproductive behaviour of an amœba or a diatom. We are ignorant of the composition of what is glibly called 'a living molecule;' we are

not even aware that such a thing exists. To sum up, a living organism undergoes rapid change, and yet retains its integrity of organization: it grows, but at the expense of material different from itself; it reproduces, giving origin to other units potentially or actually like itself; it is capable of effective response to the environment; and it has, in some measure, a co-ordinated and adaptive activity.

*The Nature of Life.*—The problem of the nature of life is certainly not solved either by the word 'vitality' or by the word 'protoplasm,' which represent the two extremes of interpretation. The facts are that chemical analysis reveals no elements in a living organism which are not common in the inanimate surroundings; that the chemical peculiarity of the physical basis of life is not in the nature of the material elements involved, but in their complexity of composition; that careful physical experiments all go to show that the formula of the conservation of energy is just as true of the living creature as it is of the engine; that there is no evidence of any special vital material, nor room in the balance-sheet for any special 'vital force' or specific 'life energy.' But these data are preliminary to an interpretation, rather than form part of one. In this connection two facts may be emphasized: (1) biologists are not yet in a position to restate even what seem to be relatively simple vital phenomena in terms of chemical and physical formulæ, and (2) they do not find in inanimate material systems any analogous operations which enable them to make clearer the adaptive and co-ordinated activity of even a unicellular organism. It seems to come to this, that although there are vital processes in living creatures which can be *in part* restated in terms of chemical



and physical formulæ, we cannot at present in this way interpret the distinctively vital behaviour of any creature. We are forced to the conclusion that a living organism is a particular synthesis of matter and energy, the secret of whose organization remains hidden. Nor can we forget that the behaviour of higher animals cannot be thought of apart from the idea of intelligence, and this renders the false simplicity of pretended materialistic interpretations even more obvious.

*Origin of Life.*—What Francesco Redi began in the 17th century was perfected by Pasteur and Tyndall in the third quarter of the 19th century—*viz.* the destructive criticism of alleged cases of spontaneous generation, or the origin of living creatures from not-living matter. In experiments which suggest this it has always been found that germs of life were present from the start, or that they found entrance at some stage in the operations; and the biologist may safely make the negative statement that no records of precise observation afford any evidence that any form of life has ever come into being except from a parent form of the same kind. There is no known evidence of not-living matter giving origin to living organisms. But this fact of biogenesis does not exclude (a) the possibility that the evolution of living matter from not-living matter once took place, (b) the possibility that it may be taking place now in conditions unknown to us, and (c) the possibility that the conditions of spontaneous generation, or abiogenesis, may be artificially reproduced. To make a dogma out of a negative fact is bad science.

There are many, like Huxley, Haeckel, Nägeli, Pflüger, Ray Lankester, who have expressed the opinion that if they could have been witnesses of the be-

ginning of organic evolution, they would have seen the origin of protoplasm from not-living matter. It may be that the synthesis, which we do not understand, took place in some chemical hotbed when the earth was very young; it may be that the first protoplasmic mixtures fed upon other naturally synthesized carbon compounds which had failed to reach the vital level of complexity; but the difficulties in even imagining the origin, the evolution of a protoplasmic unit are so great that we are not surprised to find the suggestion of Helmholtz and Lord Kelvin, that the germs of life were borne to earth by meteorites from elsewhere. But while the scientific attitude in regard to the origin of life must at present be agnostic, we venture to make four remarks. 1. That the discussion, which is in essence extremely theoretical, has been of great practical value; for it has brought to light many facts of great importance in connection with the preservation and improvement of food-stuffs, the occurrence of parasites, the use of antiseptics, and the nature of many diseases. 2. That since 1828, when Wöhler made urea artificially, there has been great activity on the part of the synthetic chemists, who are able, for instance, to build up sugars from inorganic substances; and it is conceivable that carefully-thought-out mixtures of such substances might result in a vital combination. 3. That even if proteids were synthesized, and even if mixtures of proteids and other substances were brought together so as to result in a chemical organization like protoplasm, the biologist would still have to ask whether the artificially compounded corpuscles had the insignia of vitality, such as effective response to environment, co-ordinated activity, growing and reproducing power. 4. That if living matter has origi-



inated from not-living matter, then we must credit not-living matter with the potentiality of giving origin to that kind of organization which in appropriate conditions may manifest consciousness and intelligence.

*Differentiation and Integration.*

—When we compare simple forms of life, such as amœba and slime fungi, with more complex creatures, such as squirrel and oak tree, we get an impression analogous to that which follows from a comparison of an early embryo with the adult organism. We express the contrast by using words like 'higher' and 'lower,' and in the terms employed there is often a suggestion of anthropomorphism, as if we estimated the position of an organism in the scale of being by its degrees of approximation to ourselves. But the biological standard is not crudely anthropomorphic, for it is evident that the oak tree is not genetically any nearer man than the slime fungus is, though we call the former much 'higher' than the latter. The criterion is twofold—(a) in reference to complexity of structure, or the number of parts with specialized functions, and (b) in reference to the degree in which the parts are unified and correlated in the life of the whole. The one criterion is differentiation—the structural expression of division of labour; the other is integration—the unification of the organism, for example, by the nervous and vascular systems. The former may be compared to the expansion, the latter to the federation, of an empire; and the criteria apply to Stephenson's 'Puffing Billy' as compared with a 20th-century locomotive, just as they apply to a sponge as compared with a bird. It is necessary, however, to notice that an organism which is, on the whole, of simple type may show a high degree of differentiation

in particular directions, as radiolarians and sponges often do as regards their skeleton systems. Furthermore, a consideration of the contrast between embryo and adult makes it plain that there may be great potentiality of differentiation and integration, although these are not expressed; and this should be borne in mind when we compare apparently simple unicellular organisms with obviously complex multicellular forms.

Given a number of simple protoplasts—*i.e.* corpuscles of complex substances united in an organization which does not at present admit of being interpreted in terms of physico-chemical formulæ—the biologist has in his imagination to picture the gradual emergence of successive differentiations and integrations. The numerous grades of organization now observable among Protozoa (unicellular animals) and Protophyta (unicellular plants) are of obvious usefulness in the hypothetical reconstruction. We know, for instance, of many different degrees in the differentiation of the nucleus, of locomotor structures, of skeleton, and so on; and the risk of fallacy in arguing from the present to the past is lessened by the interesting fact that these unicellular creatures are not subject to natural death in the same degree as higher animals are, or it may be not at all. This fact suggests the possibility that some of the simplest of the unicellular organisms may have been living on, but little changed, since the early days of life's beginnings. How the differentiations and integrations came about is a question which cannot be fully answered in the present state of biology. We shall return to it in the paragraph on evolution, but we may notice here that some of the primitive differentiations and integrations may have been, so to speak, continuations



of similar processes observable in the varied forms of crystals and minerals; that some may have been further expressions of the fundamental organization which made life possible; that some may have been due to the influence of diverse environments operating on the plastic protoplasts. That the last-named results might be hereditarily entailed on successive generations is admitted by all; for, at the low level we are considering, the distinction between 'body' and germinal matter has not yet been made. One of the early steps was probably the differentiation of three main phases of cell life—amœboid, ciliated or flagellate, and encysted—which are still often observable in the course of a protist's life-history, and which afford a general classification for the different kinds of cells in a higher animal. Another early differentiation was doubtless the establishment of a distinction between a kernel or nucleus in the cell unit and the general cell substance or cytoplasm. From nuclear substance in the form of diffuse particles in the cell to the establishment of a definite trophic centre there are many gradations observable today; and the specialization may be followed further in the ciliate infusorians, where there is always a distinction between a macronucleus, concerned apparently with the everyday life of the unit, and a micronucleus, the importance of which is chiefly reproductive. It is not yet possible to define with precision the function of the nucleus in a cell, but it is certain that there are important interactions between nucleoplasm and cytoplasm, and that a fragment of a unicellular organism bereft of its nuclear constituent does not grow or recover itself, though it may exhibit irritability and contractibility for a brief space. Other differentiations,

again, concerned the cytoplasm (or general cell substance), which is marked by great complexity of organization, the gross aspects of which are described as reticular, granular, fibrillar, or alveolar. The important fact is that unlike white of egg, which has, in spite of its complex molecular constitution, a simple physical structure, the physical basis of life reveals more and more complex organization the further we see into it.

*Cell Theory.*—In 1838 and 1839 Schleiden and Schwann formulated the 'Zellen-Lehre,' or cell doctrine, which amounts to this, that all organisms have a cellular structure; that all but the unicellulars are built up of numerous cells; that development and growth imply the multiplication of cells, all normally the progeny of the fertilized ovum; and that physiologically the life of the whole multicellular organism is capable of being expressed as the co-ordinated summation of the lives of the component units. The cell may be defined as a nucleated unit or unit-area of living matter, and although the original statement of the cell doctrine may not be altogether adequate, even after corollaries suggested by Virchow, Goodsir, Max Schultze, and others, the general fact remains as one of the foundation-stones of biology.

*Body-making and its Consequences.*—When a unicellular organism divides into two or more units, these usually part company and live independent lives. In some cases (numerous, though relatively few) the daughter units remain combined and form a colony, as is well illustrated by *Volvox* and its relatives. This is the beginning of a 'body,' and it should be noted that there are some simple multicellular animals and plants which are not more differentiated than the *Volvox* colony. Another possible



mode of origin is hinted at in those unicellular plants and animals in which the nucleus has divided many times, though the cell substance has not; a step towards body-making which is echoed in the development of various ova—*e.g.* in certain species of *Peripatus*, a primitive arthropod.

Differentiation within a multicellular colony will tend to the establishment of *tissues* (aggregates of similar cells with one prominent function in common), and eventually of *organs* (more or less unified integrates of tissues subserving a particular function or several functions). It is interesting to notice that in sponges there are tissues, but no definite organs apart from the gut, and that from this level onwards the origin of organs is gradual. Often, as we follow the emergence of organs, it is seen (1) that there is a change of function—a subsidiary activity becoming locally the dominant one; and (2) that a structure, after serving temporarily for a specific function, gives place in the development of the individual to another, technically called its 'substitute:' thus the notochord, for instance, is replaced in most vertebrates by its substitute the backbone. One of the differentiations involved in body-making is of special interest—*viz.* that which, especially in animals, expresses the distinction between the *somatic cells* (specialized as absorptive, digestive, elaborative, glandular, conductive, contractile, and irritable) and the *germ-cells*, which remain, in many cases, obviously unmodified, unspecialized, and not implicated in body-making, but continue unaltered the organization of the fertilized ovum from which the creature arose. Even in protist colonies like *Volvox*, sometimes claimed by zoologists as an animal, equally often claimed by botanists as a

plant, this all-important distinction between somatic and reproductive cells may be clearly discerned. There is not, of course, any hard and fast distinction—thus, a clump of body-cells from a plant or a simple animal may be able to regrow the whole—nor, on the other hand, do the strongest upholders of the distinction, such as Weismann, maintain that the germ-cells live a 'charmed life' apart from the general metabolism of the body. Many of the wearisome obscurities in the discussion concerning the transmissibility of 'acquired characters' or 'modifications'—*i.e.* structural changes effected on the soma as the result of environmental or functional influence—are due to the lack of a sufficiently concrete appreciation of the facts of the case. Sometimes the germ-cells are set apart at an early stage in development; sometimes their distinct appearance is late; in either case they owe their peculiar power of reproducing to their retention of the original organization of the fertilized ovum. And though they may be strengthened or weakened by the general metabolism of the body, or even thereby prompted to vary, this fact is very different from the Lamarckian assumption that specific changes in the body can affect the germ-cells in a manner so definite and representative that the 'modifications' of the parent are transmitted to the offspring. See HEREDITY.

Another result involved in body-making is *natural death*. We recognize at least three ways in which a full stop may be put to the life of an individual—(1) by some violent shock which shatters the organization, as when the grouse falls before the sportsman's gun; (2) by the poisons and lesions and blockages produced by intruding parasitic organisms, as when the grouse dies



of grouse disease; (3) by the accumulation of physiological arrears or fatigue effects (especially in organs like brain, heart, and liver), which mount up until the organism, in a state of physiological insolvency, dies—a natural death. This consideration of the different modes of death brings us naturally enough to another problem—the continuance of life.

*The Continuance of Life.*—While it is characteristic of living organisms that they persist in spite of their ceaseless changes (metabolism), there are in most cases limits to this endurance. The structural effects of fatigue are not always removable by rest and food; arrears accumulate quickly or slowly according to the nature of the organism; eventually they become fatal in their amount, and the creature dies. It has been maintained that the unicellular animals are exempt from this natural death; their relative simplicity of structure makes complete recuperation possible, their capacity of regenerating injured portions is perfect, and their modes of reproduction are inexpensive. The so-called 'immortality of the Protozoa' suggests that reproduction should not be looked upon as primarily an arrangement securing the persistence of a mortal race, for reproduction is more primitive than death, and is indeed one of its frequent causes.

Here the biologist has to face the problem presented by the different modes of reproduction: (a) asexual, when a portion of the parent organism, whether continuous or discontinuous, grows into or reproduces a unit-whole, more or less like the parent, as in the budding hydra or the fragmenting sea anemone, the gemma-producing liverwort or the bulbil-making tiger-lily; (b) sexual, when there are definite egg-cells or ova, and sperm-cells or spermatozoa.

This scheme is complicated by the occurrence of a degenerate form of sexual reproduction (parthenogenesis), when ova develop without fertilization by sperm-cells; and by the occurrence of alternations of sexual and asexual reproduction, as in the life-history of many zoophytes, or of most of the fernlike plants. Starting with the growing cell—where the increase of mass tends to outrun its increase of surface—the biologist has to endeavour to explain what 'the limit of growth' means, and to show that the reproduction which so often ensues at the limit is in its simplest expressions a mode of discontinuous growth. Experimental work shows that a non-nucleated fragment of a protozoon will for a time move and respond to stimuli, but does not feed or grow; which goes to show that what is essential in reproduction is that the separated portion or portions should have the characteristic organization of the parent organism. And this leads us again to the important general idea of 'genetic continuity'—the idea that the germ-cells have their particular power of reproducing because they are the unmodified, unspecialized lineal descendants of the germ-cells which gave rise to the parent organism.

It is especially to Virchow (1858) that biology owes the conception 'of an uninterrupted series of cell divisions, extending backward from existing plants and animals to that remote and unknown period when vital organization assumed its present form. Life is a continuous stream. The death of the individual involves no breach of continuity in the series of cell divisions by which the life of the race flows onwards. The individual body dies, it is true, but the germ-cells live on, carrying with them, as it were, the traditions of the race from which they have sprung' (E. B. Wilson).



*Fertilization.*—The study of reproduction must include an inquiry into the origin and meaning of fertilization. As to the former, the flowing together of many cells to make a 'plasmodium,' the union of three or four in 'multiple conjugation,' the ordinary conjugation of two apparently similar units, and the union of slightly dimorphic cells are possible stages, leading towards what is certainly typical both in animals and plants—the union of a minute active spermatozoon with a relatively large passive ovum. As to the meaning of the process, there are, in the first place, many facts which suggest that the nuclei are the chief bearers of the hereditary qualities of the (usually) two parents; and, in the second place, there are other facts which suggest that the entrance of the spermatozoon supplies some dynamic stimulus, which prompts to division. In many cases it has been shown that, besides the nucleus, the spermatozoon brings into the ovum a minute corpuscle called the centrosome, which seems to play an important part in the segmentation which follows. Of much interest also is the process of maturation which precedes fertilization; in that process the number of nuclear elements or chromatin bodies in the egg-cell and in the sperm-cell is reduced, so that after fertilization the number which is characteristic of the species is still present.

In 1878 Huxley wrote: 'It is conceivable, and indeed probable, that every part of the adult contains molecules derived both from the male and from the female parent; and that, regarded as a mass of molecules, the entire organism may be compared to a web, of which the warp is derived from the female and the woof from the male.' This has been confirmed by subsequent research, and has been rendered more pre-

cise by the evidence, which goes to show that a very important part of the web is represented by the chromatin substance of the nuclei. The modern interpretation is thus summed up by Prof. E. B. Wilson: 1. From the mother comes, in the main, the cytoplasm of the embryonic body, which is the principal substratum of growth and differentiation. 2. From both parents comes the hereditary basis or chromatin by which these processes are controlled, and from which they receive the specific stamp of the race. 3. From the father comes the stimulus inducing the organization of the machinery of mitotic division, by which the egg splits up into the elements of the tissues, and by which each of these elements receives its quota of the common heritage of chromatin.

*Sex.*—The biologist finds another series of problems in the facts of sex. Of two eggs in a nest, one will develop into a male, the other into a female; what is the difference between the eggs, and their development, and their final result? Is it that the animate mechanism which we call an organism has, so to speak, two grades of gearing, and that one or the other may be fixed by environmental influences acting on the germ-cells, or on the embryos, or in some cases (*e.g.* tadpoles) even on the larvæ? Is there one constitutional and fundamental difference, which we compare to a difference in gearing, which finds expression in the hundred and one differences in structure and habit which so often distinguish male from female? That every germ-cell has a complete specific inheritance—potentially complete for either sex—seems obvious enough from cases like that of drone bees, who, though males, have no father; but how are we to conceive of the process by which male characteristics find expres-



sion in the development of one germ-cell, and female characteristics in another, or both in a third (hermaphroditism)? From these fundamental questions, still far from answerable, the biologist will pass to the adaptive relations of one sex to another and to functions that are characteristic of each, to the problem of preferential mating and sexual selection, and so on along an ever-lengthening radius.

*Development.*—Let us suppose that the biologist has become in some measure clear that an egg-cell is able to reproduce an organism like the parent, in virtue of its genetic continuity with the fertilized egg-cell which gave rise to that parent; that he has interpreted the fertilization of the egg-cell (*a*) as an intimate and orderly union of maternal and paternal heritages (tending, on the one hand, to ensure specific constancy, and yet, on the other hand, to prompt variations), and (*b*) as also implying a stimulus to that cleavage or segmentation with which all development begins. He has still before him the problems presented by each and every process of development. Out of the apparently simple there emerges the obviously complex; each stage seems to condition its successor, but the actual nexus of events is obscure. How much of the process is the unfolding of a preformed organization, how much of it is due to the reciprocal action of cells, and to the reaction of the whole embryo to its environment? How is a fit statement to be made of the fact that one of the first two cells into which an egg (*e.g.* of the frog) divides will in certain circumstances develop by itself into a one-sided embryo, and in other circumstances into a half-sized complete embryo? Again, while it seems fairly clear that the maternal and paternal contributions which come together in

fertilization form the warp and woof of the developing embryo, and that the little body—called the centrosome—which the spermatozoon brings into the egg along with the paternal heritage behaves like the weaver at the loom, how are we to interpret the fact that in the final result the hereditary resemblance is sometimes almost exclusively to one parent and sometimes an average between the two? Or, again, how is a generalization to be framed which will recognize, on the one hand, the tendency of the individual development to recapitulate the racial evolution, and, on the other hand, the fact that there are specific peculiarities which are capable of being detected almost from the first? In the life-history of the frog there are hints of a recapitulation of ancestral piscine stages, and yet, from the beginning and throughout, the developing organism is distinctly amphibian.

*Heredity.*—The problems of development are closely united to those of heredity, or the relation of genetic continuity between successive generations. This relation has its visible material basis in the germinal matter of the ova and sperm-cells, and what most distinguishes the modern conception of the germ-cells is a recognition of their continuity in character and organization with the germinal material from which the parent arose. It is to this continuity that they owe their power of developing into organisms like the parents.

While there tends to be a great completeness in the expression of what may be called the specific inheritance—like tending to beget—the completeness of hereditary resemblance is only approximate. Thus the biologist is brought to face the problem of variations—*i.e.* inborn or congenital differences within a species



as distinguished from differences due to 'modifications' or the structural effects on the body induced by changes in the functional and environmental influences. The former are heritable or transmissible, but this has not been proved for the latter.

The biologist has also to study the expression of the offspring's inheritance in relation to the characteristics of the two parents; it may be a blend, or it may be unilateral, or it may be a combination without being a blend. The inheritance is normally dual, but the contributions from the two parents may not find equal expression; moreover, since the inheritance of each parent was also dual, and so on backwards, an inheritance is in a strict sense mosaic or multiple, made up, as it were, of contributions from many ancestors. The problems become yet more complicated when the facts of filial regression, atavism, and reversion are considered. For some higher animals, and notably for man, it is likewise necessary to take account of what may be called the external as opposed to the organic heritage—the influence, in other words, of traditions, customs, and the like. Here biology is linked to comparative psychology and sociology.

*Evolution.*—The largest problems which the biologist raises are those of organic evolution. A survey of plants and animals discloses a maze of relationships to which here and there the genetic clue has been found; in a few cases a more than plausible genealogical tree has been constructed. One species seems often to merge with another, as nebula with nebula in the heavens; even when the central or more typical forms in two or three related groups seem distinct enough, there are outliers which might equally well be affiliated to any one of the three sets. Even genera may be

arranged in series, which seem to represent successive steps of progress, or it may be of retrogression; and there are not wanting 'synthetic types' or 'connecting links' uniting stocks which would otherwise appear quite discontinuous. An anatomical survey shows us the same material of bone, muscle, and nerve twisted and fashioned into manifold forms—*e.g.* in the fore or hind limbs of vertebrates—and the persistence of vestigial structures in organisms where they seem of little moment or relevancy, though they are essential organs in other organisms of lower degree. Another survey shows the plasticity of the organism, as an individual under the moulding influences of environment and functions, and as a race when we compare with precision the members of successive generations. The rock or geological record, extending back for many millions of years, shows the gradual emergence of higher and higher forms of life (higher as judged by the twofold standard of differentiation and integration), and affords the sublime spectacle of races gradually attaining a climax and then waning into extinction. And again, the study of development shows in a few days or weeks or months an individual progress from the fertilized egg-cell to the finished form—a process in which each step seems to condition and determine the next, in which obvious complexity is evolved from apparent simplicity. A survey of these different sets of facts has led to the formulation of the general evolution idea, that the present is the child of the past and the parent of the future, that the forms of life around us have been derived by long-continued processes of change from ancestors on the whole simpler and more generalized. The evolution formula suggests a mode of origin, a



process of becoming, a progress, or it may be in some cases a retrogression, from one established order of being to another; and it owes much of its cogency to the fact that it appears to be applicable to all orders of facts—from the solar system to human institutions. It cannot be exactly demonstrated, as the doctrine of the conservation of energy may be, but it is justified, like the conception of the ether in physics or the atomic theory in chemistry, by its utility as a thought-economizing general formula, unifying a multitude of facts, and contradicted by none.

But while the general idea (or, as some would say, fact) of evolution is all but unanimously accepted by biologists—and it is the only scientific interpretation in the field—there is great uncertainty in regard to the factors in the process.

These factors may be distinguished as primary and secondary. Originative factors are those that induce hereditary changes or variation; the secondary or directive factors are those that operate upon the raw material afforded by the first. As to the first, precise inquiry is only beginning, for we know almost nothing in regard to the causes of variation, and relatively little in regard to their nature and amount. It may be that environmental and functional changes affecting the body also exert an influence on the complex germinal material; it may be that the processes of maturation and fertilization induce new permutations and combinations of molecules in the material basis of inheritance; and it may be that environmental influences act directly on liberated germ-cells before fertilization occurs. But it is premature to make any definite statement. Researches into the actual occurrence of variations show that they are

very frequent, that they are sometimes 'saltatory,' 'transilient,' or 'discontinuous' mutations—that is, as it were, leaps to a new position of organic equilibrium—and that they are sometimes slow and gradual, like stages of growth or phases in development; that they are sometimes genuinely new departures, often describable as 'freaks' or 'sports,' and that they are often 'definite,' expressing a little more or less of one of the parental or specific characteristics; that they are sometimes apparently particulate, affecting one part or organ of the body, and sometimes more general, as if the organism varied as a whole and not piecemeal. But many years of work will be necessary before general statements as to the nature of variations can be made with anything like safety.

In actual practice, the biologist has to begin by recording the observed differences between members of a species, say of crab and buttercup. Then must follow an attempt to discriminate between those differences which can be demonstrably described as due to 'modifications' (bodily changes due to diversity in the environment or function of the organisms) from those which cannot be so regarded, and are therefore interpreted as the outcrops of germinal variations. If it be true that the former do not in any specific or representative manner affect the inheritance, then they can have no more than an indirect effect in evolution. But this question is still much discussed. As to the secondary or directive factors which operate upon the raw material afforded by variability, there are as yet only two which will stand much testing—natural selection and isolation.

The first is a result of what is called, 'in a wide and metaphorical sense,' as Darwin said,



the struggle for existence. From two parents many offspring usually arise; the conditions of existence put limits to the increase of population, and some form of struggle ensues. There is competition between members of the same kin—*e.g.* between rats, between locusts, between seedlings in a plot—competition for food, for standing-room, for mates, and so on; and there is the struggle between the variable organism and its inanimate environment, which is also variable. Similarly, there may be struggle between ova and between spermatozoa; the competition is all-embracing. It varies infinitely in its form and intensity; but wherever the effectiveness of vital response to given conditions is of critical moment, there natural selection operates. The relatively less fit tend to be eliminated, to have shorter, less successful lives, to have fewer and less vigorous offspring, and so on. The relatively more fit (which need not mean *higher*) tend to survive; and if the relative degrees of fitness depend on germinal variations (by hypothesis inheritable), there results a process of racial evolution.

The second directive factor on which some reliance may be placed is expressed in the term isolation, which includes a variety of ways in which free intercrossing between members of a species is prevented—*e.g.* by geographical barriers, by change of habit, by a reproductive variation causing mutual sterility between two sections of a species living on a common area, and so on. The importance of this factor becomes evident when we consider that without some form of isolation—corresponding to one part of the breeder's procedure—particular variations of small amount would tend to be lost or neutralized by intercrossing. But although Romanes went the length of say-

ing that 'without isolation, or the prevention of free intercrossing, organic evolution is in no case possible,' there is still a lack of sufficiently precise evidence in regard to the alleged swamping of new variations when there is no isolation, and in regard to the supposed general prevention of free intercrossing.

In regard, then, to the factors of organic evolution, as in regard to the other difficult problems of metabolism and growth, differentiation and integration, reproduction and sex, development and heredity, biology has still to wait awhile for its foundation-stones. The outlook is, however, hopeful, especially when we consider the rapidly-increasing body of workers, the improvements in method, the more frequent recourse to experimental tests, the growing tendency to the correlation of different lines of inquiry and of the different sciences, and the dominance of the critical mood.

Some biological classics:—Carl Ernst von Baer, *Ueber Entwicklungsgeschichte der Thiere: Beobachtung und Reflexion* (1828-37); Charles Darwin's *Origin of Species* (1859; new ed. 1902), *Descent of Man* (1871; new ed. 1901), *Variation of Plants and Animals under Domestication* (1868); Goethe's *Zur Morphologie* (1790), etc.; Ernst Haeckel's *Generelle Morphologie* (1866); Lamarck's *Philosophie Zoologique* (1809); Fritz Müller's *Für Darwin* (1864); M. J. Schleiden's *Beiträge zur Phytogenesis* (1838; trans. 1847); Th. Schwann's *Mikroskopische Untersuchungen* (1839; trans. 1847); Herbert Spencer's *Principles of Biology* (1864-1866); R. Virchow's *Die Cellularpathologie* (1858).

Some works discussing the general problems of biology:—W. K. Brooks's *Foundations of Zoology* (1894); Ernst Haeckel's *Generelle Morphologie* (1866); C. Lloyd Morgan's *Animal Behaviour* (1900),



new ed. of *Animal Life and Intelligence* (1890-1); Karl Pearson's *The Grammar of Science* (new ed. 1900); Herbert Spencer's *Principles of Biology* (1864-6); J. A. Thomson's *The Science of Life* (1899); M. Verworn's *General Physiology* (trans. 1899); J. Ward's *Naturalism and Agnosticism* (1899); A. Weismann's *The Germ-Plasm* (1893).

Some text-books of zoology:—C. Claus's *Grundzüge der Zoologie* (4th ed. 1880-2); Hatchett Jackson's edition of G. Rolleston's *Forms of Animal Life* (1888); T. H. Huxley's *Anatomy of Invertebrated Animals* (1877), and *Anatomy of Vertebrated Animals* (1871); Ray Lankester's *Treatise on Zoology* (10 vols. 1900, etc.); T. J. Parker and W. A. Haswell's *Text-book of Zoology* (2 vols. 1897); A. Sedgwick's *Student's Text-book of Zoology*, vol. i. (1898); J. A. Thomson's *Outlines of Zoology* (3rd ed. 1899).

Some text-books of botany:—A. B. Frank, *Lehrbuch der Botanik* (1892); Kerner von Marilaun, *Pflanzenleben* (1887 and 1891, trans.); F. Ludwig's *Lehrbuch der Biologie der Pflanzen* (1895); J. von Sachs's *Text-book of Botany* (2nd ed. 1883); W. Pfeffer's *Pflanzenphysiologie* (1897); Strasburger, Noll, Schenck, and Schimper, *A Text-book of Botany*, trans. by Porter (1898); S. H. Vines's *Student's Text-book of Botany* (1895); J. Wiesner's '*Elemente der wissenschaftlichen Botanik*,' particularly vol. iii., *Biologie der Pflanzen* (1889).

General morphology:—Herbert Spencer's *Principles of Biology* (1864-6; first volume revised, 1898); Ernst Haeckel's *Generelle Morphologie* (1866)—a scarce classic. See also W. His, *Unsere Körperform* (1874); G. Jaeger, *Allgemeine Zoologie* (1878); P. Geddes's article 'Morphology,' *Encyc. Brit.*; Bronn's *Morphologische Studien* (1858); treatises on Compara-

tive Anatomy of Animals, by Gegenbaur (trans. 1878; in process of re-ed.); Wiedersheim (trans. of 3rd ed. 1907); and the older works of Owen and Huxley. Compare also K. von Zittel's *Text-book of Palaeontology* (trans. and re-ed. 1900); Hatchett Jackson's ed. of G. Rolleston's *Forms of Animal Life* (1888).

General physiology:—Max Verworn's *General Physiology* (trans. 1899); Claude Bernard's *Leçons sur des Phénomènes de la Vie communs aux Animaux et aux Végétaux* (1878); C. B. Davenport's *Experimental Morphology* (1897 and 1899, in progress).

Comparative physiology:—Jeffrey Bell's *Comparative Anatomy and Physiology* (1887)—an excellent introduction; C. F. W. Kruckenberg's *Vergleichend-physiologische Studien und Vergl.-Physiol. Vorträge* (1881-9); A. B. Griffiths's *Comparative Physiology* (1891); W. D. Halliburton's *Essentials of Chemical Physiology* (4th ed. 1901); M. I. Newbigin's *Colour in Nature* (1898).

Embryology:—F. M. Balfour's *A Treatise on Comparative Embryology* (1880-1)—a classic work, but now requiring to be corrected by more recent investigations; Sir M. Foster and F. M. Balfour's *Elements of Embryology*, revised by Sedgwick and Heape (1883)—mostly occupied with the development of the chick; O. Hertwig's *Embryology of Man and Vertebrates* (trans. 1893); Korschelt and Heider's *Embryology of Invertebrates* (trans. 1895); A. Milnes Marshall's *Vertebrate Embryology* (1893); C. Sedgwick Minot's *Human Embryology* (1892); A. C. Haddon's *Introduction to the Study of Embryology* (1887); L. Roule's *Embryologie Générale* (1893), and *Embryologie Comparée* (1894); Bergh's *Allgemeine Embryologie* (1895).

For discussion of the general theory of development, see O.