Spanish influence on the progress of medical science : with an account of the Wellcome research institution and the affiliated research laboratories and museums founded by Sir Henry Wellcome ... Commemorating the tenth International congress of the history of medicine held at Madrid 1935.

SPANISH INFLUENCE
ON THE PROGRESS OF MEDICAL SCIENCE

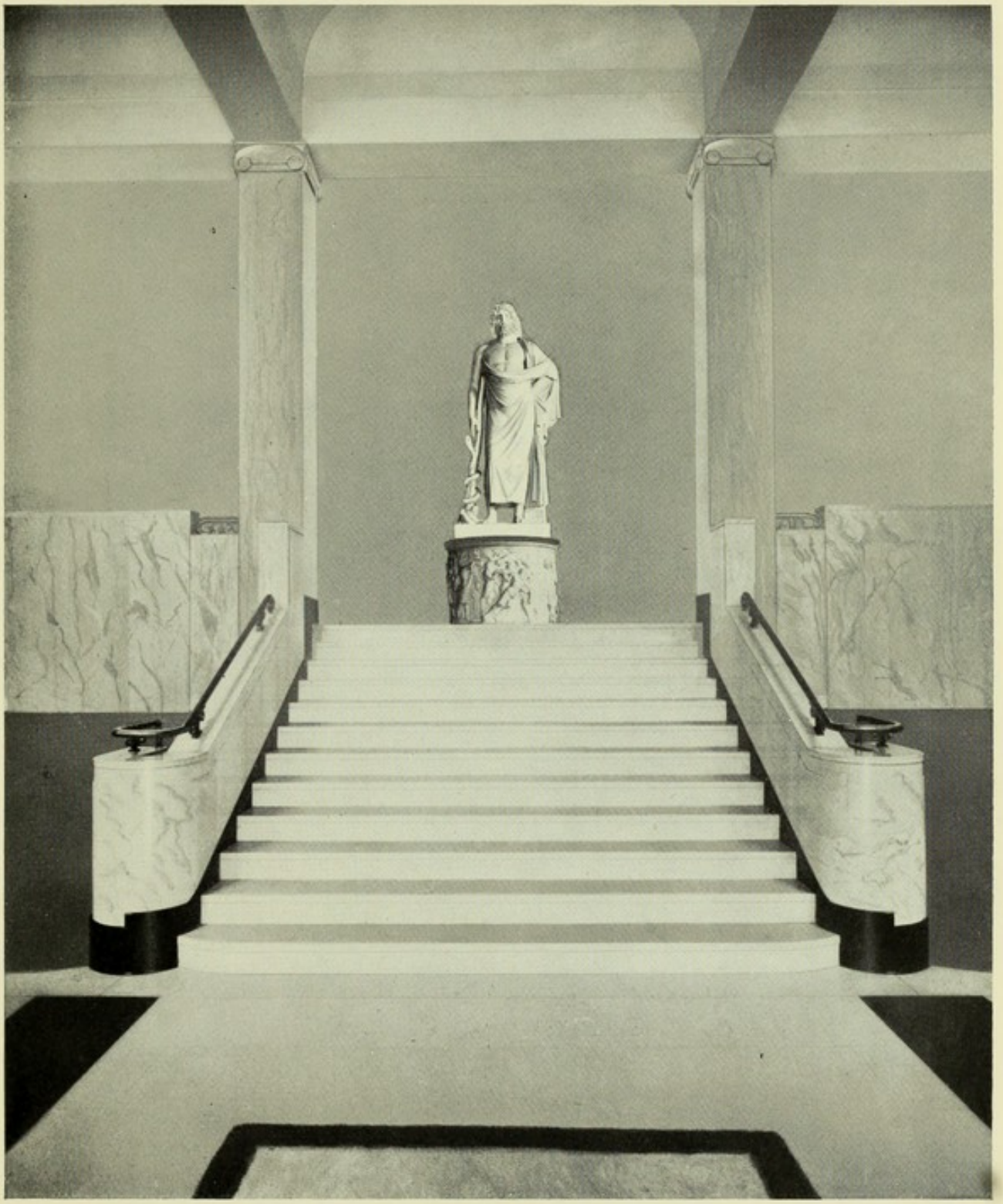
INTERNATIONAL CONGRESS
HISTORY OF MEDICINE
MADRID
1935

"THE ASSOCIATION OF MUSEUMS WITH RESEARCH INSTITUTIONS IS AN IMPORTANT FEATURE OF MODERN SCIENTIFIC WORK."

"SANS LABORATOIRES LES SAVANTS SONT DES SOLDATS SANS ARMES."

—*PASTEUR.*

"Men of science without laboratories
are as soldiers without arms."



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SPANISH INFLUENCE ON THE PROGRESS OF MEDICAL SCIENCE

WITH AN ACCOUNT OF

THE WELLCOME RESEARCH INSTITUTION
AND THE AFFILIATED RESEARCH LABORATORIES
AND MUSEUMS FOUNDED BY

SIR HENRY WELLCOME
LL.D., D.Sc., F.R.S.

COMMEMORATING THE TENTH INTERNATIONAL
CONGRESS OF THE HISTORY OF MEDICINE
HELD AT MADRID

1935

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SECTIONAL INDEX

ARNOLD OF VILLA NOVA (*c.* 1235–1313) WITH AVICENNA

From the "Herbolarium seu de Virtutibus Herbarum"
printed at Venice in 1491

(See page 33)

SPANISH INFLUENCE
ON
THE PROGRESS OF MEDICAL SCIENCE

THE birth of medical knowledge was already achieved in the far-distant period of primeval life when early man began to practise the instinctive acts of self-protection and care in times of sickness and injury, and formed elementary rules designed to aid in the preservation of life and health, and in the cure of disease.

In his selection of herbs and other remedial agents for healing and curative effects, or, in the case of the female, for controlling both post-partum hæmorrhage and lactation ; in his appreciation of warmth and rest as aids to recovery ; and in many other ways, the actions of early man were doubtless akin to the habits of the animal world in general.

PALEO-PATHOLOGICAL REMAINS

As a result of archæological research, pathological evidence of disease in pre-historic man has been brought to light. By the very nature of the relics that have been recovered, it is, however, limited to bone changes. The femur of the *Pithecanthropus erectus*, of Java, reveals exostoses or bony outgrowths, whilst the Neanderthal jaw, found at Krapina, in Yugo-Slavia, showed definite signs of caries and tartar with arthritis deformans in addition.

If primitive man escaped most of the dietary diseases of modern times, it is apparent that he was subject to a variety of ailments regarding which he doubtless sought therapeutical methods, with the same primary intelligence as he displayed in certain surgical conditions which led him to practise amputation and trephining.

In the pre-historic caves of Spain and France, evidence exists that the practice of amputating fingers was common amongst the Aurignacians. In the cave at Gargas, in Spain, numerous silhouettes of hands with amputated finger stumps have been left on the walls, some of the hands having several of the fingers removed. This custom, which has been similarly observed in Egypt, Arabia, India, Mexico and other parts of the world, seems to have been connected with

sacrificial rites, such as were practised amongst certain Indian tribes of North America. These paleolithic silhouettes are evidence of the earliest known surgical procedure—older even than trephining.

The distribution of pre-historic trephination is almost world-wide. In Europe, France has so far yielded the largest number of specimens. Great Britain, Scandinavia, Germany, Bohemia, Poland, Russia, Montenegro and Portugal all have one or more skulls, however, to prove its practice by early man.

A considerable growth of interest in the investigation of the pre-historic sites of Spain has made itself apparent in recent years, stimulated by the revelations which followed the discovery of the paleolithic remains at Altamira, Hornos de la Paña, Pasiega, Castilló (Santander), Pindal and other sites. Along the coastal area of eastern Spain is situated a series of pre-historic sites, the most important of which are Cogul by Lérida, Valltorta in Castellón, Albaracin by Teruel, Alpera and Mortaja in Albacete, and Cantos de la Visera in Murcia. Further excavations and research will no doubt bring to light still more material of paleo-pathological interest.

In Portugal, in the sepulchral caves known as the "Casa da Moura," human skeletons were found, many with the long bones broken and the medullary canal cleaned and enlarged, a circumstance which led M. Delgado to the conclusion that these caverns were the "banqueting chambers" of cannibals.

Primitive Magic and Religion

At a very early stage in the evolution of human intelligence there was developed in the mind of man a belief in the supernatural and in the powers of magic. Suggestions of primitive magic are in evidence in the Aurignacian wall-drawings in the caves at Ariège and Dordogne in France, and in the monstrous forms to be found side by side with the very fine wall-drawings at Altamira, in Spain.

The beginnings of this belief in the supernatural and in the powers of magic witnessed the dawn of primitive religions. As, in the words of Malinowski, "religion fulfils at vital crises an indispensable function in the scheme of human culture," it was inevitable from the first that magic and religion should have formed an association

with the practice of medicine, as death, the ultimate crisis of every human existence, is so often the direct consequence of disease or injury.

As an intermediary between the human and the supernatural, as the exponent of divine healing, and as the interpreter of therapeutic magic, came the priest and the medicine-man of early races, with their awe-inspiring rituals, and the practice of magic through things tangible and intangible, by incantations, charms, spells and amulets, claiming to perform the exorcism of evil spirits, or cures, by herbs or the presentation of some prophylactic fetish.

In pre-historic times, as in later periods, Spain evidently suffered a succession of invasions.

The neolithic age in Spain reached a fairly uniform culture spread over the entire peninsula, the rock-shelters with neolithic drawings having a wide distribution and showing a striking similarity.

In regard to the Iberians, who lived in walled towns, and the Celtiberians, archæological researches are being undertaken which will doubtless yield a much better understanding of the Iberian and Iberianised Celtic culture of the Spanish peninsula.

Spanish Contacts with Ancient Civilisations

Of other ancient races who came into contact with Spain, the Phœnicians, though mainly traders rather than settlers, considerably exploited the east and south coasts of Spain. In the region of south-west Spain they owned profitable mines of silver and other metals, and tradition asserts that Phœnician merchants founded the city of Cadiz as early as 1100 B.C., in which case they no doubt brought with them the worship of Eshmun, the god of vital force and healing, and protector of the Acropolis, identified by the Greeks with Æsculapius.

But the Phœnician exploitation of Spain dates mainly from the time of the rise of Carthage, and the brilliant victories of Hannibal (247–183 B.C.), by which he achieved the consolidation of the Punic Empire. The religion of the Carthaginians, founders of the city of Cartagena (*c.* 243 B.C.), was that of the Phœnicians, so that the

cult of Eshmun, god of healing, was continued in certain parts of Spain for nearly a thousand years.

The Greeks established early colonies along the east and south coasts of Spain, where traces of their settlements have survived. The culture of the Greeks had considerable influence upon the Iberians, as is demonstrated by hybrid examples of archaic Greek and Iberian art that have survived. Amongst a quantity of fine examples of Greek and Roman sculpture, found at Ampurias, was a life-size Hellenistic statue in white marble, representing Æsculapius.

Roman Influences

The great Roman Empire, with all its glorious conquests of war, its grandeur of social life, its efficiency of public administration and government, its patronage of literature and art, did not at any time originate or possess an independent school of medicine of its own. Such Greek medical knowledge as the Romans brought to Spain had become permeated with religious superstition and left no lasting impression upon the culture of that country. The medical influence of Roman civilisation in Spain manifested itself mainly in the sphere of public health through such works as the foundation of well-built cities, the construction of roads, bridges, aqueducts, reservoirs, systems of drainage and sanitation, hospitals and public baths, of which many remains exist. The great Roman aqueduct of Segovia, known as "El Puente del Diablo," dating from the time of Trajan (*c.* A.D. 53–117), still brings down the waters of the River Frio from the Sierra Fuenfria. This aqueduct, apart from similar constructions at Tarragona and Seville, remains as one of the glories of Hispano-Roman Spain.

The Visi-Goths

The centuries which followed the Roman occupation were distinguished chiefly by the establishment of important schools of learning at places destined to become the seats of Moslem domination, thus laying the foundations of culture which very materially contributed towards the subsequent dissemination of Arabian medical knowledge.

When the Visi-Goths (A.D. 409–711), although at first accepting Roman culture, at any rate superficially, came under the influence

of Christianity, there arose a Visi-Goth culture that produced the great luminary of the early Spanish Church, St. Isidore, Archbishop of Seville (*c.* A.D. 560–636).

St. Isidore founded a school at Seville, where he propounded to his compatriots that Science was one of the *ideales*, and, through his efforts, a great pre-Arabian movement towards intellectualism was established in Spain. Here, in Seville, the liberal arts and sciences were studied, as well as Greek and Hebrew, and, long before the arrival of Arabian culture, St. Isidore was teaching the philosophy of Aristotle. His indefatigable intellectual curiosity led him to reproduce in encyclopædic form the fruits of his wide reading. His most elaborate work, the "Originum sive etymologiarum," is an encyclopædia of all the sciences, in 20 books, the fourth of which is devoted to medicine. This work remained one of the capital books of the Middle Ages.

In addition, he was author of "De natura rerum ad Sisebutum regum," a treatise on astronomy and meteorology, which contained the sum of physical philosophy up to his time.

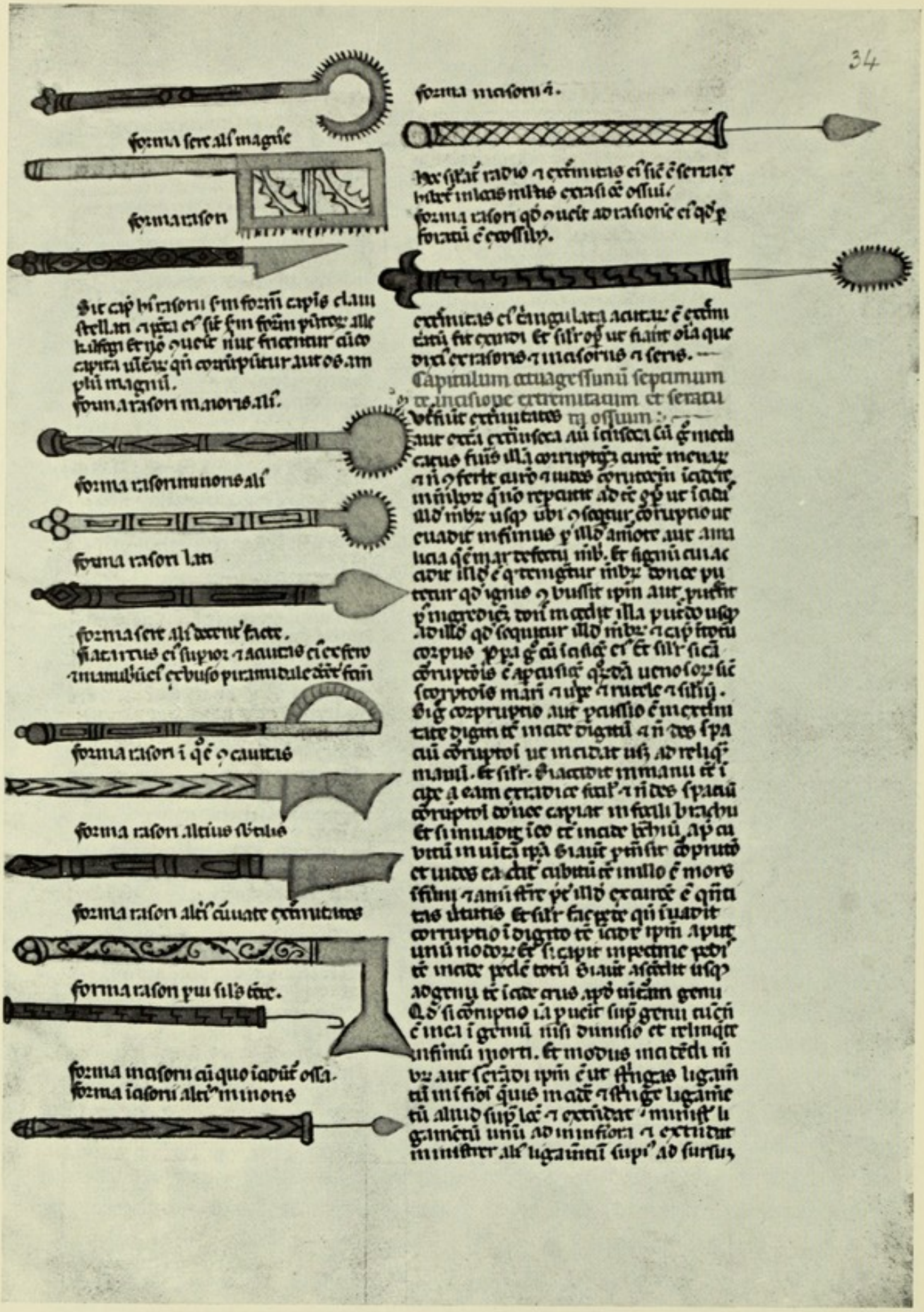
Although the works of St. Isidore are largely uncritical, yet they served to foster and develop a knowledge of antique culture and learning throughout the dark ages which preceded the spread of Hispano-Moresque knowledge.

The Hispano-Moresque Renaissance

The influx of Arabian culture following the Mohammedan invasion of Spain, at the beginning of the eighth century (A.D. 711), had the most important influence upon medical science, not only in that country but also upon the whole of Europe.

The Islamite rulers were quick to encourage the establishment of schools of medicine, often connected with hospitals, and schools of pharmacy. Learning progressed and developed, and Spain soon formed the most important link in an unbroken chain of Arabian culture reaching from India to the western extremity of Europe.

Through the medium of this long line of intellectual communication there poured into Spain the vast forgotten treasures of Greek medical literature. Of paramount importance in this resuscitation



ARABIAN SURGICAL INSTRUMENTS

Surgical Saws and Scrapers for the removal of diseased bone

From an early Fourteenth Century Manuscript of the Surgical Treatise of Albucasis

(See pages 13, 17 and 33)

of classic medicine was the fact that with it came Arabian translations of seven books of Galen's "Anatomy," of which the originals had been lost. By the tenth century the Moslems had brought to Spain a vast accumulation of Greek philosophical and scientific works, with Oriental elements added.

Out of this movement arose the golden age of Hispano-Moresque medicine, lasting from the tenth to the thirteenth century. During that period Spain became the mentor of European science.

Conspicuous amongst the earlier figures of this movement was Ibnu'l-Wáfid, or "Aben Guefit" (*c.* 997–1074), a hospital physician at Toledo, distinguished for developing a rational method of treatment based mainly upon dietetic measures. The best known of his works is "De Medicamentis simplicibus," afterwards printed some 50 or more times.

One of the most distinguished names of the Hispano-Moresque renaissance of medicine was Abu'l-Qásim az-Zahráwí, known to mediæval Europe as "Albucasis" (*c.* 1013–1106), the greatest surgeon of the Arab race. He was born near Cordova, at a time when operative skill in surgery had almost entirely vanished. It was his great medico-chirurgical treatise, called the "Al-Tasrif" (or "Collection"), that succeeded in setting the profession of surgery upon a more estimable plane than it had ever before occupied. By its very excellence in treating with the subject from the standpoint of Galen, it afterwards retarded the progress of surgery for centuries.

The surgical part of Albucasis' work consists of three books, giving descriptions and illustrations of the instruments used *(pages 12 and 15)*. The first book describes the technique of actual cauterisation, with a chapter on the arrest of hæmorrhage by cauterisation and other methods. The second book, based largely upon the work of Paulus Ægineta (625–690), surveys exhaustively the subject of surgery and surgical method. He describes lithotomy and amputations, with a discourse on the treatment of wounds, and deals with the problem of suppuration. The third book is upon fractures and dislocations, with a mention of paralysis following fracture of the spine.

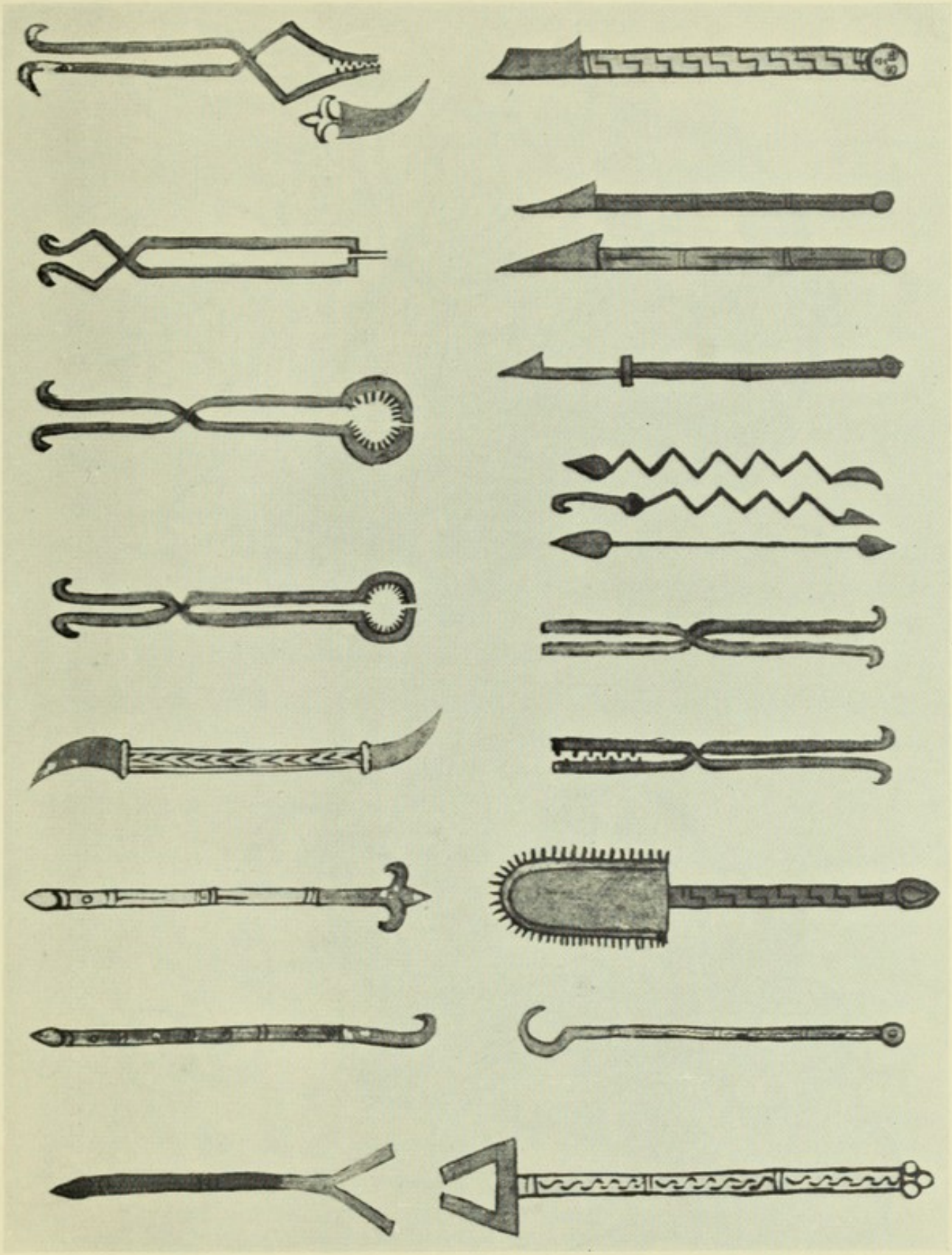
USES OF THE INSTRUMENTS ILLUSTRATED ON THE PAGE OPPOSITE, AS DESCRIBED BY ALBUCASIS

OBSTETRICAL INSTRUMENTS

1. Forceps for gripping the head.
2. Knife for decapitating the fœtus.
3. Obstetrical stretcher for widening the passage.
4. Obstetrical forceps.
5. ditto.
6. Double-bladed surgical knife.
7. Barbed Obstetrical hook.
8. Obstetrical hook.
9. Instrument for guiding or pushing the fœtus.

DENTAL INSTRUMENTS

10. 11. 12. Instruments for laying bare the roots of teeth.
13. Instrument for cutting through a tooth.
14. 15. 16. Dental Scrapers.
17. 18. Dental Forceps.
19. Dental file.
20. Hook for removal of broken teeth.
21. Lever for removal of roots of broken teeth.

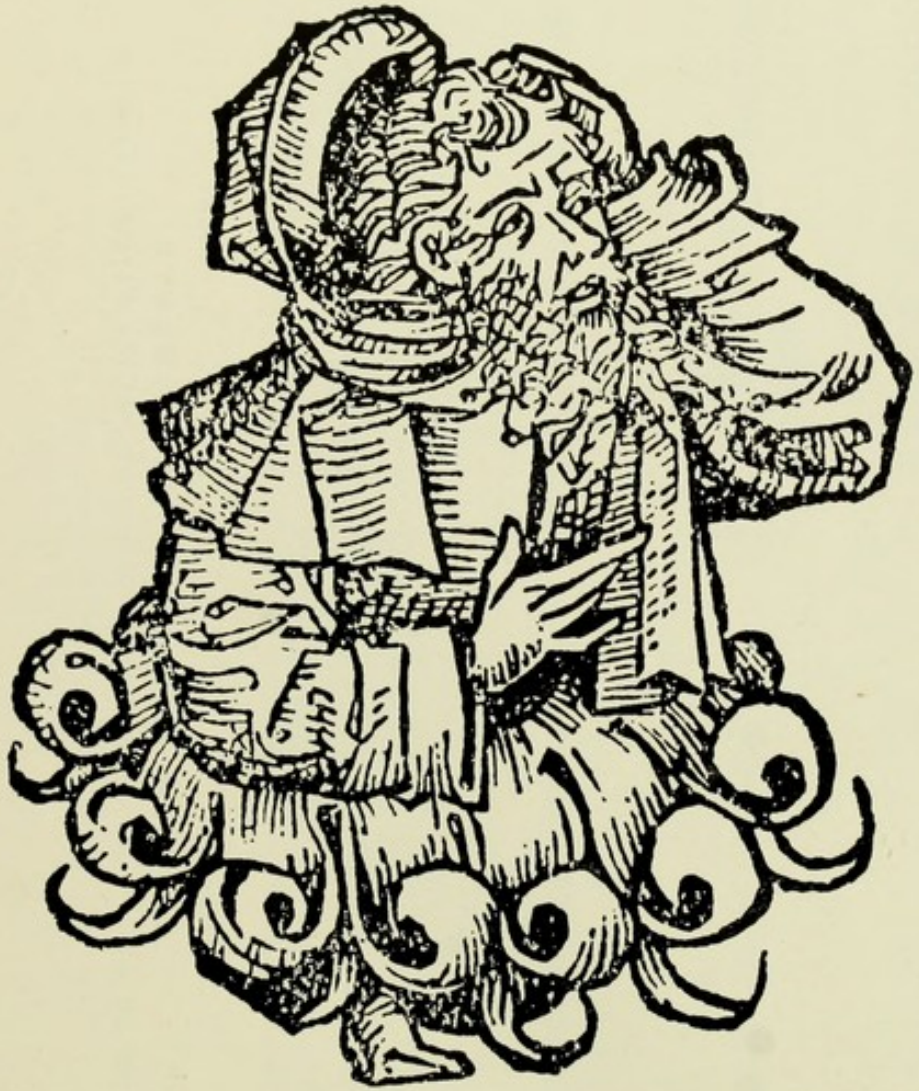


Obstetrical Dental

ARABIAN SURGICAL INSTRUMENTS

From an early Fourteenth Century Manuscript of the Surgical Treatise of Albucasis

(See pages 13, 17 and 33)



Ibn Zuhr, or Avenzoar of Seville (*d.* 1162)

(See page 17)

Ibn Rushd, or Averroes of Cordova (1126–1198)

(See page 19)

Albucasis was also the first to write on the treatment of dental arches and deformities of the mouth, and, in the otological section, deals with the removal of foreign bodies, which he classifies under four heads: *viz.*, hard substances, vegetable seeds, fluids and living animals or insects.

With considerable force of character Albucasis declined to operate for goitre; he resorted to tracheotomy with discretion, refused to meddle with cancer, and evacuated large abscesses by degrees. In the section on obstetrics he mentions the posture which is now known as the "Walcher position," and deals with the questions of irregular presentation and instrumental delivery.

From the School of Toledo appeared many translations in Latin of Albucasis' "Surgical Treatise." The surgical instruments illustrated on *pages* 12 *and* 15 are from a fine copy of one of Gerard of Cremona's translations, executed in Spain or Southern France during the early fourteenth century.

His manual of surgery remained the leading text-book until the time of William of Saliceto (1275). It was published in Vienna in 1497, at Basle in 1541; meanwhile, in 1500, it had been interpolated in the Venetian surgical anthology.

The greatest personality of all the renowned Hispano-Moresque physicians was undoubtedly the clinician Ibn Zuhr, known as Avenzoar *(d.* 1162) of Seville *(page* 16). Born of an illustrious family, he became an exceptionally talented practitioner inspired by the highest ideals. His attack on Galenism evidently influenced his pupil, Averroes, who pursued his master's policy with important results.

Avenzoar's most important work, "Al-Teisir," contains many interesting descriptions of diseases. He described serous pericarditis, mediastinal abscess (from which he personally suffered), pharyngeal paralysis and inflammation of the middle ear, and prescribed the use of goat's milk in phthisis. By his description of the itch mite *(Acarus scabiei)* he may be accounted the first parasitologist after Alexander of Tralles (525–605).

MOSES BEN MAIMON, OR MAIMONIDES (1135–1204)
A Traditional Portrait

Ibn Rushd, or Averroes (1126–1198), also Cordovan born, was another physician of rare strength of character and erudition, whose numerous and important works earned for him the title of "The Commentator" *(page 16)*.

Although Averroes himself did little to advance medical practice, there lay concealed in his system of medicine, based on the neo-Platonic modification of Aristotle, a factor of the greatest moment in the transformation of medical knowledge, which shook to the very foundations the edifice of Galenic medicine.

It was Averroes who showed the theory of Polypharmacy, or the use of numerous ingredients in prescriptions, to be incorrect, although the practice was not discontinued in European medicine until the eighteenth century.

One of the most eminent personalities of the twelfth century was the Hispano-Jewish philosopher and physician, Moses ben Maimon, or Musá ibn Maimún, known as Maimonides *(page 18)*. He was born at Cordova on March 30, 1135, but, in 1148–9, with his father and family, was forced by persecution to leave the city, and for several years wandered through Spain, until in 1160 they were compelled to leave the country. For a time they lived an unsettled life in Fez, but in 1165 sailed for Palestine, whence, after a few months' stay, they departed for Egypt and settled in Cairo. Here Maimonides found, amongst a large colony of his co-religionists, the more sympathetic environment requisite for the pursuit of his philosophical studies, and soon became famous as an exponent and commentator upon Hebrew Law. As his extensive correspondence reveals, his opinions were sought by students throughout Europe and Asia.

Having completed his standard works, the "Kitāb al-sirāj," a Commentary on the Mishnah (1169), *(pages 20 and 21)*, and the "Mishneh Torah" (1180), *(page 23)*, the crowning achievement of Maimonides' Rabbinical and philosophical works, was his "Dalalat al Ha'irin," or "Guide for the Perplexed," completed in 1187–89, in which he demonstrated his belief that the Aristotelian system was not fundamentally inconsistent with Biblical truth.

A FREE TRANSLATION OF THE EXCERPT FROM MAIMONIDES' MANUSCRIPT ON AGRICULTURE

(See opposite page)

[I am coming back to our subject. Already the Talmud argues against] the opinion of the Tanna-Kama (the former Tanna) who thinks that only one kind of seed could be planted in the centre of the garden-bed. The Talmud asks: why could not one plant six kinds of seed in the centre? They (the Talmudists) endeavoured to explain this difficulty, but did not succeed. I mention this in order to show you that Rabbi Judah's opinion is the right and true one. We may say that Rabbi Judah opposes the Tanna-Kama, and the difference of opinion between them is as follows: Rabbi Judah forbids that one kind only should be planted in the centre, because the whole garden-bed would then appear as planted only by that one kind, with the other plants on the border appearing like Kilayim[1] as we have shown before by his saying (R. Judah's) "for it looks like a field planted with mustard (hardl)." However, the Tanna-Kama allows it (to plant one kind). It is in order to sanction this that the Tanna-Kama emphasises the words "*one in the centre*," and does not say six in the centre. The Talmudists, however, did not make use of this explanation. From what we have said, and from what is explained in the Talmud, it follows that one is allowed to plant either one or six different seeds in the centre of the garden-bed, as I have shown in the diagram. If you argue, saying, why did not Rabbi Judah permit to plant nine different kinds, as the following figure will illustrate, and at the same time there not being less than thirty plants in the garden-bed, you ought to know that this is impossible, for then the space between two sides of any two divisions (of the nine) will be less than one and a-half tefahim (hand-breadth). The space between the lines of each of the nine different divisions will then only amount to one and two-fifths of a tefah, whereas we need one-and-a-half, as we have pointed out before. How it amounts to one and two-fifths of a tefah is clearly shown from the fact that the sides of the nine divisions form spaces each of a square tefah, and the diagonal of a square tefah equals one and two-fifths of a tefah (approximately) which is based on the following principle "A figure of one square cubit has a diagonal line of one and two-fifths cubits." The question, why did he (R. Judah) not say that in a garden-bed of six tefahim square, could be planted nine kinds of seed? may be explained from the accompanying diagram. For all that has been planted is only nine tefahim, but on the preceding figure the plots make twenty-four tefahim, as we have explained before, and therefore the Mishnah says five and not nine. It takes as an example a bed six by six because it is the smallest size of a garden-bed people usually make, which is a cubit square. It shows that although it is the smallest possible bed, yet one can plant in it different kinds of plants, and not conflict with the law of Kilayim, as we have explained and shown.

(1) Kilayim = the Biblical law against planting different seeds in the same plot (*cf.* Lev. xix, 19, and Deut. xxii, 9–11.)

A Page of Maimonides' Autograph Manuscript on Agriculture—A Section of his Commentary on "The Mishnah," with diagrams drawn by Maimonides. Arabic—in Hebrew characters.

TRANSLATION OF FINAL PAGE OF MAIMONIDES' "MISHNEH TORAH"

(See opposite page)

. . . . . and although a religious command was performed by this cure, because it was not intended for a religious command. Therefore if the Gentile intended it for the purpose of circumcision an Israelite may perform it. The orlah (the prepuce, or uncircumcised membrum) is very objectionable, for the wicked men were reproached by it, as it is said; "for all the nations are uncircumcised" (Jer. ix, 25). The act of circumcision is so important that Abraham the patriarch has not been called "perfect" until he was circumcised, for it is said "walk before me and be thou perfect. And I will make my covenant between me and thee." (Gen. xvii, 1–2.) And he who breaks the covenant of Abraham the patriarch, and was left uncircumcised, although he may be a pious man, he will forfeit his share in the future world. How important is the law of circumcision can be observed from the fact that it was not allowed to our master Moses to postpone it even for a short while, notwithstanding his being on a journey. Moreover, all the other commandments of the Torah were confirmed[1] by only three covenants, as it is said "These are the words of the covenant . . . " (Deut. xxviii, 69), "beside the covenant which He made with them in Horeb" (*ib.*), and there it is also said "Ye stand . . . " etc. (*ib.* xxix, 9) "that thou shouldest enter into covenant with the Lord thy God" (*ib.* xxix, 11). These are the three covenants. But the commandment of circumcision was given on the strength of thirteen covenants with Abraham our patriarch, as it is stated—

"And I will make my covenant between me and thee." (Gen. xvii, 2).
"As for me, behold my covenant is with thee" (*ib.* 4).
"And I shall establish my covenant between me and thee" (*ib.* 7).
"for an everlasting covenant" (*ib.*).
"thou shalt keep my covenant" (*ib.* 9).
"this is my covenant" (*ib.* 10).
"And it should be a token of the covenant" (*ib.* 11).
"And my covenant shall be . . . for an everlasting covenant" (*ib.* 13).
"he hath broken my covenant" (*ib.*14).
"And I will establish my covenant with him for an everlasting covenant" (*ib.* 19).
"But my covenant will I establish with Isaac"(*ib.* 21).

Blessed be the Merciful God who aided me.

This is the end of the second book (with the help of the Almighty).
The number of chapters in the second book is fifty-six.

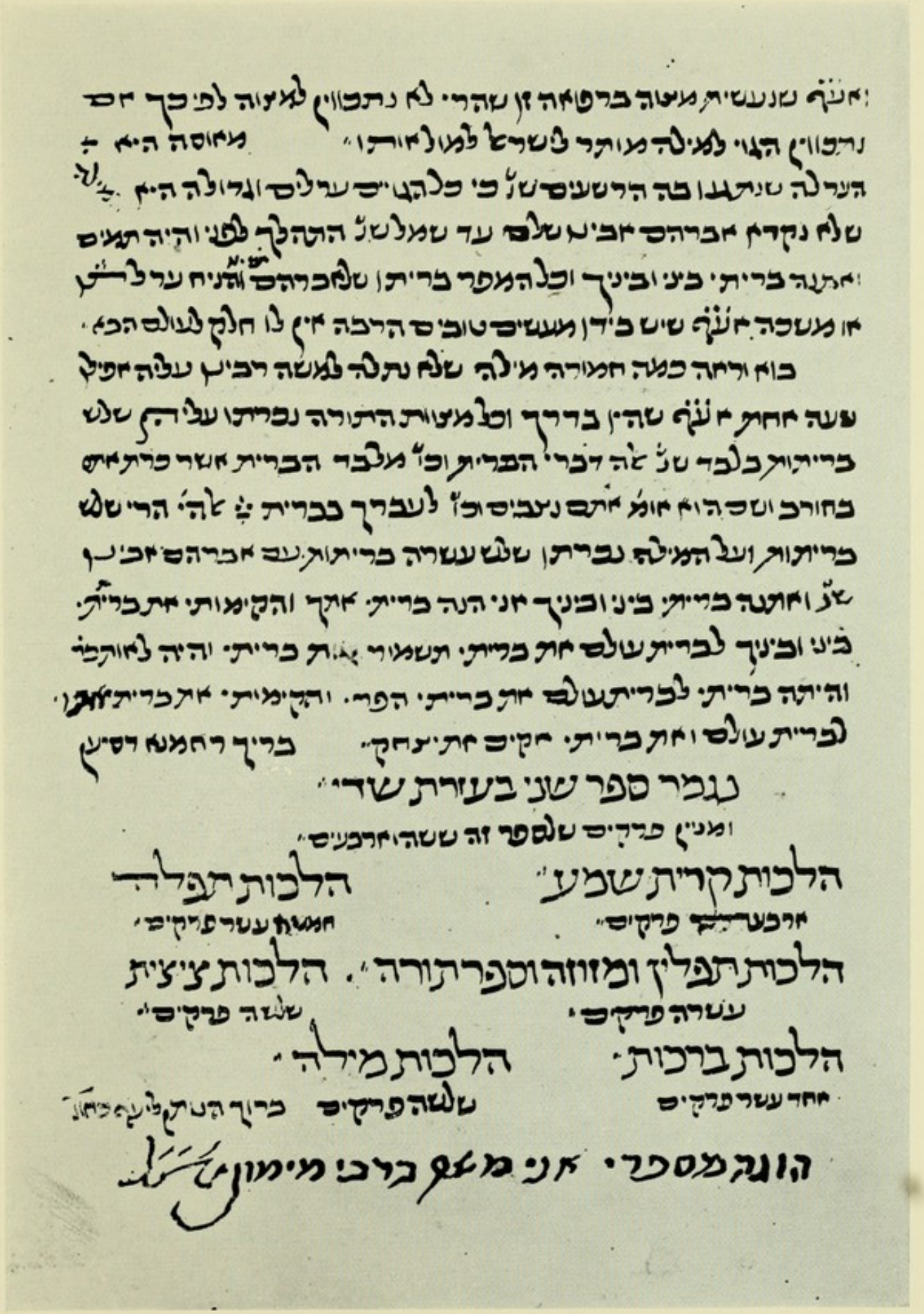
Laws on reciting the Shema[2]—fourteen chapters.
Laws on Prayer—fifteen chapters.
Laws on Phylacteries, Mezzuzah, and on the Scroll of the Law—ten chapters.
Laws on the fringes—three chapters.
Laws on Benedictions—eleven chapters.
Laws on Circumcision—three chapters.

Blessed be he who grants strength to the weary.

It was compared and corrected out of my own book,

I, MOSES THE SON OF MY MASTER MAIMON may his memory be blessed.

(1) *cf.* Exodus iv, 24–26.
(2) *cf.* Deuteronomy vi, 4.



Final page of Part II of Maimonides "Mishneh Torah" in Hebrew, the bottom line of which contains
THE SIGNATURE OF MAIMONIDES

In this masterly reconciliation of the Old Testament with Aristotelian science Maimonides' philosophy became the inspiration of Christian-Aristotelism which, as afterwards expounded by St. Thomas Aquinas, Albertus Magnus and others, dominated mediæval philosophy from the thirteenth century onwards.

Not long after his arrival in Egypt, Maimonides suffered the loss of both his father and his brother David, the latter having been drowned during a voyage to the East. David, a merchant in precious stones, had been the financial mainstay of the family, and, as it therefore became necessary for Maimonides to seek a livelihood, he adopted the profession of medicine.

A man of his brilliant intellect could not for long remain in the rank and file of ordinary physicians. Maimonides practised medicine with a sincerity amounting almost to religious fervour, although he never ceased to give public lectures upon philosophical, Talmudic and Rabbinical subjects. His extensive medical knowledge secured for him the patronage of the Court of the Sultan Saladin, to whom he became personal physician. As a medical man he became not only the favourite of royalty but the idol of the masses. His method of professional practice was to begin with simple treatment, endeavouring to cure by a prescribed diet before administering drugs. As he reveals in his letters to the son of Saladin, upon personal hygiene and diet ("Tractatus de Regimine Sanitatis"), Maimonides was a powerful advocate of preventive measures in the maintenance of health. He himself explains that the function of medical knowledge is "to teach humanity the causes of ill-health, the correct dietetic hygiene . . . how to prolong life, and how to avoid disease."

The fame of Maimonides' medical works, and his renown as a practitioner spread throughout Europe and the Near East, and his writings were amongst the leading medical authorities during the succeeding centuries of the Middle Ages. According to the Arab historian Al-Kitti, Maimonides received the offer of appointment as Royal Physician to Richard Cœur de Lion, King of England, which he declined.

On *page* 21 is reproduced a portion of an autograph manuscript by Maimonides, in Arabic (Hebrew characters), on Agriculture, it being a section of his Commentary on the Mishnah (Zᵉra'im). In this manuscript is an interesting note stating that it was in the possession of Solomon ben David ben Abraham ben Moses, the great grandson of Maimonides. Solomon was also a physician.

The known medical writings of Maimonides are as follows :—

1. "Fi al-Jama'ah," on sexual intercourse, dedicated to Malik al-Mustafir, Sultan of Hamat and nephew of Saladin.
2. "Al-Sumun wal-Mutaharriz Min al Adwiyyah al Kitalah," on various poisons and their antidotes.
3. "Fi al Bawasir," on Hæmorrhoids, in seven chapters, of which an extract is reproduced on *page* 27. This manuscript contains a Colophon stating that the copyist collated his manuscript with the author's original.
4. "Fusul Musa," the Aphorisms of Maimonides, of which a manuscript exists, "written by the physician Makhluf ben R. Sh' muel he-Hazan, finished 11th of Elul 5112" (= A.D. 1352).
5. "Makalah fi al-Rabw," on asthma.
6. Commentary on Hippocrates' Aphorisms.
7. Tracts on Diet and Personal Hygiene (*Tractatus de Regimine Sanitatis*).
8. "Makalah fi Biyan al A'rad," on the case of the Prince of Rikka. Latin translation (1519), viz., *De Causis Accidentium Apparentium*.

In addition to his medical works, the philosophical and Rabbinical writings of Maimonides also abound with precepts of medical interest. He died in 1204.

This epoch is distinguished for the important pharmacological treatises which appeared on simple drugs and on compound remedies. Of the former, the most famous was compiled by Ibnu'l-Bayṭár (*d.* 1248), whose work, "Simplicia," demonstrates his extraordinary observation and erudition, and is the greatest of the Arabian botanical works. Ibnu'l-Bayṭár, born at Malaga, assiduously collected plants throughout the Mediterranean world from Spain to Syria, and his

TRANSLATION OF THE PORTION OF MAIMONIDES "TREATISE ON HÆMORRHOIDS"

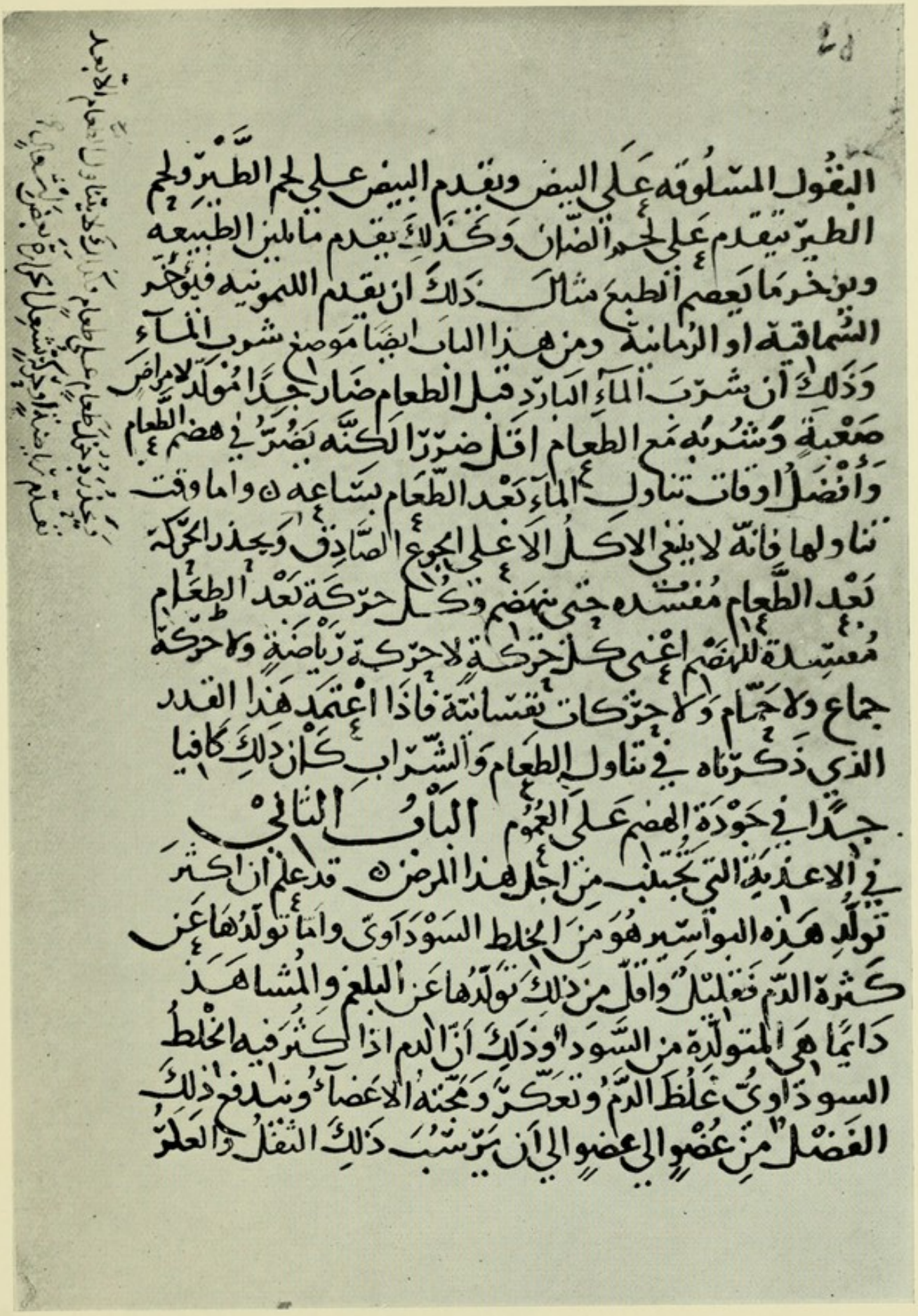
(Reproduced on the opposite page)

" [So one should prefer] boiled vegetables to eggs, and eggs to the flesh of birds, and the flesh of birds to the flesh of sheep ; and similarly one should give preference to that which suits the nature and defer taking that which strengthens nature ; for instance, lemon-preparations should be taken first, and sumach-preparations, pomegranate-preparations afterwards.

Connected with this chapter is the occasion of the drinking of water which is as follows. The drinking of cold water before the meal is extremely injurious and causes serious ailments ; while drinking it with the meal is least injurious, but it impairs the digestion of the food. The best time for drinking water is an hour after the meal.

As regards the time of taking, one ought not to eat except on true appetite, and should guard against eating one meal upon another, and similarly one should not take a meal except after preceding it with some exercise or some movement which would produce at least some heat. And one should refrain from movement after a meal, which would interfere with digestion, that is, all kinds of movement—no movements of exercise, nor of sexual intercourse, nor of the bath, nor any emotional disturbances. When one has adopted this course which we have mentioned with regard to eating and drinking, it will be sufficient to (maintain) good digestion on the whole.

The Second Chapter : about foods which should be avoided because of this disease (Hæmorrhoids). It is known that mostly the cause of these piles is the black bile humour, and as for its being due to too much blood, that is rare. Rarer still is its being due to phlegm. However, the observed fact always is that it is caused by the black bile. It is like this : when there is too much black bile in the blood, it (the blood) becomes thickened and foul (or dark), and the different parts of the body eject it, and thus this superfluity flows from one organ into another till this heavy and foul matter settles in the lowest parts of the body, because of its heaviness and the thickness of its matter."



البقول المسلوقة على البيض ويقدم البيض على لحم الطير ولحم
الطير يقدم على لحم الضان وكذلك يقدم ما يلين الطبيعة
ويؤخر ما يعصم الطبع مثال ذلك ان يقدم اللوبيه فيولد
السماقية او الرمانية ومن هذا الباب ايضا موضع شرب الماء
وذلك ان شرب الماء البارد قبل الطعام ضار جدا مولد للامراض
صعبة وشربه مع الطعام اقل ضررا لكنه يضر في هضم الطعام
وافضل اوقات تناول الماء بعد الطعام بساعة ن واما وقت
تناولها فانه لا ينبغي الاكل الا على الجوع الصادق ويجذر الحركة
بعد الطعام مفسدة حتى ينهضم وكل حركة بعد الطعام
مفسدة للهضم اعني كل حركة لا حركة رياضة ولا حركة
جماع ولا حمام ولا حركات نفسانية فاذا اعتمد هذا القدر
الذي ذكرناه في تناول الطعام والشراب كان ذلك كافيا
جدا في جودة الهضم على العموم

الباب الثاني

في الاعذية التي تجتنب من اجل هذا المرض ن قد علم ان اكثر
تولد هذه البواسير هو من الخلط السوداوي واما تولدها عن
كثرة الدم فقليل واقل من ذلك تولدها عن البلغم والمشاهد
دائما هي المتولدة من السوداء وذلك ان الدم اذا كثر فيه الخلط
السوداوي غلظ الدم وتعكر ومحنه الاعضاء وندفع ذلك
الفضل من عضو الى عضو الى ان يرسب ذلك الثفل والعكر

A PAGE FROM MAIMONIDES TREATISE ON HÆMORRHOIDS
in Arabic.

The copyist states that he collated this copy with the Author's original.

PETRUS ALFONSUS (*b.* 1062)

(See page 30)

ARNOLD DE VILLA NOVA (*d. circa* 1313)

"The last renowned Spanish medical translator"

(See page 33)

treatise, "Jami al-Mufradat," or "Corpus simplicia medicamentorum et ciborum continens," described no fewer than 1400 drugs, of which a large number were then new, comparing them with the records of more than 150 ancient Arabian authors. The work constituted, in fact, a compendium of the materia medica and dietetics of his period.

The works on compound remedies were called *Agrábádhín* (mutilation of Greek γραφιδίον, *i.e.*, small treatise), a name distorted in Latin manuscripts and early printed versions as *Grabadin*. These works became the apothecary's manuals; they were amongst the first medical books to be printed (Venice, 1471), and exerted considerable influence upon all subsequent pharmacopœias.

Some conception of the prosperity of Spain under Arabian rule may be gained from the fact that in the tenth century the population of Cordova is computed at about 300,000. At this period the city is said to have possessed 50 hospitals, 900 baths, 800 schools, 600 mosques and a library of 600,000 volumes, in addition to 70 private libraries. The great mosque of the Ommeyad Caliphs of Cordova (now the Cathedral), ranked amongst the largest and most sumptuous of Moslem shrines. Begun in 785 by Abderrahman I, and enlarged by Abderrahman II (833–848) and Hakam II (961–976), it rivalled all others in splendour. Unfortunately, in 1523, the Cathedral Chapter, against enlightened opposition, built the cruciform church which now occupies the centre of the ancient mosque. Their action drew from Charles V, in 1526, the famous reproof: "You have built here what you or anyone might have built anywhere else, but you have destroyed what was unique in the world."

Apart from the apothecaries' shops, or drug stores, which were amongst the most characteristic features of such cities as encountered the Arabian influence, establishments for dispensing medicine existed at Cordova, Toledo, etc. They were placed under the severest legal restrictions, similar no doubt to those imposed by Frederick II, who, in 1233, passed a law, which remained in force for a long time in the two Sicilies, by which every medical man was required to give information against any pharmacist who should sell bad medicine.

Moslem Hospitals

One of the glories of Arabian civilisation was the development of the *Bímáristán*, or Hospital. Although no graphic descriptions of Western institutions have survived to compare with the detailed accounts of the tenth century hospitals of Bagdad, Cairo, etc., there is evidence that the Hispano-Moresque hospitals of Cordova, Toledo, Seville and elsewhere, were established and conducted on similarly efficient lines. The common assertion that Cordova possessed 50 such institutions may be an exaggeration, but, judged by contemporary standards, Spain possessed a more efficient hospital service than any other country in Europe.

That Avenzoar himself was at one time in charge of a hospital at Seville, is shown by his reference to a case of gastric cancer *(Verruca stomachi)*, regarding which he says :—

> " When I was superintendent of the hospital, I found there a man with this disease, very weak and emaciated. Under my treatment he recovered strength and began to put on flesh ; but afterwards took to eating bad food and sank rapidly."

In addition to being centres for the treatment of disease, these hospitals were institutions for clinical education and served as academies of medical learning. They were equipped with large libraries. That of the Mansouri Hospital required six librarians, whilst immense collections were accumulated at Cordova and elsewhere.

The Spread of Hispano-Moresque Culture

The influence of this powerful movement of Hispano-Moresque culture rapidly made itself felt throughout Europe. Petrus Alfonsi *(b.* 1062) came to England from Spain as Physician to King Henry I and, in 1120, collaborated with Walcher, Prior of Malvern, in the production of a translation of Alfonsi's astronomical treatise, *(page* 28*)*. In England their united effort represents the first impact of Arabian learning. Its effect was rapid, for, immediately afterwards, Adelard of Bath earned the distinction of being the first prominent European man of science, outside Spain, to come to Toledo and make a special study of Arabian learning. The cultural links thus formed between England and Spain were destined to produce important results.

They stimulated in England the desire for the new philosophical and scientific learning and led to the achievements of Michael Scot (*c.* 1175–1232) and Roger Bacon (1214[?]–1294).

Scot, having studied successively at Oxford and Paris, passed on to Bologna and Palermo. He afterwards proceeded to Toledo in order to gain a knowledge of Arabic and of Arabian philosophy. He became celebrated as a translator of Aristotle's biological works, a writer on alchemy and a contributor to the sciences of astronomy and astrology. He ranked high in the estimation of Vincent of Beauvais, Albertus Magnus and Roger Bacon. In the practice of medicine Scot enjoyed a great reputation, being renowned for his treatment of leprosy, gout and dropsy. He is stated to have been one of the early teachers in the Medical School of Salerno.

MICHAEL SCOT (*c.* 1175-1232)
Philosopher, Physician and Arabic Scholar

At Oxford, Roger Bacon *(page 32)* achieved brilliant success as an exponent of the new Arabian-Aristotelian philosophy. He demonstrated his ability as a scientist of unusual power by his discoveries in optics, and by his realisation, far in advance of his time, of the value of experimental method. His pupils at Oxford included a class of Spanish students, amongst whom was no less distinguished a person than Raimon Lull (or Lully) of Majorca (*c.* 1235–1315).

In the library of the Dean and Chapter of Canterbury Cathedral is a late thirteenth century (*c.* 1280) illuminated manuscript, "Vetus logica," the earliest known commentary on Aristotle's logic produced in England following the Arabian "renaissance" of Aristotelian philosophy. It bears the name of John de London, a monk of Christ Church, Canterbury, a friend of Roger Bacon; and there are strong reasons for believing him to have been none other than the "youth John" whom Roger Bacon educated and sent, with presentation copies of his books, to Pope Clement IV in 1267.

ROGER BACON (*c.* 1214–1294)
English Philosopher and Man of Science
(See page 31)

The Schools of Translation

One of the most important factors in the dissemination of Hispano-Moresque medical knowledge was the establishment of schools of translation. As early as 951, at Cordova, the Greek text of Dioscorides had been translated into Arabic, for the use of the Hispano-Moresque students. The most celebrated of these schools was that founded by Archbishop Raymond, at Toledo. It flourished until the thirteenth century. Here the part of the polyglot translators was largely undertaken by the Jews, proficient in Arabic, Hebrew, Spanish and sometimes in Latin and Greek, who translated many medical, mathematical, astronomical, astrological and philosophical works.

The most famous of the numerous translators of Arabian medical literature was Gerard of Cremona (1114–1187), who worked in the Toledo School during the greater part of his life.

In the 20 years preceding his death Gerard made nearly 80 translations, some of the utmost importance, including the surgical treatise of Albucasis *(pages 12 and 15)*. He has been deservedly named " the father of Arabism in Europe."

The schools of Toledo attracted scholars from every part of Europe. Amongst those from Britain were Robert of England (flourished 1143), first translator of the " Qur'án," Michael Scot, Daniel Morley (flourished 1170), Adelard of Bath, etc.

As a result of the efforts of the Toledo translators and commentators, numerous translations of medical works descended on the scientifically barren soil of Europe. The effect was widespread, and gave rise to generations of prominent medical teachers.

In fact, Aristotelian science, as introduced from Toledo, with Averroes' commentaries, became the foundation of mediæval learning. Roger Bacon's work " Optics " was based on Alhazen's " Thesaurus Opticæ." The alchemical teachings of Jabír ibn Hayyán (Geber) and other Arabian writers, are apparent in the " De Mineralibus " of Albertus Magnus, whilst in the " Speculum Naturale " of Vincent of Beauvais the influence of Geber is pronounced.

To Arnold of Villa Nova (*c.* 1235–1313) belongs the honour of being " the last renowned Spanish medical translator " *(pages 6 and 28)*. A doctor of theology, law, philosophy and medicine, and consultant to Peter III of Aragon, he was one of the earliest European writers

on alchemy. He taught medicine at Montpellier, and is credited with the introduction of tinctures and of brandy *(aurum potabile)* into the pharmacopœia. He translated Avicenna's book on the heart, and was an early pioneer in the classification of diseases. His medical works were printed at Lyons in 1504.

Epidemics

In the sphere of pestilential disease Hispano-Moresque physicians showed a sagacity of understanding conspicuously absent from classical or mediæval medicine. Free from the theological prejudices which prevented plague from being regarded in any other light than that of a divine punishment, they were wise enough to consider epidemics from the aspect of contagion. In his description of the great plague of the fourteenth century, the celebrated physician Ibnu'l-Khatíb, of Granada (1313–1374), in his famous treatise, "On Plague," made the following remarkable observations :—

> "The existence of contagion is established by experience, study and the evidence of the senses, by trustworthy reports on transmission by garments, vessels, earrings ; by the spread of it by persons from one house ; by infection of a healthy seaport by an arrival from an infected land . . ."

Ibn Khátima *(d.* 1369) also wrote a work on the plague which ravaged Alureria, in Spain, in 1348–9. It is far superior to all the numerous plague tracts issued in Europe between the fourteenth and the sixteenth centuries.

Mediæval Theurgy

The attitude of the mediæval mind to the sciences is one of extraordinary complexity, the outstanding feature of the period being the comparative absence of advance in medical knowledge. The reasons for this lack of progress are manifold. There is no doubt that the emotional fervour which permeated Christianity during the eleventh, twelfth and thirteenth centuries ; which inspired the Crusades ; built the innumerable gems of Gothic architecture ; created priceless treasures of embroidery, jewellery, illuminated manuscripts and paintings ; an age which witnessed the universal popularity of pilgrimages and saw the rise of monasticism to a splendour of power far removed from the tenets of its founders,

was unfavourable to that rationalism of mind which is essential for experimental research in science. The legacy of superstition and belief in pagan incantations and invocations, which had lingered through the early centuries of the Christian era, gradually came to assume a new form of orthodoxy. So, to combat the influence of pagan superstition and direct the popular beliefs into more conformable channels, the young expectant mother, instead of reciting pagan incantations and invoking the aid of Juno Lucina, was taught to repeat the 18th Psalm and to reflect upon the wonderful deliverance of St. Margaret of Antioch; or to appeal to St. Dorothy, who, in the agony of her martyrdom, had prayed that women in childbirth might be speedily relieved by the invocation of her name.

The cult of the invocation of the saints for the prevention and cure of disease, which spread throughout Christendom, became firmly rooted and somewhat retarded the growth of a spirit of investigation and experiment in medical science.

From the fourth century onwards are recorded cases of the translation of bodies of saints, and even of dividing the sacred relics, which became objects of veneration. From the fifth century certain celebrated saints were honoured universally. The belief in the miraculous powers of holy relics to cure disease, and in the efficacy of the invocation of saints to achieve similar results, established, during the mediæval period, a vogue of theurgical practice.

As century succeeded century, this cult became universal throughout Christendom. The arts and crafts of the Gothic period vied with each other in the production of conventional representations of saints with all the lavish splendour of the age, as constant reminders of the powers of invocation.

In addition to such saints of widespread popularity as St. Anthony, specially invoked for the cure of scorbutic diseases; St. Apollonia for toothache; St. Clare for ophthalmic diseases; St. Erasmus for abdominal complaints; St. Laurence for lumbago and burns; St. Petronilla for fevers; St. Vitus for nervous diseases; and the famous St. Roche and St. Sebastian for protection from and cure of plague, legions of others flourished, of universal or local repute.

In Spain, amongst numerous others, were St. Ignatius de Loyola, invoked by women in childbirth and for the cure of fevers; St. Francis

Xavier, invoked against plague; St. Thomas of Villa Nova, Archbishop of Valencia, who was regarded as a special protector of those suffering from incurable diseases; and St. Ramond Nonnatus, patron of midwives and protector of women in childbirth.

As the patron saints of physicians, the two Arab brothers, St. Cosmas and St. Damian, enjoyed considerable popularity. Concerning these two saints, who during their lives were medical practitioners legend asserts that one day a man suffering from a cancerous leg went to pray at the Church of SS. Cosmas and Damian, Rome. He fell asleep, and the two saints appeared to the man and decided to restore him to health. This they did by amputating the afflicted limb and, in its place, grafting the leg of a Moor who had recently died. The legend is graphically depicted in the painting by Jaime Huguet (early fifteenth century) in the Church of Santa Maria, Barcelona.

The cult of the invocation of saints, together with faith in the miraculous cures performed at the shrines of saints, and in the powers of relics, charms and amulets, pervaded lay opinion in every grade of society from kings to beggars. It was not until the full force of the Renaissance was felt throughout Europe, and the minds of men became rationalised by the leaven of ancient wisdom, that medical knowledge was able to advance along the more certain path of experimental investigation which leads to scientific discovery. Also the mediæval Church looked with disfavour upon the practice of medicine by the *religiosi*. In fact, by the sixth canon of the Council of Rheims (1131), they were forbidden to do so, the reason being that :—

> "An unchaste eye is the messenger of an unchaste heart, and whatsoever things are shameful to speak of an honest priest should not meddle with. Wherefore, by apostolic authority, we forbid the continuance of this practice, and let the bishops, abbots and priors who connive at such an enormity be degraded and excommunicate."

The same decree was re-enacted at the second Council of Lateran (1139), and again at Montpellier in 1162, and from time to time was repeated by Papal Acts.

As by far the greater proportion of the intellectuals were in holy orders, and the majority of the literature of the period was

in the possession of religious foundations, such edicts hampered the progress of medical knowledge.

Notwithstanding these edicts, however, the Vatican records show that sometimes clerics obtained dispensations from Rome to practise the art of medicine; in fact, many of the outstanding mediæval figures in medical science were *religiosi*, as for example, Michael Scot, Roger Bacon, Petrus Hispani (Pope John XXI) and others.

The works of Albertus Magnus (1206–1280), St. Thomas Aquinas (*c.* 1225–1274), Vincent of Beauvais (1190–1264) and Roger Bacon, demonstrate that even in the Middle Ages the spirit of scientific investigation was astir, although Bacon's discoveries suggest that he was far in advance of his age in his appreciation of the value of experimental method. The philosophy of Aquinas was based on the recovered Aristotelian works of Maimonides, and by his genius the combination of Aristotelism and Christianity resulted in an advance upon either system, in its attempt to explain the phenomena of life and the universe. But mediæval Aristotelism, Physics for instance, hardly rose to the level of a science. Yet, notwithstanding the genius of these and others of the scholastics, the advance of medical knowledge during the Middle Ages was so slow as to be almost non-existent.

If, as has been pointed out, the surgical teaching of Albucasis actually retarded the advance of surgical progress during the latter centuries of the Middle Ages, by its adoption of Galen's principles of anatomy rather than by relying upon experimental dissection, it was no fault of Albucasis. On the contrary, it was due to the predilection of the scholastics of the period for revived classical learning, which led them readily to assimilate the teaching of Albucasis, rather than to pursue the science of anatomy by methodical investigation. In fact, the whole outlook of the mediæval intellect was directed towards an understanding of the past rather than to an advancement in the realms of knowledge by experiment and research.

There were other factors which reacted against the progress of medical science. For instance, so firmly implanted was this fashion of scholasticism, that in the curricula of most European Universities, for some time after the close of the Middle Ages, the degree of Doctor of Medicine called only for a *lectio* upon each of the

BARCELONA, HOSPITAL DE LA SANTA CRUZ
Founded 1229
(See page 39)

"Liber Tegni" of Galen, and the "Aphorisms" of Hippocrates. If the candidate were required to show further knowledge of other books lectured on in the schools, he might have to demonstrate his acquaintance with the "Canon of Avicenna," the medical treatise of Averroes, or further works of Galen or Hippocrates. Of the *practice* of medicine, or of any clinical experience, no evidence whatever was demanded in the large majority of mediæval Universities. Graduation in medicine demanded little more than a philosophical disputation.

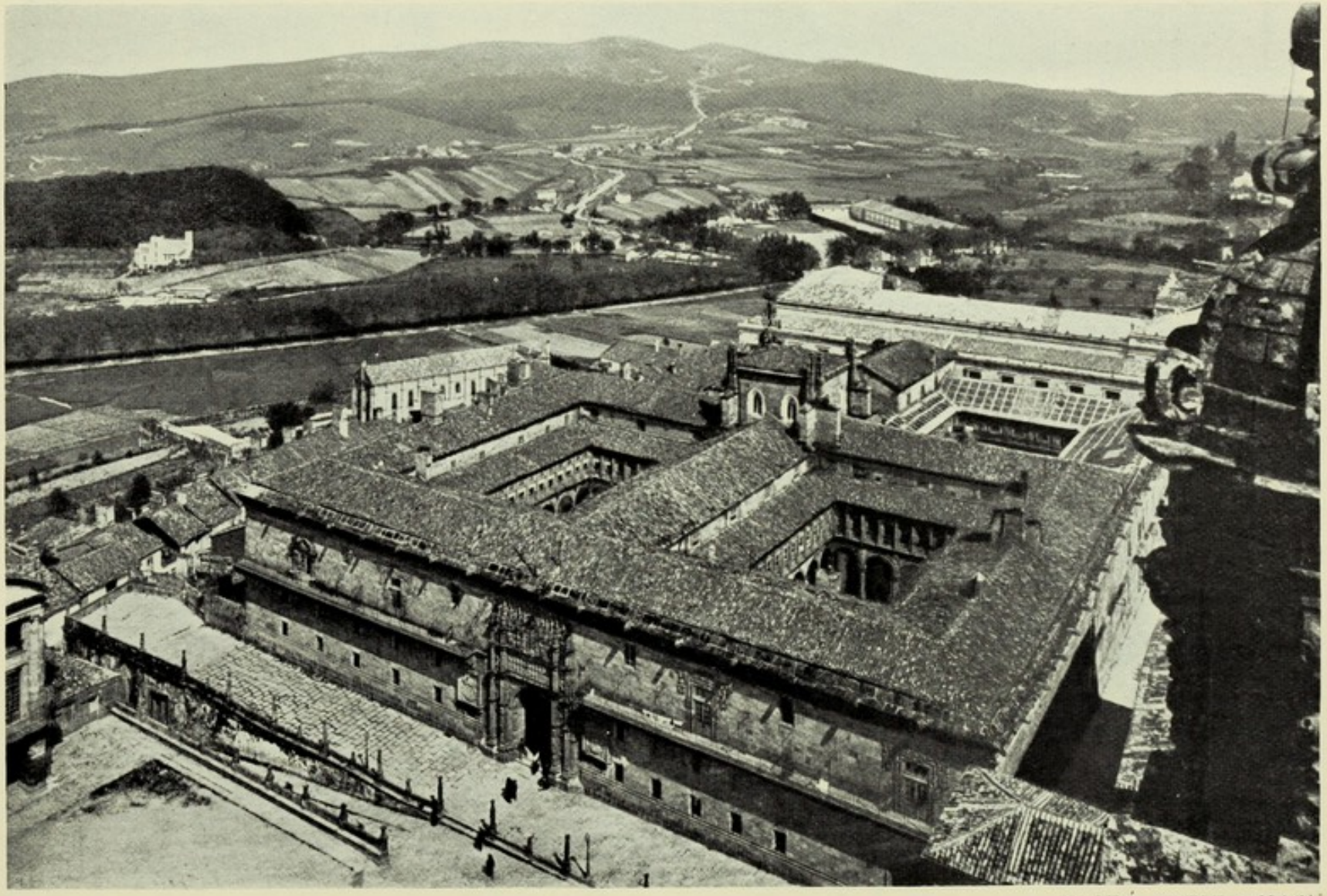
With such an absence of concern for the value of practical work amongst the academic foundations, it is small wonder that the spirit of experiment, of research and rational investigation, was so inanimate that scientific discovery and progress were well-nigh impossible. Nor did the Renaissance of itself at first bring forth more than a resurrection of ancient science. It cultivated, however, a yearning after truth and reason, which, although primary essentials of the scientific mentality, are not in themselves science.

Mediæval Hospitals

The mediæval hospitals of Spain were numerous, and many of them of ancient foundation, but, with the expulsion of the Moslems by Ferdinand and Isabella, in 1492, with subsequent political convulsions and constitutional changes, apart from the ravages of time and iconoclasts, a large number of them have either disappeared or become merged into later foundations.

In the year 1566, Philip II, endeavouring to regulate the hospitals of Madrid, united under one organisation the older institutions of St. Lazaro, of Moslem foundation, the Hospital de San Juan de Dios (1552), and the Hospital de la Paz, for contagious diseases and incurables (1565).

Of the mediæval hospitals that have survived to recent times, one of the earliest is the Hospital de Santa Cruz at Barcelona (*page* 38), founded in 1229, with which other institutions were incorporated in 1401. In the same city is the Hospital de la Santa Marta, for travellers, founded in 1308, and an Orphanage which dates from 1370; whilst the Hospital of San Severo, for infirm and demented cases, was founded in 1412.



CLIXÉ ARXIU "MAS"

SANTIAGO DE COMPOSTELA: HOSPITAL REAL
Founded 1501

(See page 41)

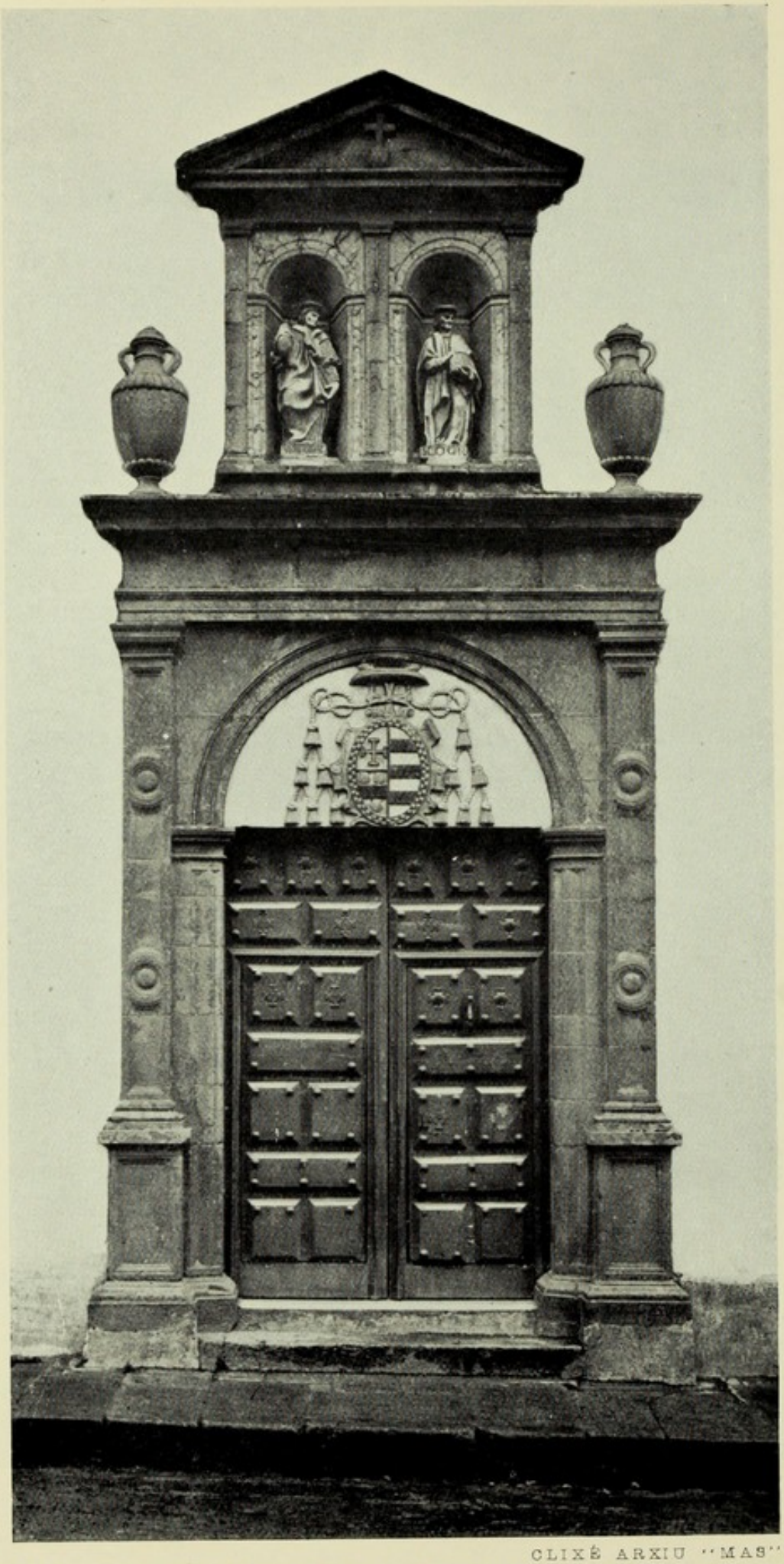
At Burgos, Alfonso VIII (1158–1214) founded the Hospital del Rey, which was subjected to the jurisdiction of the Monastery of Las Huelgas. In the same city the Hospital de Barrantes ó de San Julian y San Quirge was founded in 1627, by Pedro Barrantes, for the treatment of venereal disease, and was the first hospital instituted in Spain for this purpose.

In Lérida the Hospital de Santa Maria has existed since the fifteenth century, though since its foundation several ancient institutions have been incorporated.

At Santiago de Compostela, the Hospital Real *(page 40)* was founded in 1501, by the Catholic rulers as a hostel for travellers. It now stands as an imposing example of Spanish architecture of the Early Renaissance. Also in Santiago is the Hospital de San Roque, founded in 1578 by Archbishop Francisco Blanco *(page 42)*.

In Valencia is a Hospital for Poor Priests, dating from 1356, and the Hospital Provincial, built at the beginning of the fifteenth century. The latter owes its foundation to Juan Gilabert Jofré, who, on his way to the Cathedral to preach, saw a group of boys illtreating a madman. Impressed by the scene, he appealed to his congregation with such eloquence for contributions towards the foundation of a Hospital for the Insane, that from that point the "Manicomio," or "Espital dels Folls," as it was first called, of Valencia, was virtually founded. It is said to have been the first of its kind to be established in Europe, and was opened on June 1, 1410.

Another instance of the policy of uniting several hospitals to form one institution is in connexion with the Hospital de Santa Cruz at Toledo, established by Cardinal Pedro Gonzáles de Mendoza (1428–1495), for foundling children. His project, interrupted by his death, was realised by Queen Isabella as his executrix. Within half a century after the death of Mendoza, Cardinal Juan Pardo de Tavera (1472–1545) had built in Toledo the Hospital de San Juan Bautista de Afuera ó de Tavera, a huge establishment for the treatment of every kind of sick and suffering person. It was founded in 1541 *(page 44)*.



CLIXÉ ARXIU "MAS"

SANTIAGO DE COMPOSTELA: HOSPITAL DE SAN ROQUE

Founded 1578

(See page 41)

Hospitals of the Sixteenth and Seventeenth Centuries

In the sixteenth and seventeenth centuries a large number of hospitals were founded, amongst them being :—

Barcelona.—Casa de Misericordia (1583), Convalescent Hospital de San Pablo (1629).

Granada.—Hospital de la Caridad y Refugio (1513), Hospital de Corpus Christi (1517), Hospital de San Juan de Dios (1540), Hospital de Santa Ana (1592), Hospital Real de Dementes, begun in 1511, completed in 1536 by Juan Garcia de Pradas.

Malaga.—Hospital de San Tomas (1500), Hospital for Convalescents (1571), Hospital de la Caridad (1680), Hospital de San Julian (1682).

Madrid.—Hospital de San Juan de Dios (1552), The Inclusa and Colegio de la Paz (1567), El Hermano Santo del Refugio, founded by the Society of Jesus (1615) ; Hospital de San Pedro (1619) ; Hospital de San Patricio de Irlanda (1629).

Of these perhaps the most noteworthy is the Hospital de San Juan de Dios, at Granada, which bears the name of its founder. San Juan de Dios (1435–1550), in 1540, rented a house in the fish market at Granada, where he received the poor, sick and infirm. With 300 reales, given to him by a priest of the Chapel Royal, he provided 46 beds and alone carried out the multiple duties of the establishment. The Archbishop of Toledo, Pedro Guerrera, supported by various rich citizens, took the institution under his patronage.

The body of secular persons which Juan de Dios afterwards enlisted to exercise the duties of his hospital, was, after his death, formed into the Order of los Hermanos Hospitalarios, and, in 1571, approved by Pope Pius V, who imposed upon it the rule of St. Augustine. At the end of the eighteenth century the Order counted in Europe and Spanish America 281 hospitals, 2915 *religiosi* and 10,689 beds.

San Juan de Dios was adopted as the Patron Saint of Infirmarers, and hospitals bearing his name were established in Granada, Madrid, Cordova, Seville, Lucena and Rome, as well as in America.

TOLEDO: HOSPITAL DE TAVERA
Founded 1541
(See page 41)

The Universities

Even before the beginning of the university system in European cities, Cordova, Granada, Seville, Malaga, Almeria, Barcelona, Valencia and Toledo possessed academies where medicine was taught, and libraries existed richly equipped with scientific works. In addition to these institutions, at end of the fifteenth century, eleven other Spanish towns were in possession of university foundations with medical faculties.

Famous amongst the later mediæval Universities of Spain was the ambitious academic establishment, founded in 1498 by the eminent Cardinal Francisco Jiménez de Cisneros (1436–1517), the University of Alcalá de Henares, now incorporated with the University of Madrid *(page 46)*. Intending to cover the whole field of education —theology, arts, moral philosophy, mathematics, rhetoric, grammar, etc.—Cisneros endowed no fewer than six Professorships of Medicine and two of Anatomy and Surgery.

Carried away by a dominant spirit of intolerance, Cisneros, during his campaigns against the Moslem faith, had innumerable Arabian manuscripts burnt, with the stipulation, fortunately for medical knowledge, that only those that treated of medicine were to be spared.

In the mediæval Universities of Spain, traditions of the Hispano-Moresque era of medicine were preserved long after the decline of Arabian influence, by such celebrities as Alfonso Chirino, Physician to Don Juan II of Castilla y Leon, author of " Menor daño en la medicina " (1447) ; and Alfonso Lopez de Corella, sixteenth century Author and Arabist.

Not only as a distinguished practitioner, but also as a commentator and translator, Andres Laguna (*c.* 1499–1560), Physician to the Court of Carlos V, occupies an eminent position in the history of Spanish medicine of his period *(page 48)*. Educated at Salamanca and Paris, he was appointed to a Professorship at the University of Alcalá. He afterwards proceeded to Cologne, to earn considerable literary reputation at the University. He visited Rome and Bologna, where he received a doctorate of medicine, and, after being called to Germany to cure Cardinal Bobadilla of a serious malady, he was, in 1549, appointed *medico de camara* by Pope Julian III.

One of the greatest misfortunes to medicine in Spain, and to the whole scientific world, was the death, at an early age, of Michael

CARDINAL JIMENEZ DE CISNEROS (1436–1517)
Founder of the University of Alcalá de Henares, and preserver of Arabian Medical Manuscripts

(See page 45)

Servet (1509–1553), who was burned at the stake for "the crime of honest thought."

In his work called "Christianismi restitutio" (1553), Servet solved the mystery of the pulmonary circulation, an achievement which must have brought him very near to anticipating Harvey's discovery of the circulation of the blood. Moreover, to him belongs the merit of being the first to state that the cardiac septum is not perforated, as had hitherto been believed.

Although one of Spain's adopted sons was none other than the great anatomist Andreas Vesalius (1514–1564), he seems to have had comparatively little influence upon medicine in Spain. Having left Padua, indignant at the derision heaped upon his magnificent work "De Fabrica Humani Corporis" (1543), in 1544 he accepted the remunerative post of personal physician to Charles V. At Madrid, however, Vesalius found Court life so incompatible with the serious work of anatomical research that he "could not get hold of so much as a dried skull, let alone the chance of making a dissection."

The Age of Discovery

Scarcely had the great intellectual Renaissance of the fifteenth century begun to spread its influence beyond the shores of Italy than the dynamic news of the discovery of America burst upon an astonished world and brought about the most glorious epoch in the history of Spain. The rapid development of her vast new dominions, administered by Spain from the beginning in the strictest spirit of the "colonial system," gave birth to a new era, an age of discovery, not only territorial but intellectual.

As the development of America changed the political power of the world, so, in medicine, the discoveries of the sixteenth and seventeenth centuries gradually changed the treatment of disease from a speculative art into a rational science. Surgery began its upward course; anatomy attracted the attention of methodical investigators; gynæcology became the subject of scientific study; whilst ophthalmology passed from the hands of wandering empirics to those of learned physicians.

An outstanding personality of this golden age was the distinguished physician Nicolás Monardes (*c.* 1512–1588) of Seville. Educated at

ANDRES LAGUNA (*c.* 1499–1560)
Physician and Humanist
Physician to Charles V and to Pope Julian III
(See page 45)

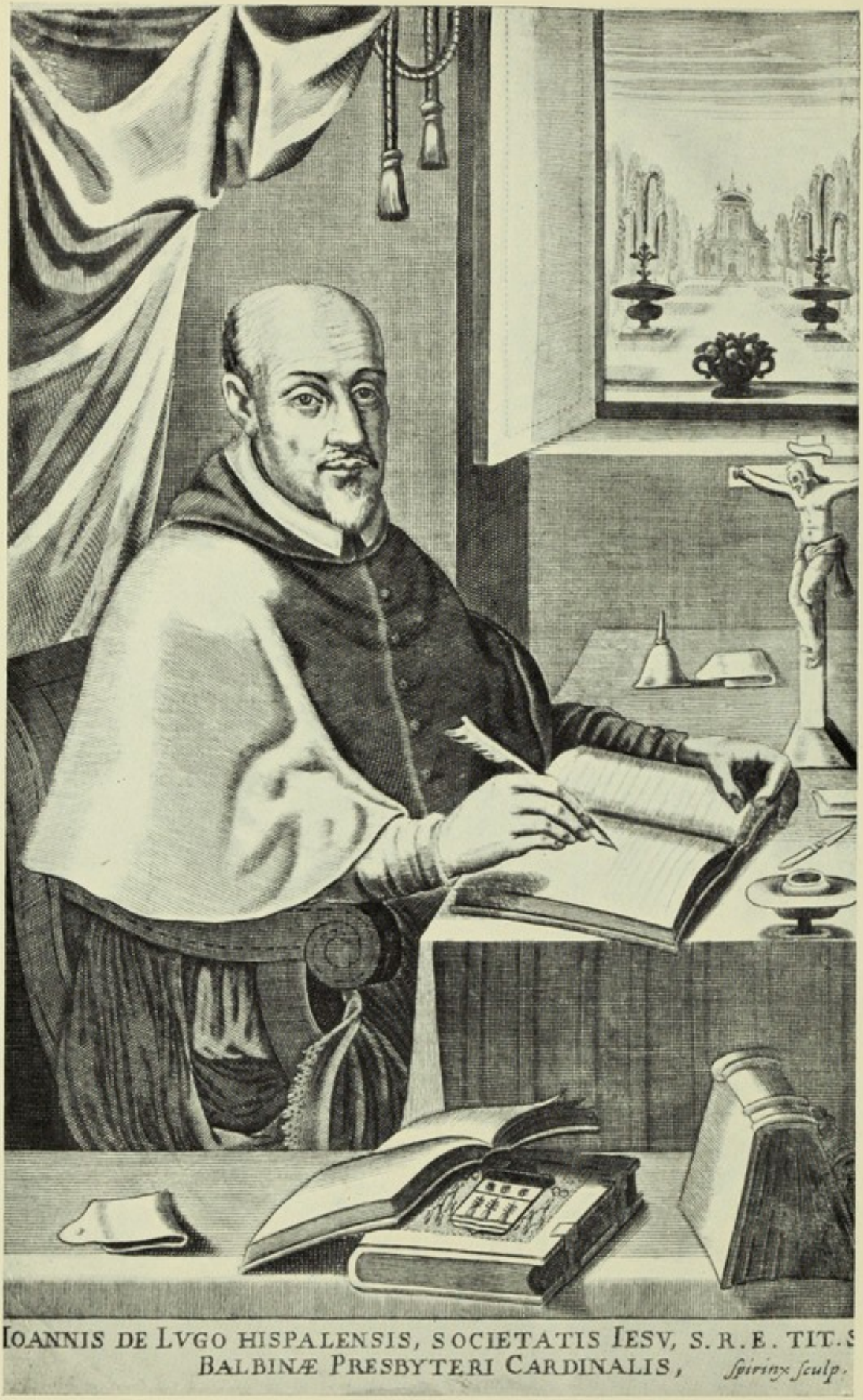
Alcalá, he was one of the earliest to make a practical study of the new remedial plants, which were being continually found in the New World. He possessed a private botanical garden for the cultivation of these exotic plants, which assisted him in the performance of his experiments in therapeutics. Most famous amongst his medical and scientific publications was his " Historia medicinal de las cosas que se Traen de nuestras Indias Occidentales," the complete work appearing in 1574.

It was Monardes who first described Balsam of Peru (*Myroxylon peruiferum*, Lin. fil.), and he was one of the first to note the celebrated *Lignum nephriticum* as a remarkable diuretic for renal and dropsical troubles. He also made early observations on syphilis. His large private museum of natural objects was one of the earliest, if not the first, to be formed in Spain. The name of Monardes is perpetuated by Linnæus in the botanical genus *Monarda*.

The strange new remedial and other plants brought from America, although at first resulting in the complete bewilderment of European botanists and physicians, led to a fruitful quickening of the spirit of scientific investigation. This appetite for enquiry was fed by the numerous topographical and historical works of Spanish authors, such as the " Historia general de los hechos de los castellanos en las islas y Tierra Firme del mar Oceano " (1601) of Antonio de Herrera y Tordesillas (1559–1625) ; the " Comentarios reales que tratan del origin de los Incas " (1605) ; and the " Historia general del Peru " (1617) of Garcilaso de la Vega (*c.* 1539–1615).

Francisco Hernandez (1517–1587), Physician to Philip II, was sent to Mexico to study the natural history of the country and its relation to medicine. His work, in seventeen volumes, unfortunately perished in the Escorial fire of 1671, though a section had been published in Mexico in 1615, under the title of " Quatro libros de la naturaleza y virtudes de los arboles, plantas y animales de la Nueva España . . . de que se aprovecha la medicina," whilst a compendium of Hernandez' work, entitled " Rerum Medicarum Novæ Hispaniæ Thesaurus " appeared in Rome in 1628.

To these important works, describing the medicinal plants of the New World, might be added the " Historia Natural y Moral de las Indias " (1590) of José de Acosta (*c.* 1539–1600) and many others of prominence.



CARDINAL JUAN DE LUGO (1583–1660)
Famous for his efforts to establish the use of cinchona bark in Europe
(See page 52)

The Influence of the Discovery of Cinchona

At the time when William Harvey published his momentous treatise on the circulation of the blood (1628), a discovery destined to end the usefulness of Galen's theory, Spain was on the eve of an event which did more than any other incident in history to upset the current school system of medicine—the discovery of the febrifuge properties of cinchona bark, and its introduction into European materia medica.

William Arrot, in 1730, and La Condamine with Joseph de Jussieu, in 1738, after intensive personal investigations and researches, formed the conclusion that the febrifuge properties of cinchona were well known and employed by the native races of Peru, Bolivia, Columbia and Ecuador long before its initial use by the Spaniards —a view supported by Sir Henry Wellcome after his expedition to the native forests in 1879.

The story of the first recognised use of cinchona by Europeans, and of its introduction into Europe, forms one of the most romantic pages in the history of medicine. Although cinchonologists differ on details, the principal facts of the story are generally accepted.

It was about the year 1630 that Don Juan Lopez de Canizares, the Spanish corregidor of Loxa, having been ill with an intermittent fever, was cured by a native Indian, who revealed to him the curative properties of cinchona bark.

Shortly afterwards the Countess Chinchon, Francisca Henriquez de Ribera, wife of the Viceroy of Peru, at Lima, became a victim of malarial fever. The Court Physician, Dr. Juan de Vega, having been acquainted of the remedial properties of cinchona by Lopez de Canizares, successfully administered the bark to the Countess.

The date of the cure of the Countess, usually given as 1638, is somewhat uncertain, for, according to the Genoese physician, Sebastian Bardus, the earliest writer on cinchona (1663), Doctor Villerobel, of Valladolid, had stated that the bark was being sold in Spain as early as 1632. Therefore, if the bark was not received in Europe until after the cure of the Countess Chinchon, as all available evidence suggests, either the cure took place much earlier

than 1638, or Villerobel was mistaken in his assertion. In any case, it appears certain that a quantity of the bark was received in Alcalá de Henares in 1639.

As a token of gratitude for her recovery, the Countess Chinchon caused the remedy to be distributed to the fever-stricken poor of Lima, in Peru, through the agency of the Jesuit Fathers of the Collegio de San Pablo in that city. This fact lends support to the assertion of Rompel and other authorities—that the bark was introduced into Europe by the Jesuits. In any case, cinchona was comparatively well known in Spain and Italy soon after the year 1640, and its efficacy and use were being fostered by members of that Order.

The early dissemination and favourable reception of the remedy were due mainly to the activities of the celebrated Spaniard, Cardinal Juan de Lugo (1583–1660), Procurator-General of the Jesuit Order in Rome *(page* 50*)*. In that city, from his palace and from the Jesuit pharmacy, the Cardinal distributed the bark gratis to the suffering poor, with the result that the remedy became known as *Pulvis eminentissimi cardinalis de Lugo*, or *Pulvis cardinalis*.

Notwithstanding the efforts of Cardinal de Lugo and others, however, the universal acceptance of the remedy was only accomplished after a long struggle and in the face of considerable antipathy. But the fierce controversy regarding its value, waged by the European physicians Honoré Fabri (1607–1688), Roland Storms *(b. circa* 1600), Jean J. Chifflet (1588–1660), Vopiscus Plemp (1601–1671) and others, set in motion a process of experimental investigation which had the most important influence upon therapeutical knowledge. In fact, by 1714, the distinguished cinchonologist Ramazzini (1633–1714) had so far realised this fact as to express the opinion that cinchona had done for medicine what gunpowder did for war—a view emphasised by Neuburger in 1910.

The proof of this aphorism could not have been more conclusively demonstrated than it was by the Cinchona International Tercentenary Celebration and Exhibition, held at The Wellcome Historical Medical Museum, London, during the month of December, 1930, at the opening Session of which His Eminence the late Cardinal Bourne,

Archbishop of Westminster, presided. In his opening address His Eminence remarked upon the keen interest in the Celebration and Exhibition shown by the Holy See, by the contributions of historic material over which it had control, and he pointed out that the Exhibition was organised to mark the tercentenary of the first recognised use of cinchona by Europeans, and to illustrate the historical development of the use of this remedial agent, which for three hundred years has proved itself of inestimable value. The rich accumulation of historical material exhibited on that occasion served to manifest the fact that in all the glorious and varied aspects of the history of medicine there exists no more brilliant epic than the long and eventful story of cinchona.

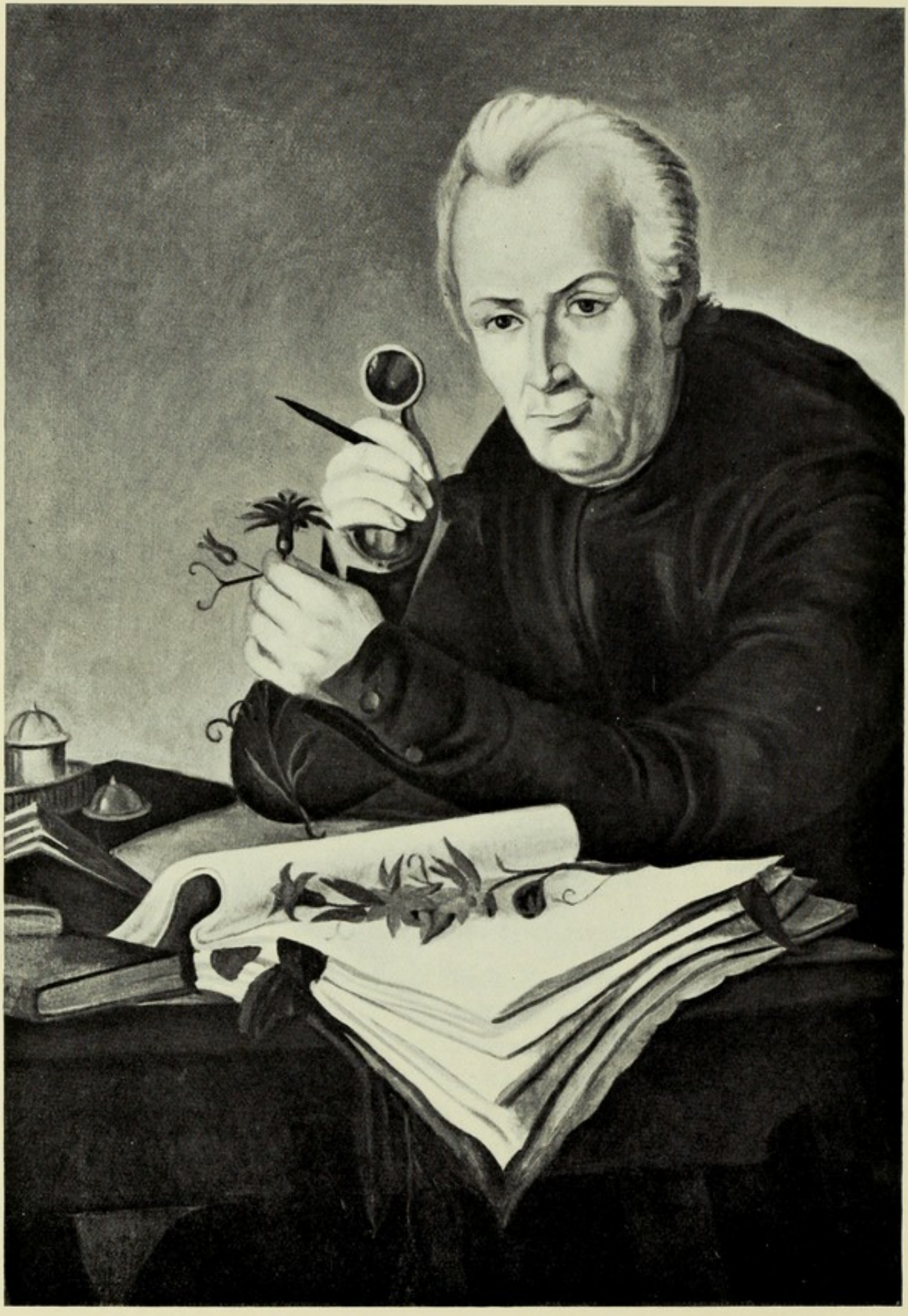
The Prevalence of Malaria in Europe

At the time of the discovery of cinchona the whole of Europe had for centuries been literally reeking with malaria. Facilitated by the numerous ill-drained swamps of low-lying districts, epidemic after epidemic swept over the Continent with a characteristic virulence that assumed pestilential proportions. Towns and villages were decimated; rich and poor alike were stricken with the malady in scores of thousands; whilst whole armies were more effectively incapacitated by intermittent fever than by actual warfare.

Sir John Pringle's survey (1752) of the diseases of the British Army, during its campaigns in the Low Countries, from 1742 to 1748, shows an almost continuous record of military incapacitation by malaria.

Describing the conditions of the Netherlands, he says:—

> "Everywhere is incommoded with water. . . . Low and watery, surrounded with oozy and slimy beaches, it were no better than a large morass. The water underground is everywhere so near the surface that a constantly dry ditch, the sure mark of a healthful situation, is never seen except in the higher lands.
>
> "The epidemic of the hot season, and great endemic of this and other marshy countries, is a fever of an intermitting nature, commonly of tertian shape, but of a bad kind."



JOSÉ CELESTINO MUTIS (1732–1808)
Distinguished Botanist and Cinchonologist
(See page 56)

In the year 1747, referring to certain regiments located in Zealand, Pringle records that during the height of the epidemic over 86 per cent. of the soldiers were at the same time sick with malaria, and, even later in the season, after they had moved into their winter quarters,

> " their sick were in proportion to their men in health, nearly as four to one."

With the Napoleonic Wars fresh in mind, Édouard Désiré Infroit, the French military surgeon, wrote in 1828 :—

> " Among the illnesses which attack the soldier, intermittent fevers fill military hospitals with the greatest number of casualties."

Even in England, where indigenous malaria has for some time been exterminated, as late as from 1850 to 1860, one-twentieth of all the patients of St. Thomas's Hospital, London, were cases of malaria.

It is a curious fact that during the early period of the use of cinchona, when the medical profession of Europe was divided into two warring camps upon the subject of its efficacy, it was the English empiric, Sir Robert Tabor (or Talbor), who achieved outstanding success in its use. Long before his rivals, he discovered the beneficial effects of administering smaller and more frequent doses. To the chagrin of his opponents, he was not only knighted in 1678 by Charles II of England, but by him was sent to the Court of France, where he cured the Dauphin.

The following year Tabor proceeded to Spain and successfully treated the Queen of Carlos II, Maria Luisa de Orleans.

The success of Tabor's practical methods, so brilliantly achieved in the face of his grudging adversaries, formed a landmark in the advance of therapeutical knowledge.

Spanish Botanical Expeditions

Hardly had the struggle been definitely determined in favour of the efficacy of cinchona, than it was discovered that the genus *Cinchona* consisted not of one species but of many, a fact which gave rise to a fresh controversy concerning the relative remedial

merits of the various species. Into this second wordy warfare entered the redoubtable José Celestino Mutis (1732–1808), discoverer of many of the new species *(page 54)*, against Hipolito Ruiz (1754–1818) and José Pavon (1750–1844), their respective disciples Zea, Caldas and others, lending support. Humboldt and Bonpland, who had made an important botanical expedition to the cinchona regions in 1799, also contributed to the subject.

If the contest was embittered the results were of inestimable value to medicine. Not only did it inspire the efforts of analysts to solve the problems involved, which led to the all-important achievement of Caventou and Pelletier in 1820, in isolating the alkaloid quinine, but it prompted the spirit of adventure which formed botanical expeditions eagerly searching for new species of cinchona and new remedies.

Influenced, no doubt, by the impetus imparted through the brilliant botanical achievements of Linnæus, and advised by Pedro Loefling, his pupil, employed by Ferdinand VI, Spain made great contributions to medical knowledge, through the many botanical expeditions organised and sent to South America by the Government authorities. José Iturriaga and Eugenio Alvarado embarked from Cadiz on February 15, 1754; whilst a further expedition went, in 1761, under the leadership of the distinguished José Celestino Mutis, who remained abroad until his death in 1808. In 1777, Hipolito Ruiz and José Pavon conducted another important expedition; further missions being undertaken by Martin Sessé *(d. circa* 1809) in 1788, and Alejandro Malaspina (1754–1809) in 1795.

The work of Mutis, Ruiz and Pavon was of world-wide importance; especially their researches concerning the discovery and identification of the various new species of the genus *Cinchona*, and their therapeutic merits.

The full story of the botanical investigations of these pioneer scientists, and the real importance of their contributions to medical knowledge, has yet to be adequately written.

The Pioneer of Medical Jurisprudence

To Spain belongs the honour of having given birth to the pioneer of medical jurisprudence. Mateo J. B. Orfila (1787–1853), born at Mahon (Minorca) and educated at the Universities of Valencia and Barcelona, afterwards proceeded to Paris, where he became successively Professor of Medical Jurisprudence and of Chemistry. He became famous for his works on toxicology and forensic medicine, and his contributions to the latter subject won for him the handsome tribute :—

> " Few branches of science, so important in their bearing on everyday life, and so difficult of investigation, can be said to have been created and raised at once to a state of high advancement by the labours of a single man."

The Arms of Cardinal Juan de Lugo (1583-1660)

(See pages 50 and 52)

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THE WELLCOME RESEARCH INSTITUTION

AND THE AFFILIATED

RESEARCH LABORATORIES AND MUSEUMS

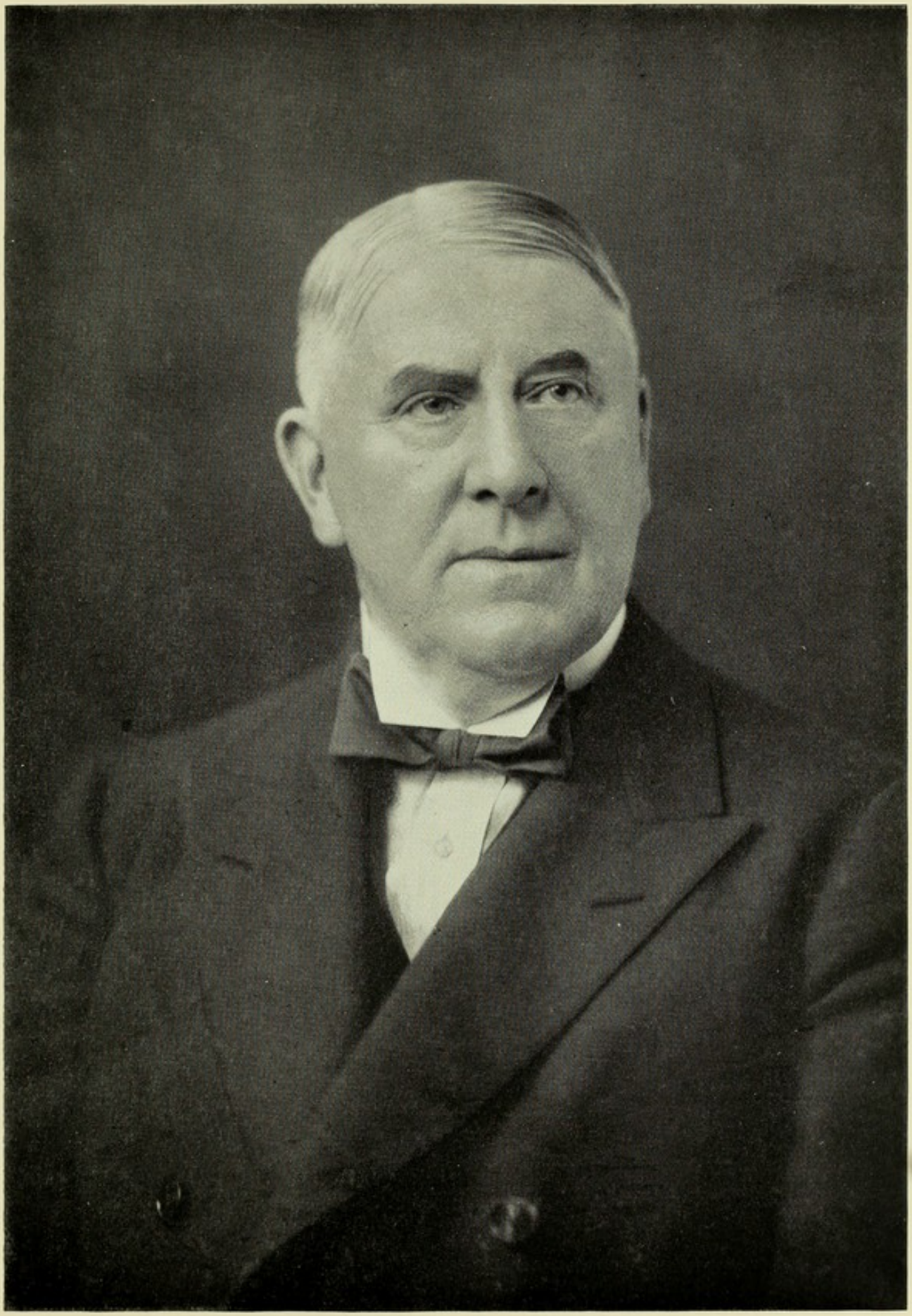
FOUNDED BY

SIR HENRY WELLCOME

LL.D., D.Sc., F.R.S.

THE WELLCOME FOUNDATION LTD.
LONDON, ENGLAND
1935

SECTIONAL INDEX



THE RT. HON. LORD MOYNIHAN, K.C.M.G., C.B., M.S., LL.D.
President of the Royal College of Surgeons of England, 1926–1932

SIR HENRY WELLCOME, LL.D., D.SC., F.R.S.

CEREMONY
OF
LAYING THE CORNER STONE
OF THE
WELLCOME RESEARCH INSTITUTION
LONDON
BY
THE RT. HON. LORD MOYNIHAN OF LEEDS
K.C.M.G., C.B., M.S., LL.D.
PRESIDENT OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND
WEDNESDAY, NOVEMBER 25TH, 1931

[*Extract from Press Report*]

THE ceremony of laying the Corner Stone of The Wellcome Research Institution was performed by Lord Moynihan on Wednesday, November 25th, in the presence of a large and representative company.

Dr. (now SIR HENRY) WELLCOME, in his Introductory Remarks, said: "Your Excellencies, my Lords, Ladies and Gentlemen: The project of constructing this building has long been studied and planned by me. I have been very fortunate in finding a master mind in Mr. Warwick, the famous architect. His architectural ideals correspond with my own, and his sense of the essential features and adaptations of a building for the purposes of the various departmental laboratories and museums complied with our needs.

I have a strong belief in the inspiring influence of graceful, symmetrical architecture, and I have found by experience that artistic environment is not incompatible with the practical operations of scientific research, but, on the contrary, stimulates the mind and facilitates the solution of difficult problems. Whenever I enter the British Museum I feel stimulated by the sublime architectural expression of that noble building. Special tribute should be paid to Mr. Septimus Warwick for his achievement in creating this stately building. Great credit is also due to Messrs. Trollope & Colls, the builders, who have carried out the work of construction with the utmost precision and fidelity.

I have made my remarks very brief, as we are anxious to hear the address of The Rt. Hon. Lord Moynihan, President of the Royal College of Surgeons of England, who has kindly consented to lay the Corner Stone.

Mr. George E. Pearson, the Deputy-Governing Director of The Wellcome Foundation, will now assist me in placing this casket within the Corner Stone."

(A bronze casket containing historical records of the Wellcome Research Laboratories and Museums was then placed within the Stone.)

THIS CASKET, INSERTED IN THE CORNER STONE OF THE WELLCOME RESEARCH INSTITUTION ON THE 25TH NOVEMBER 1931 LAID BY LORD MOYNIHAN OF LEEDS K.C.M.G., C.B., M.S., LL.D., PRESIDENT OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND, CONTAINS HISTORICAL RECORDS OF THE AFFILIATED RESEARCH LABORATORIES AND MUSEUMS FOUNDED BY HENRY S. WELLCOME, LL.D., F.S.A., GOVERNING-DIRECTOR OF THE WELLCOME FOUNDATION LIMITED, LONDON

INSCRIPTION ENGRAVED ON LID OF BRONZE CASKET

Mr. SEPTIMUS WARWICK : Lord Moynihan, I have much pleasure in presenting to you this silver trowel for the purpose of laying the Corner Stone.

(The Corner Stone was then placed in position.)

LORD MOYNIHAN, having duly laid the stone and tested it with the level, announced : I declare this Corner Stone well and truly laid.

Mr. WALLACE ELLIOTT (Managing Director, Messrs. Trollope & Colls) : Dr. Wellcome, I ask you to accept this maul and level, which have been used by Lord Moynihan in laying this Corner Stone. These tools, which are symbols of the ancient and honourable art of masonry, have served their purpose in bringing into existence this building which is a monument of the magnificent services you have rendered to science and humanity, and I hope that you may for many years continue to live and prosper in your good works.

THE ADDRESS

LORD MOYNIHAN : Dr. Wellcome, your Excellencies, my Lords, Ladies and Gentlemen : To-day we lay the corner stone to a life's work. For 40 years Dr. Wellcome has devoted his best energies, and has bestowed his most lavish gifts, with the intention of creating a great research organisation and founding this Institution for medical research. May I briefly recite to you some of his activities during that time. In the year 1894 he founded in London his Laboratory for Physiological Research, which was followed two years later by his Laboratory for Chemical Research.

On the recapture of the Sudan by Kitchener, Dr. Wellcome was one of the first civilians to visit that country, and he there saw, and for some time studied, conditions as they then were ; and he found great opportunities for public service. It was in the year 1900 that he founded The Wellcome Tropical Research Laboratories in connexion with the Gordon Memorial College at Khartoum. The first Director of these Laboratories was Sir Andrew Balfour, who served there for ten years. Attached to that research institution Dr. Wellcome equipped a floating research Laboratory, which cruised through the waterways of the Nile and its tributaries in the Sudan, giving the opportunity for continuous research, and for carrying the benefits of medical research to the people who live in far distant parts of that country.

Dr. Wellcome's activities continued also in this country. In the year 1913 he founded in London the Bureau of Scientific Research, and the Historical Medical Museum. In 1914, he founded the Museum of Medical Science, including Tropical Medicine and Hygiene, and in 1920 he founded the Entomological Field Laboratory.

All these affiliated Research Institutions suffered, however, under one great disadvantage, which all research students will at once appreciate : they were separate from one another, giving no opportunity for that hour-to-hour, or minute-to-minute, consultation which is one of the great advantages of having collective research under the one roof ; but from to-day we see the possibility of that difficulty being overcome. Under the roof of this building the following subjects are to be studied : tropical medicine and hygiene,

medical zoology, entomology and parasitology; there will be twenty-four or more laboratories, including physiological, chemical and various other laboratories. In addition, there will be the Historical Medical Museum and a Museum of Modern Medical Science.

I think you will agree that that is a formidable and very impressive list. (Hear, hear.)

Dr. Wellcome's activities, however, have not been confined to this country; for I have recently been reading an account of the proceedings when he gave great help towards securing the foundation of the Gorgas Memorial Tropical Research Laboratories on the Panama Canal.

One of the conspicuous features of Dr. Wellcome's life-work has been at once its relevance and its opportunism. In all his investigations of tropical diseases he begins in an almost virgin country, and the harvest gathered has been such that not only have many lives been saved and much suffering spared, but vast tracts of country have, for the first time, been made fit for human habitation.

The great need of medicine to-day lies in the direction of increasing the opportunities for medical research, and not less, I think, in the opportunities for creating those competent to undertake medical research.

Physical observation alone—from the time of Hippocrates through our great students, Sydenham, Addison and James Mackenzie—has revealed many secrets which have been so long hidden in connexion with diseases that lay within the orbit of pure investigation, and the conquests of mere observation have been innumerable and of a value beyond all reckoning. Upon it a virile and beneficent art has been built, to the infinite advantage of mankind.

It is within living memory that this most exquisite art has found its opportunities extended and its thought affected by the encouragement and adoption of methods which are seeking to change a practical art into an applied science. Difficulties, of course, have been found all along the way, but experiment in medicine is for ever inevitable.

As a result of experiment in medicine, we are happily gradually replacing anatomy by physiology, and if disease is, in many respects,

merely altered function, then we are about to create a science new to humans, of comparative function in health and in disease. But experiment has done even more for us than that. I think it has strengthened the arm of medicine, and has made the tests more severe for the acceptance of evidence which has been derived by the methods of observation.

Medicine depends, of course, not only for its present stability but for its future advance, upon a large number of ancillary sciences. Those sciences are to be studied in this building. The effect, therefore, on medicine will be considerable; but I hope something better even than that will come out of the work done in this Institution and similar institutions; that is, to create in the minds of the leaders of the profession what my friend Sir Walter Morley Fletcher would like to call "The Religion of Research."

I hope the day is not far distant when those who are to serve upon the teaching staffs of hospitals throughout this country will be permeated by "The Religion of Research," and, in time to come, all members of the teaching staffs will themselves have undergone, in institutions similar to this, a discipline of research.

To-day, in your name, I would like to offer our homage to the man who has made this Institution possible (*applause*), and by his constant thought, and by his most lavish generosity has done as much, I think, as any man has ever done in this or any other country, to make it possible for those who work within our profession to advance both the science and the art of medicine. Dr. Wellcome, for myself and in the name of us all, I offer you our most grateful homage.

Dr. WELLCOME: Lord Moynihan, I am deeply moved by your generous expressions regarding the success of my pioneer efforts and life-work in the field of Medical Research. With grateful heart and deep appreciation I acknowledge your kind tribute. Great credit for the success of my various undertakings is due to the expert chiefs and staffs who have faithfully carried out my plans and purposes. I want to say that I have been fortunate throughout in securing the services of talented young men with good technical education, who, with fidelity and zeal, have entered heart and soul

into the work and developed under the guidance of the highly qualified Directors of my several Research Institutions.

I want especially to express my sincere thanks to you, Lord Moynihan, for having honoured us by your presence to-day and by performing the ceremony of laying the Corner Stone of this Institution.

THE WELLCOME RESEARCH INSTITUTION

During many years The Wellcome Foundation Ltd. has maintained medical and chemical research laboratories and museums. Developments in the operations and scope of these institutions necessitated extension and co-ordination of their activities.

With this object in view the Foundation has constructed a new Research Building which forms the headquarters of The Wellcome Research Institution, embracing the following affiliated Research Laboratories and Museums :—

BUREAU OF SCIENTIFIC RESEARCH
ENTOMOLOGICAL FIELD LABORATORIES
PHYSIOLOGICAL RESEARCH LABORATORIES
CHEMICAL RESEARCH LABORATORIES
MUSEUM OF MEDICAL SCIENCE
HISTORICAL MEDICAL MUSEUM

In this building accommodation and the most modern scientific equipment are provided for all the above except The Physiological Research Laboratories, which are located at Langley Court, Beckenham, Kent (Eng.), with grounds of more than 100 acres of park-land ; and the Entomological Research Field Laboratories, which are situated in spacious open country at Claremont, Esher, Surrey (Eng.).

The Building

The building has nine floors and occupies a ground area measuring 225 feet by 135 feet facing on three thoroughfares.

The architecture is of the Grecian-Ionic order. On the main façade, which fronts on the Euston Road, there are twelve Ionic columns. The central four columns are free standing, and are surmounted by a pediment, from each side of which extends a balustrade.

The building is of Portland stone. The main entrance doors, vestibule doors, and the doors between the galleries on the upper floors, are all of bronze, as are also the balustrade railings and gates, lift cars, garage doors, windows, electrical fittings, door frames, hand rails and radiator grilles.

The internal appointments and equipments have been designed to afford every facility for efficient working. The heating and ventilating systems are of the most scientific and modern types, maintaining adequate ventilation and uniform room temperature. The auditorium, with a seating capacity of 500, has been designed to attain a high acoustic efficiency.

THE WELLCOME RESEARCH INSTITUTION

Embracing the following affiliated Research Laboratories and Museums:

THE BUREAU OF SCIENTIFIC RESEARCH

Founded 1913.

The study and investigation of medical problems, more particularly in their relation to tropical medicine and hygiene. (*Pages* 73-87)

AFFILIATED LABORATORIES AND MUSEUMS

THE ENTOMOLOGICAL FIELD LABORATORIES

Founded 1920.

Researches into the life-history and habits of noxious insect pests. (*Pages* 86-89)

THE PHYSIOLOGICAL RESEARCH LABORATORIES

Founded 1894.

Therapeutic investigations in Bacteriology, Physiology, Pharmacology, Serology and Veterinary Medicine. (*Pages* 88-92)

THE CHEMICAL RESEARCH LABORATORIES

Founded 1896.

Chemical investigations and researches, particularly in connexion with organic, organo-metallic and synthetic medicaments. (*Pages* 93-97)

THE MUSEUM OF MEDICAL SCIENCE

Founded 1914.

Presents a new system of visual teaching and a general survey of human disease from every aspect. (*Pages* 98-109)

THE HISTORICAL MEDICAL MUSEUM

Founded 1913.

Illustrates the evolution and practice of medicine, surgery and allied sciences throughout the world from pre-historic times. (*Pages* 110-116)

THE MAIN HALL—LOOKING WEST
THE WELLCOME RESEARCH INSTITUTION

FOUNDED IN 1913

THE WELLCOME BUREAU OF SCIENTIFIC RESEARCH

183, EUSTON ROAD, LONDON, N.W.1

C. M. WENYON, C.M.G., C.B.E., M.B., B.S., B.Sc., F.R.S.

DIRECTOR-IN-CHIEF

The Bureau was founded by Dr. (now Sir Henry) Wellcome in 1913, and to it are affiliated the research laboratories and museums referred to herein. Originally located at Henrietta Street, London, W., its first Director-in-Chief was Sir Andrew Balfour, distinguished authority on tropical medicine, who for the previous ten years had been Director of The Wellcome Tropical Research Laboratories, at the Gordon Memorial College, Khartoum.

Extensive reports of the work in these Laboratories at Khartoum have been published. As chief health officer, Sir Andrew sought and destroyed the breeding-places of mosquitoes, eliminated malaria and made Khartoum the most healthy city in Africa. The death-rate was reduced from 70 to 7 per mille. The Governor-General of the Sudan reported that no words of his could adequately express the value of Sir Andrew Balfour's services to the country. Sir Andrew Balfour was succeeded at Khartoum by the late Dr. A. J. Chalmers and later by Major R. G. Archibald, the present Director, who has been associated with The Wellcome Tropical Research Laboratories, Khartoum, with great distinction for twenty years.

The Wellcome Bureau of Scientific Research, which was reconstructed and enlarged in 1926, has been greatly extended in the new building, which houses a large number of affiliated Research Laboratories devoted to the study and investigation of medical problems, especially in relation to tropical medicine and hygiene. In addition to Research Laboratories, an art studio, photographic department and a number of auxiliary rooms are devoted to the preparation of specimens for research, sterilisation and other purposes.

At The Wellcome Bureau of Scientific Research and affiliated Laboratories investigations are conducted in various branches of medical science, medical zoology, parasitology, bacteriology, pathology, chemo-therapy and other subjects.

The research library in the building contains representative standard works, reprint files and current medical literature dealing more especially with the research departments mentioned above.

Routine teaching is not undertaken at the Bureau, but, when practicable, individual research workers who wish to follow any particular line of investigation may be given accommodation and facilities for their studies.

Information is supplied gratis to medical men, health officers and others in all parts of the world, with a view to assisting them in their work and investigations.

The results of the researches carried out at the Bureau and at its affiliated Laboratories are published for the most part in various current scientific periodicals and transactions. In addition, publications dealing with special subjects are issued from time to time.

In 1913, Dr. Wellcome placed the services of Dr. Louis Sambon, a member of the staff of The Wellcome Bureau of Scientific Research, at the disposal of the official Pellagra Investigation Committee, in order that the previous investigations, commenced with Dr. Wellcome's assistance in Italy in 1910, might be continued.

In 1914, Dr. Wellcome sent Sir Andrew Balfour, then Director-in-Chief of this Bureau, on a mission to the West Indies and the South American Tropics for the purpose of investigating certain local problems in tropical diseases.

Sir Andrew visited Barbados, Grenada, Trinidad and Venezuela, whence, after travelling up the Orinoco River to Ciudad Bolivar, he worked his way back to the coast and visited Caracas and the island of Curaçao, thence proceeding to Maracaibo and subsequently to Port Colombia. He travelled south on the Magdalena River to Mariquita and thence, partly by steamer and partly by mountain railway, to Bogotá, the capital of Colombia. The return was made by trekking westwards by mountain, forest and valley, to the Rio Atrato and then northwards to Cartagena. Sir Andrew next visited the Panama Canal Zone, Jamaica and Cuba. In Panama he visited, and conferred with, General Gorgas, by whose genius results were achieved similar to those obtained by Sir Andrew Balfour at Khartoum. Malaria and other tropical diseases were

exterminated and the death-rate reduced from a similar high figure to 7 per mille. Sir Andrew published the results of his investigations during this Expedition in the "Transactions of the Royal Society of Tropical Medicine and Hygiene," and in a volume under the title "War Against Tropical Disease," published by the Bureau.

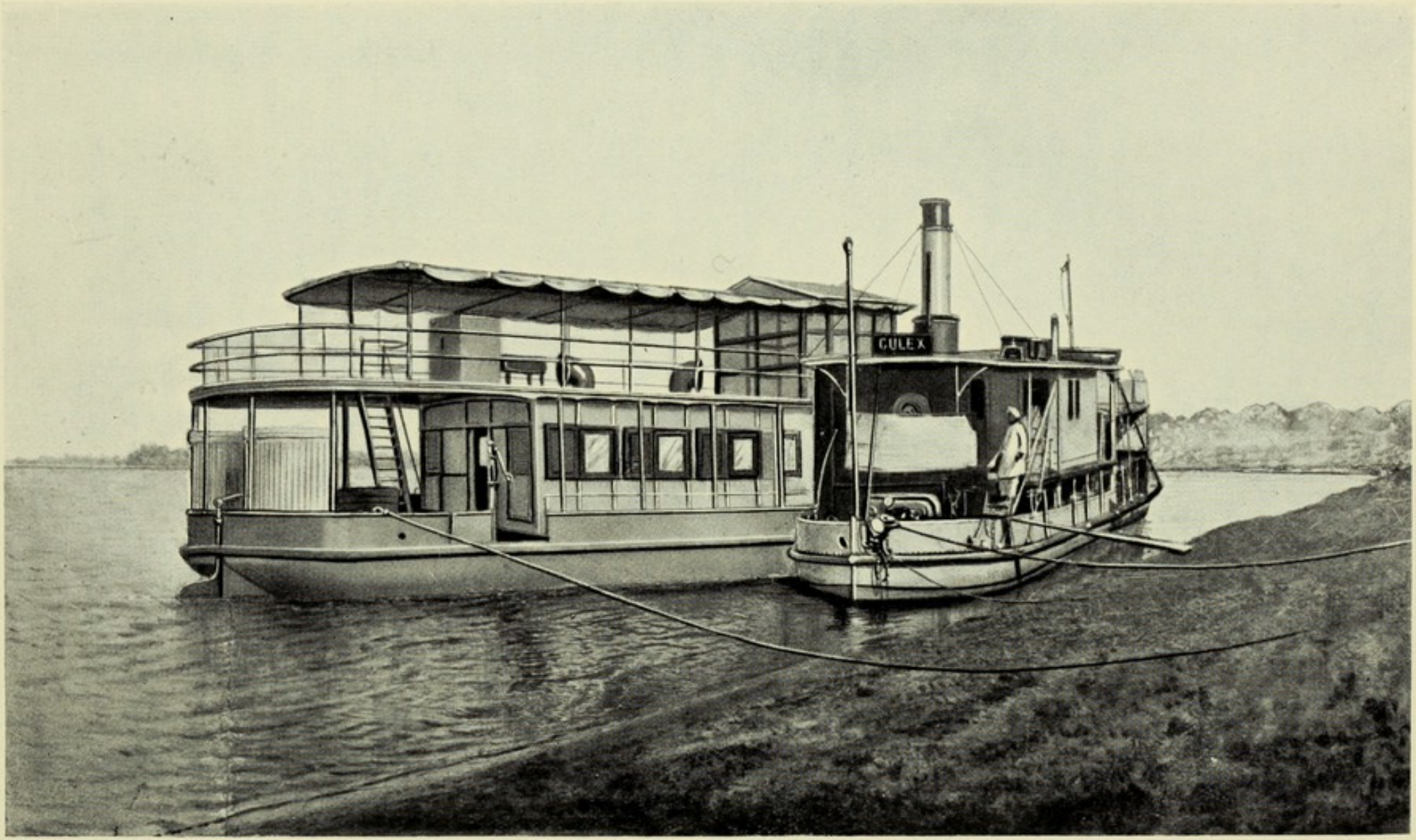
Dr. Wellcome placed the Bureau of Scientific Research and its staff and resources wholly at the disposal of the British War Office throughout the Great War (1914–1918), and members of the Bureau staff were appointed to official positions in connexion with the Army Medical Hospitals in England and in the various fields of action, especially in tropical and sub-tropical areas. The work included the training of Army Medical officers for service in tropical regions.

In 1915, Sir Andrew Balfour was sent to France for the purpose of studying and advising on the possibility of improvements in ambulance equipment, and in connexion with the sanitary problems of the army. Later in the same year, with the rank of Lieutenant-Colonel, he was appointed a member of the Army Medical Advisory Committee in the Near East, serving in Gallipoli, Macedonia and Egypt.

In 1916, as President of the British Army Medical Advisory Committee, Sir Andrew proceeded to India and Mesopotamia. The Medical Advisory Committee in the Near East and Mesopotamia inspected in detail every organisation concerned with the health of the troops, and reported its findings, with recommendations, not only to the War Office, but also to the local commanders, who were able immediately to take advantage of the advice and to effect a great improvement in the health of the forces.

In 1917, Sir Andrew Balfour accompanied the Inspecting Major-General as his Scientific Adviser to East Africa, where again his unrivalled experience was the means of improving the health and sanitary conditions of the Army. In 1918, he was appointed President of the Egyptian Public Health Commission to formulate a plan for the reorganisation of the public health service in Egypt.

On the completion of that work, Sir Andrew Balfour proceeded to Palestine on the request of General Allenby. During the war he wrote "The Medical Entomology of Salonica" and "Memoranda on Some Medical Diseases in the Mediterranean War Area." Both



THE WELLCOME FLOATING RESEARCH LABORATORY ON THE NILE
WITH ITS TENDER S.W. "CULEX"

Fitted and equipped with the most up-to-date scientific technical appliances

these publications proved of much value, the latter especially being constantly used by practically every medical officer in the tropical and sub-tropical areas.

In accordance with Dr. Wellcome's offer and at the request of the British War Office, in 1915, Dr. Wenyon,* the present Director-in-Chief, was appointed to conduct, at The Wellcome Bureau of Scientific Research, tutorial classes in the diagnosis of protozoal infections for medical officers who were destined for service in the tropical and sub-tropical war areas. Late in 1915 he also lectured to troops on the principles of protective vaccination against typhoid fever and other diseases.

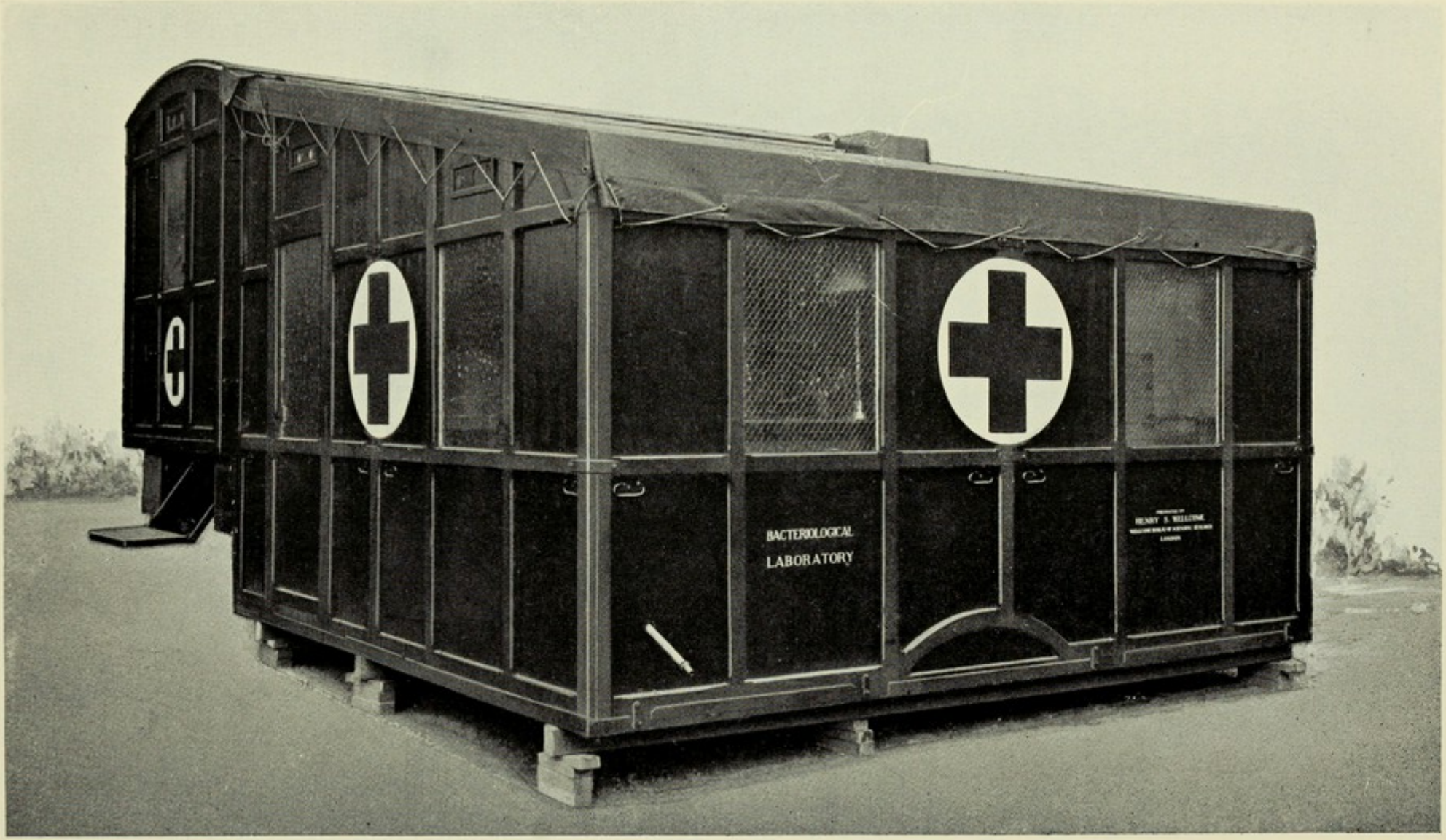
In 1916, with the rank of Lieut.-Colonel, Dr. Wenyon joined Sir Andrew Balfour on the Medical Advisory Committee, and, in Egypt, conducted investigations into the amœbic dysentery and other intestinal protozoal infections.

These researches led to important results, including the discovery of new organisms, the method by which dysentery is spread by flies, the most effective mode of administration of emetine for amœbic dysentery, and the identification of large numbers of amœbic dysentery carriers, not only amongst troops stationed in Egypt, but also amongst those just arriving from England. The immediate result was that a large amount of detention in hospital of apparently healthy men was saved, and the establishment of many unnecessary diagnostic centres was obviated. The conclusion reached was that a clinically healthy man was fit for service whether he were a

* Prior to his connexion with The Wellcome Bureau of Scientific Research, Dr. Wenyon had been associated with Sir Andrew Balfour at The Wellcome Tropical Research Laboratories, Khartoum. In 1907, Dr. Wenyon was appointed in charge of the Wellcome Floating Laboratory, by means of which he was able to carry out successful researches in pathology, protozoology, etc., on the Nile and its tributaries from Khartoum as far south as six degrees north latitude.

This Floating Research Laboratory is believed to be *the first* in the world. It is a two-decked vessel equipped by the founder of The Wellcome Tropical Research Laboratories, and operates as efficiently as any modern scientific research laboratory on land.

As an auxiliary to the chief Laboratories at Khartoum, it enables valuable research work to be carried out in remote parts of the country otherwise difficult or impossible of access to the research worker.



THE ARMY MEDICAL MOTOR FIELD LABORATORY

Exterior view. Body and Annexe fully erected for use

carrier or not. The results of the investigations are described in detail in "Human Intestinal Protozoa in the Near East," by Dr. Wenyon and his collaborator, Dr. F. W. O'Connor.

Later in 1916, Dr. Wenyon proceeded with the Committee to India and Mesopotamia. In 1917, he was appointed consultant on malaria to the Salonica Expeditionary Force, and, in charge of the Malaria Enquiry Laboratory, carried out and organised researches into the method of spread, incidence, treatment and prevention of malaria.

A full account of the work Dr. Wenyon carried out appears in "Malaria in Macedonia," published in the "Journal of the Royal Army Medical Corps," and in the "Medical History of the War," the latter embracing malaria as it affected troops in all the War areas. In the post-war period, 1918–1920, with the rank of Colonel, Dr. Wenyon was appointed consultant pathologist to the Army of the Black Sea, serving in Turkey and the Caucasus.

On departure from the Wellcome Bureau of Sir Andrew Balfour and Dr. Wenyon on war service, in 1915–1916, Dr. Stevenson was appointed Acting-Director of the Bureau, and the tutorial classes were continued there by Mr. Clifford Dobell. Dr. Stevenson and other members of the staff of the Bureau carried out extensive and important investigations on amœbic dysentery and other protozoal infections amongst troops invalided from abroad, particularly in the Dominion and Colonial Hospitals in this country.

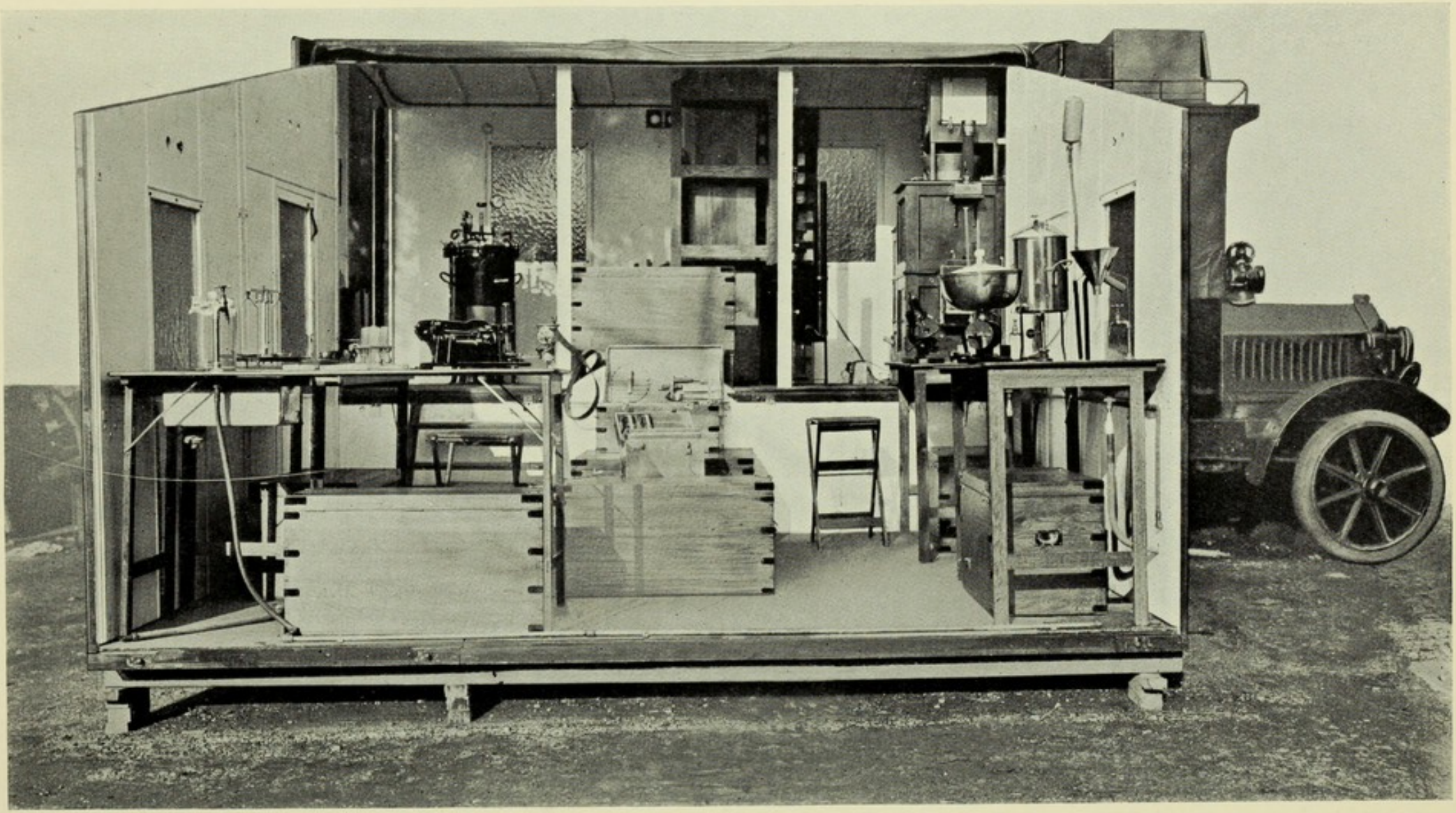
In 1915, Dr. Wellcome organised a special War Ambulance Construction Commission and provided a prize fund for the purpose of securing improvements in motor ambulances for service field work, etc.

The Commission consisted of :

Sir Frederick Treves, Bart., G.C.V.O., C.B., F.R.C.S., Chairman British Red Cross Society.

Major-General Sir John Cowans, K.C.B., M.V.O., Quartermaster-General to the Forces.

Surgeon-General Sir Arthur May, K.C.B., Director-General, Medical Department, R.N.



THE ARMY MEDICAL MOTOR FIELD LABORATORY

Presented to the British War Office by Dr. Wellcome, and used during and since the Great War in Palestine, Mesopotamia, Egypt, etc. View of a section and its equipment after removal of one end of annexe. The whole can be put together or packed for transport in two hours

Surgeon-General Sir Alfred Keogh, K.C.B., Acting Director-General Army Medical Service.

The Right Hon. Sir Claude MacDonald, P.C., G.C.M.G., K.C.B., St. John Ambulance Association.

Sir John Furley, C.B., St. John Ambulance Association.

The Right Hon. Lord Montague of Beaulieu.

Prof. W. E. Dalby, M.A., M. Inst. C.E., M.I. Mech. E., F.R.S.

John Robertson, Esq.

Sir Andrew Balfour acted as Honorary Secretary and Treasurer of the Commission.

Two hundred and thirty-three designs were submitted and considered by the Commission, who, as a result, were enabled to bring many improvements to the notice of the Admiralty, War Office, British Red Cross Society, St. John Ambulance Association and other bodies.

The best designs were submitted by Army service competitors, who, unfortunately, according to official regulations, were not permitted to accept the awards. Dr. Wellcome therefore diverted the prize fund of £2000 to the construction of a Mobile Medical Field Laboratory, which he presented to the British War Office early in 1918, through the Bureau of Scientific Research.

This Medical Motor Field Laboratory was attached to the British Army during the campaign in Palestine, Mesopotamia and Egypt as a Mobile Laboratory. It enabled the bacteriological work of the Army to be promptly carried out in the field for all Hospital Camps within a radius of more than 10 miles of headquarters. This work covered blood films for malaria and relapsing fever, blood cultures, fæcal examinations for dysentery and cholera, agglutination tests for typhoid, paratyphoid and typhus. During the final advance the mobility of the Laboratory largely extended its field of utility. The malarial work increased greatly, and as many as 600 blood films were examined daily. Much of the success of the Laboratory during the campaign was due to the efficiency of the Officer-in-Charge, Dr. J. D. Benjafield. After the Armistice the Laboratory was detailed to work on the widespread influenza epidemic which

then prevailed. In 1919, it proceeded to Egypt, where it enabled valuable work to be carried out.

After the War Sir Andrew Balfour returned to his post at the Bureau of Scientific Research, and later his services were placed by Dr. Wellcome at the Government's disposal for the purpose of investigating conditions and making recommendations for improving the health of Mauritius, which at that time was devastated by disease. He made tours of investigation also in respect to tropical diseases and sanitation in the West Indies. The results of Sir Andrew's investigations are given in a series of seven detailed Government reports, each one dealing with sanitary matters in a particular area. Recommendations were made for improvements in relation to water supplies, refuse destruction, ankylostomiasis, schistosomiasis, dysentery, plague and malaria, while it was shown that there was scope for the re-organisation and extension of the sanitary and hospital services, including laboratory facilities.

Subsequently (1922), Dr. Wellcome placed the services of Dr. MacGregor, Entomologist to The Wellcome Bureau of Scientific Research, at the disposal of the Colonial Office for the purpose of studying the mosquitoes of Mauritius. Dr. MacGregor discovered the presence in the Island of a second species of malaria-carrying mosquito and determined the distribution of the mosquitoes and the factors favouring their development. A scheme of control was elaborated and recommendations for the development of anti-malarial work were given. A full report of Dr. MacGregor's investigations was published by the Bureau under the title " Mosquito Surveys."

In 1923, Sir Andrew Balfour retired from his post as Director-in-Chief of The Wellcome Bureau of Scientific Research and was succeeded by Dr. Wenyon. Sir Andrew Balfour was subsequently appointed Director of The London School of Hygiene and Tropical Medicine.

SCIENTIFIC PUBLICATIONS AND RESEARCH REPORTS

The Wellcome Bureau of Scientific Research has issued

322 Scientific Publications and Research Reports

DESCRIPTIONS OF

THE AFFILIATED SCIENTIFIC LABORATORIES AND MUSEUMS

WITH BRIEF ACCOUNTS OF

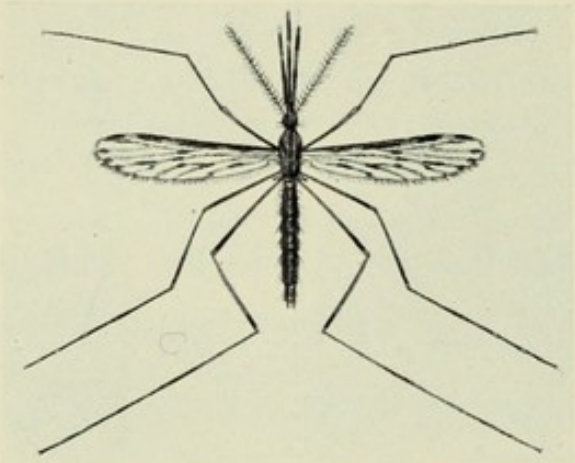
SOME EXHIBITS FROM THE WELLCOME RESEARCH INSTITUTION

SHOWN AT THE

CHICAGO EXPOSITION, 1934

Following the descriptions of the affiliated Scientific Laboratories and Museums which are embraced by The Wellcome Research Institution, is a short account of *some* of the notable exhibits shown at the International Exposition held at Chicago in 1934 *(see pages* 85, 89, 92, 95 *and* 103*)*.

The brief descriptions of these exhibits serve to illustrate further the character of the work of the Institution in its relation to the progress of medical science.



ANOPHELES WELLCOMEI

A new species secured during mosquito work on the Nile by the Director of The Wellcome Tropical Research Laboratories, Khartoum

NOTABLE EXHIBITS FROM THE WELLCOME BUREAU OF SCIENTIFIC RESEARCH SHOWN AT THE CHICAGO EXPOSITION, 1934

HALL OF SCIENCE

The work of this Research Bureau was demonstrated by exhibits dealing with investigations of diseases, particularly those prevalent in tropical and sub-tropical lands.

Department of Helminthology

The exhibit consisted of a small collection of human and other tapeworms *(Cestoda)* demonstrating the varieties of these parasites, which vary greatly in size, from the fish tapeworm *(Diphyllobothrium latum)* found in man, which may be 10 metres (30 feet or more) in length, down to almost microscopic forms, such as the "dwarf" tapeworm of the mouse *(Hymenolepis nana)*.

Departments of Entomology and Protozoology

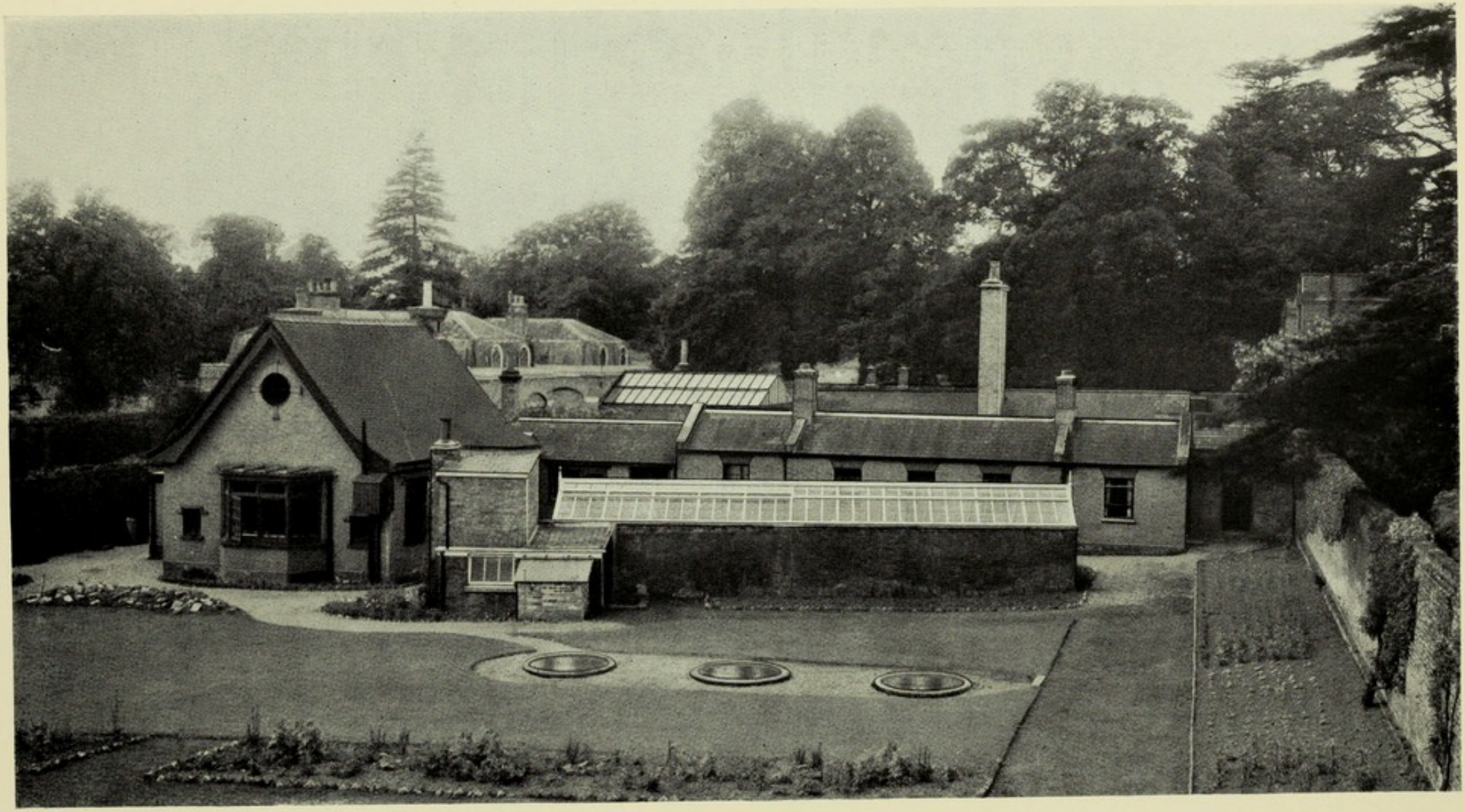
AFRICA.—Sleeping Sickness in man, and also nagana and other diseases of domestic animals, are caused by trypanosomes, organisms which are transmitted through the bite of the tsetse-fly *(Glossina palpalis)*, one of the most important blood-sucking flies of Central Africa.

The exhibit included illustrations of the fly, its complete life-history and the structure of its biting parts.

Also illustrated was the life-history of a crocodile trypanosome, which is also conveyed by a tsetse-fly.

Department of Experimental Pathology

Specimens and illustrations of Rift Valley Fever—a very fatal disease of sheep in Kenya Colony, Africa, which also affects man, causing fever with headache and pains in the limbs. It is caused



THE WELLCOME ENTOMOLOGICAL FIELD LABORATORIES, CLAREMONT, ESHER, SURREY (ENG.)
Affiliated to The Wellcome Bureau of Scientific Research

by a filterable virus, and much work on this and allied diseases has been carried out at The Wellcome Bureau of Scientific Research.

Department of Bacteriology

This Department in its exhibit illustrated the importance of *Electric Charge in certain Immunity Reactions.* This work suggests possibilities in the treatment of certain diseases and throws fresh light upon the problem of immunity.

Another exhibit dealt with the *Differentiation of Bacterial Types* by the fermentation of salts of organic acids. Practical use of this research has been made by the Metropolitan Water Board of London (Eng.).

The date of its publication (1921) establishes that the method was first originated in The Wellcome Bureau of Scientific Research.

ESTABLISHED IN 1920

THE WELLCOME ENTOMOLOGICAL FIELD LABORATORIES

OF THE

BUREAU OF SCIENTIFIC RESEARCH

B. JOBLING, F.R.ENT.S.

ENTOMOLOGIST

These Entomological Field Laboratories were originally located in the Royal Horticultural Society's Gardens at Wisley, Surrey (Eng.), where, through the courtesy of the Society's Committee and the Director of the Gardens, facilities had been granted for the study of the insect pests harboured by the plant life in the Gardens.

These Laboratories have now been transferred to more commodious premises at Claremont, Esher, Surrey (Eng.), demanded by the extensive development of the work.

The Laboratories carry on researches into the life-history and habits of such noxious insect pests as mosquitoes, etc., a careful study of which in the field affords the surest means of discovering methods for their control and extermination.

MAIN RESEARCH BUILDING, THE WELLCOME PHYSIOLOGICAL RESEARCH LABORATORIES
LANGLEY COURT, BECKENHAM, KENT (ENG.). FOUNDED IN 1894
Affiliated to The Wellcome Bureau of Scientific Research

NOTABLE EXHIBITS FROM THE WELLCOME ENTOMOLOGICAL FIELD LABORATORIES

SHOWN AT THE

CHICAGO EXPOSITION, 1934

HALL OF SCIENCE

NEW METHODS in Entomological Research were illustrated by various appliances, such as safety containers for infected mosquitoes, apparatus for collecting and observing mosquitoes.

A special pump for aerating the water in which developmental forms of mosquitoes live, and a type of bird case for use in experimental malaria work were shown.

On an easel, illustrations were displayed demonstrating the conditions found during the investigation of malaria in Mauritius. During this investigation a new malaria-carrying mosquito *(Anopheles funestus)* was discovered and a report made upon the steps necessary for prevention of malaria in the Island.

FOUNDED IN 1894

THE WELLCOME PHYSIOLOGICAL RESEARCH LABORATORIES

Langley Court, BECKENHAM, KENT (ENG.)

R. A. O'BRIEN, C.B.E., M.D., B.S., D.P.H.

DIRECTOR

The development of Therapeutics from a largely empirical code into an experimental science is one of the most striking and significant results of the world-wide scientific activity which has characterised the past half-century. The change has been brought about by the immense advances in the contributory sciences of Pathology, Bacteriology, Physiology and Pharmacology, which, indeed, may

all be said to date their history as experimental sciences from within the same period.

The necessity for this development, and a desire to promote original research in these fields, led to the foundation, in 1894, of The Wellcome Physiological Research Laboratories, the activities of which cover a wide field of therapeutic investigation in Bacteriology, Physiology with Pharmacology, Serology and Veterinary Medicine. These Laboratories are located at Langley Court, Beckenham, Kent (Eng.), and occupy an estate of more than 100 acres of park land.

There are eight main buildings and approximately 90 laboratories and auxiliary offices.

The production of anti-sera and of bacterial preparations for specific inoculation, and the researches in bacteriology and the mechanism of immunity arising from the development of this Department of Therapeutics, have been an important part of the work of these Laboratories from the time of their foundation. During the late Great War many million doses of Tetanus Antitoxin Serum were supplied for the troops from these Laboratories.

These Laboratories also took a very prominent part in the research development and production of gas-gangrene antitoxin, of which also great quantities were supplied to the military authorities in the various war areas. Since the war, this antitoxin has been widely employed in abdominal surgery, puerperal septicæmia, and in grossly-infected wounds.

These Laboratories were pioneers in the production and introduction of anti-diphtheritic and other sera, and by extensive original research have from the first done much to raise the standard of this group of medicaments and to maintain production at a high level of concentration and efficiency.

The Pharmacological Department carries on pioneer investigations into the mode of action and the nature of the medicinal agents of vegetable, animal and mineral origin, and the production by synthesis of substances identical with, or related to, the naturally-occurring active principles, both in structure and in physiological action. Numerous medicinal agents have been investigated from all points

of view in The Wellcome Physiological Research Laboratories, and many have been physiologically examined.

As an example, the discovery and isolation of ergotoxine, now admitted to be an active therapeutic constituent of ergot, was carried out in these Laboratories in 1906, during the directorship of Dr. H. H. Dale.* This was followed by the isolation of the associated amines, 'Tyramine' and 'Ergamine' (Histamine), which were found also to possess definite physiological activity.

Incidental to this pharmacological work has been research on the purely physiological problems which it suggests and involves.

The Wellcome Physiological Research Laboratories were pioneers in the physiological standardisation of medicinal products and have done a vast amount of original work, particularly in regard to the standardisation of sera, ergot, strophanthus, digitalis, etc. Methods have also been originated and developed for controlling and standardising by physiological experiment the activity of these and other organic medicinal agents to which chemical methods of assay are not applicable.

Amongst many departments of research, the Veterinary Section has carried out numerous valuable investigations into the ætiology, prophylaxis and treatment of diseases of domestic animals. Already notable contributions to knowledge regarding prophylaxis and treatment of lamb dysentery, braxy, canine jaundice and distemper, and diseases of poultry, have been made as the results of specialised investigations by research workers in this department, and suitable prophylactic sera and vaccines have been issued for use by the veterinary profession. This work forms a very important part of the Laboratories' activities and is being developed progressively.

While devoted primarily to original research, the results of which appear from time to time in scientific publications, the Laboratories have performed much valuable work of a utilitarian nature.

SCIENTIFIC PUBLICATIONS AND REPORTS

The Wellcome Physiological Research Laboratories have issued

More than 350 Scientific Publications and Research Reports

* *Journal of the Chemical Society*, Vol. 91, *page* 337

NOTABLE EXHIBITS FROM THE WELLCOME PHYSIOLOGICAL RESEARCH LABORATORIES

SHOWN AT THE

CHICAGO EXPOSITION, 1934

HALL OF SCIENCE

Charts, photographs and other exhibits illustrate recent research work carried out in these Laboratories and dealing with *Diphtheria*, *Tetanus* and *Staphylococcus Antitoxins*.

Methods of preparation, concentration, testing, standardisation, etc., were shown, and the progress made in recent years demonstrated.

The reduction of mortality during the Great War, resulting from the use of tetanus and anti-gas-gangrene antitoxin, was strikingly demonstrated.

Extensive pioneer work of an important character has been carried out in these Laboratories in the preparation of concentrated sera. Special interest therefore attached to the exhibit demonstrating the advances made.

Pharmacological Exhibits included specimens of the Salts of Ergotoxine and the other active principles of Ergot, first isolated by The Wellcome Physiological Research Laboratories. Photographs showed the physiological action of these alkaloids on the blood-pressure and uterus.

Biological assay, as carried out in the Laboratories by new methods and by instruments of great delicacy and precision, was illustrated.

VETERINARY RESEARCH WORK, as carried out at The Wellcome Physiological Research Laboratories, includes in its survey Lamb Dysentery, Dog Distemper, Braxy in Sheep, Yellows in Dogs (Canine Jaundice), Bacillary White Diarrhœa in Poultry, Tetanus in Horses, Fowl Pox.

FOUNDED IN 1896

THE WELLCOME CHEMICAL RESEARCH LABORATORIES

183, EUSTON ROAD, LONDON, N.W.1

T. A. HENRY, D.Sc. (LOND.)

DIRECTOR

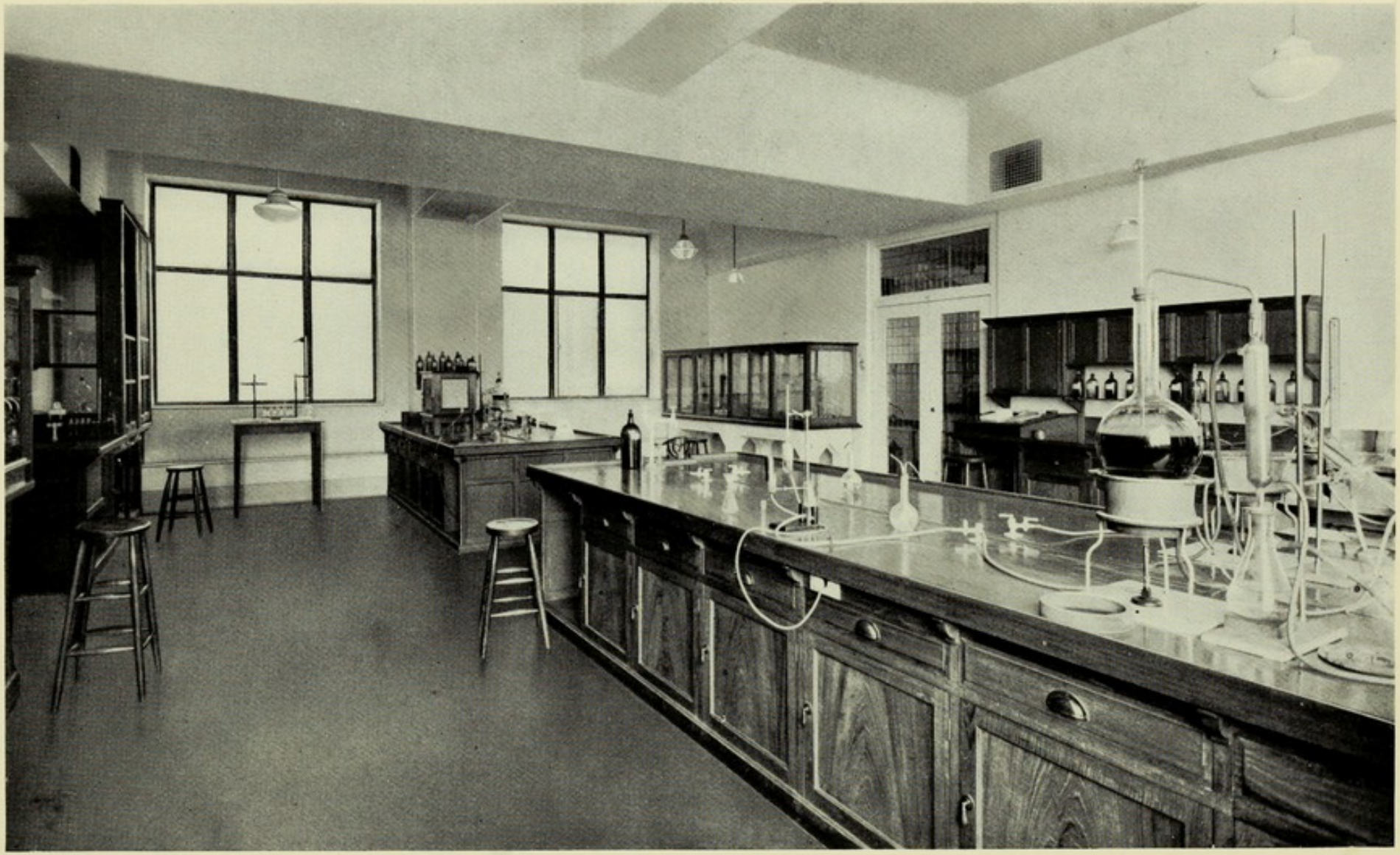
When these Chemical Research Laboratories were founded, in 1896, Frederick B. Power, Ph.D., LL.D., especially distinguished for his researches in plant chemistry, was appointed Director, which appointment he held for more than 18 years, and left a remarkable record of scientific achievement.

Thirty-nine years ago little was known regarding the composition of many of the natural drugs in common use, the production of synthetic medicinal agents was just beginning, and few chemists had the temerity to work at such biological problems as the isolation of hormones. The advance in therapeutics made since then has been mainly in these three directions, and the work done in these Laboratories has been of the wide range necessary to keep in touch with these lines of progress.

Exhaustive investigations of a large number of natural drugs have been carried out and their active principles isolated and characterised. In co-operation with The Wellcome Physiological Research Laboratories, these have been examined pharmacologically and, as a result, the use in medicine of many natural remedial agents has been placed on a sound scientific basis.

In some instances alkaloids and other active principles of plants have for the first time been made available to the physician in a pure condition.

The information gained in these investigations has suggested new lines of work for the production of synthetic drugs, and many new substances of this character have been prepared and tested.



A Section of one of The Wellcome Chemical Research Laboratories
183, Euston Road, London (Eng.), N.W.1

With the co-operation of The Wellcome Bureau of Scientific Research and The Wellcome Physiological Research Laboratories, much attention has been given to work on organo-metallic compounds for the treatment of specific protozoal diseases.

These varied investigations have involved the solution of many purely chemical problems, and have therefore led to valuable additions to our knowledge of pure chemistry, as well as to results of practical therapeutic value.

SCIENTIFIC PUBLICATIONS AND REPORTS

The Wellcome Chemical Research Laboratories have issued

More than 286 Scientific Publications and Research Reports

NOTABLE EXHIBITS FROM THE WELLCOME CHEMICAL RESEARCH LABORATORIES SHOWN AT THE CHICAGO EXPOSITION, 1934 HALL OF SCIENCE

The exhibits of these Laboratories were devoted mainly to demonstrations of investigations dealing with substances employed in the treatment of disease.

Anti-Malarial Agents

(*a*) Effects of cultivation of Cinchona on yield of Alkaloids, particularly quinine ;

(*b*) Mixed cinchona alkaloids ; " Totaquina " ;

(*c*) Principal alkaloids of cinchona—specially purified ;

(*d*) Modified cinchona alkaloids for trial in bird malaria ;

(*e*) Natural drugs with local reputations as remedies for malaria.

PART OF EXHIBIT OF THE WELLCOME RESEARCH INSTITUTION—HALL OF SCIENCE, CHICAGO EXPOSITION

GROUP H.—Booths 1 and 12 in the foreground. Booths 13 and 24 in the distance.

Amœbicidal Agents

Researches on the alkaloids of Ipecacuanha.

Kurchi Bark and its constituent alkaloids.

Alleged cures for dysentery.

Anthelmintics

Researches on Chenopodium or American Wormseed oil; Specimens of constituents, including the sole active principle —Ascaridole.

Phenols prepared for trial in hook-worm disease.

Species of Artemisia examined for santonin.

Antimonial Substances

Drugs representative of the "emetics" used in the treatment of sleeping sickness and bilharzia, and of organic compounds of antimony derived from *p*-aminophenylstibinic acid; the efficiency of the latter series in the treatment of kala azar is a noteworthy achievement of chemotherapy.

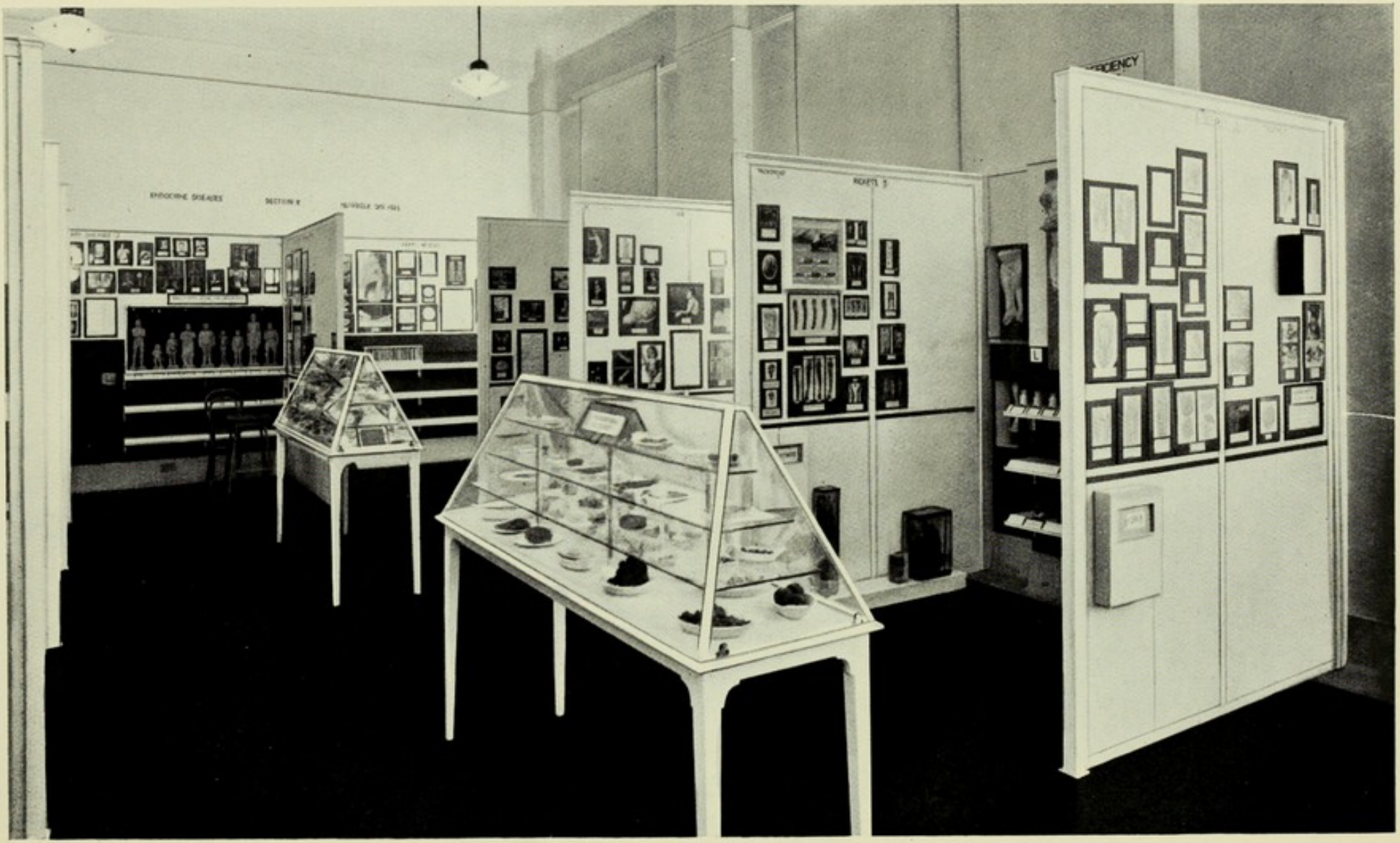
Anti-Leprotic Agents

Researches, commencing in 1904,* on chaulmoogra and hydnocarpus oils, and on oils of other less well-known Flacourtiaceous seeds.

Modern methods of utilising the characteristic acids of these oils.

Compounds of copper and of mercury representative of a series prepared for trial in leprosy.

*See Dr. F. B. Power, *pages* 93 *and* 107



THE WELLCOME MUSEUM OF MEDICAL SCIENCE, LONDON (ENG.)
Sections dealing with Endocrine and Food-deficiency Diseases

FOUNDED IN 1914

THE WELLCOME
MUSEUM OF MEDICAL SCIENCE
INCLUDING TROPICAL MEDICINE AND HYGIENE

183, EUSTON ROAD, LONDON, N.W.1

S. H. DAUKES, O.B.E., B.A., M.D., B.CH., D.P.H., D.T.M.&H.

DIRECTOR

This Museum, affiliated to The Wellcome Bureau of Scientific Research, then located at 10, Henrietta Street, London (Eng.), W. 1, was founded in 1914. In the course of time it has been greatly developed and extended in scope. The Museum of Medical Science, after a period of further development and reconstruction at Endsleigh Court, was reopened in 1926 by the Rt. Hon. Neville Chamberlain, then the British Minister of Health.

The Museum of Medical Science presents an entirely new system of visual teaching.

The purpose and plan of this Museum is to give a general survey of human disease from every aspect. The causation, pathology, symptomatology, treatment and prevention of disease are demonstrated by means of pathological specimens, models, paintings, photographs, etc., in such a way that they convey a graphic picture of the more important features.

Associated with each disease a short summary is set forth of the important points; also there are files containing abstracts with regard to all the more recent work.

A museum demonstration of the microscopic side of morbid anatomy presents certain difficulties; an effort has been made to overcome these by means of colour photomicrography. In many of the sections these photographs are shown in special illuminated cases. Thus an attempt has been made to provide a continuous demonstration of disease which will fix itself on the attention and memory of those who visit the Museum.

THE WELLCOME MUSEUM OF MEDICAL SCIENCE, LONDON (ENG.)

Sections for Diseases of the Blood-forming Organs, and Passage-way leading to Section devoted to New Growths

The Museum of Medical Science is a Research Museum and is open to Medical Men, Health Officers and Students of all countries, also to laymen interested in medicine, if introduced by a registered Medical Practitioner.

Many Teachers of Medicine, Surgery and Hygiene have found this Museum helpful to them in effectually illustrating the various branches of Medical and Surgical Science to their Students, and they are cordially invited to continue such use. Arrangements can be made in advance for teachers to give their classes demonstrations at the Museum.

During recent years The Wellcome Museum of Medical Science has participated in many Health Exhibitions at the request of the British Government.

In 1924, at the Wembley Exhibition, this Museum was responsible for organising and installing the Tropical Diseases Section in the Government Pavilion and, in addition, for supplying many other important exhibits.

In the 1925 Wembley Exhibition, at the request of the Ministry of Health, the Director of The Wellcome Museum of Medical Science organised and supervised the Hygiene Demonstration in the Government Pavilion, in which all departments of the Ministry participated. Much of the material was lent by The Wellcome Museum of Medical Science. A large part of this exhibit was subsequently displayed at Dunedin Exhibition, and further assistance given to the New Zealand Government.

In 1930, at the request of the Government Department, The Wellcome Museum of Medical Science organised the Tropical Health Exhibit in the British Pavilion at the Maritime and Colonial Exhibition, Antwerp. The materials and specimens were supplied mainly by The Wellcome Museum of Medical Science and the Liverpool School of Tropical Medicine. So successful was this exhibit that it was subsequently transferred to Buenos Aires and then to the Dresden Exhibition.

The entire organisation of the British Health Section of the Paris Colonial Exhibition in 1931 was carried out by The Wellcome Museum of Medical Science at the request of the Government

THE WELLCOME MUSEUM OF MEDICAL SCIENCE, LONDON (ENG.)

APLASTIC ANÆMIA

An Exhibit which illustrates the method of grouping. All specimens on the two top shelves are from one case

Department concerned. For this Section, which was designed on a very large scale and embraced practically all the important diseases which affect British Dominions and Colonies, the scientific exhibits were devised entirely from the resources of The Wellcome Museum.

Whilst many sections of the Museum are complete and well supplied with material, some sections, which have only recently been organised, are in an early stage of development. Much of the success of the Museum depends upon its final completeness and *the continued co-operation, help, advice and generous contribution of specimens and information by Medical Men and other Scientists interested in this field of work in various parts of the world.* Indebtedness for such help is most gratefully acknowledged.

NOTABLE EXHIBITS

THE WELLCOME MUSEUM OF MEDICAL SCIENCE

SHOWN AT THE

CHICAGO EXPOSITION, 1934

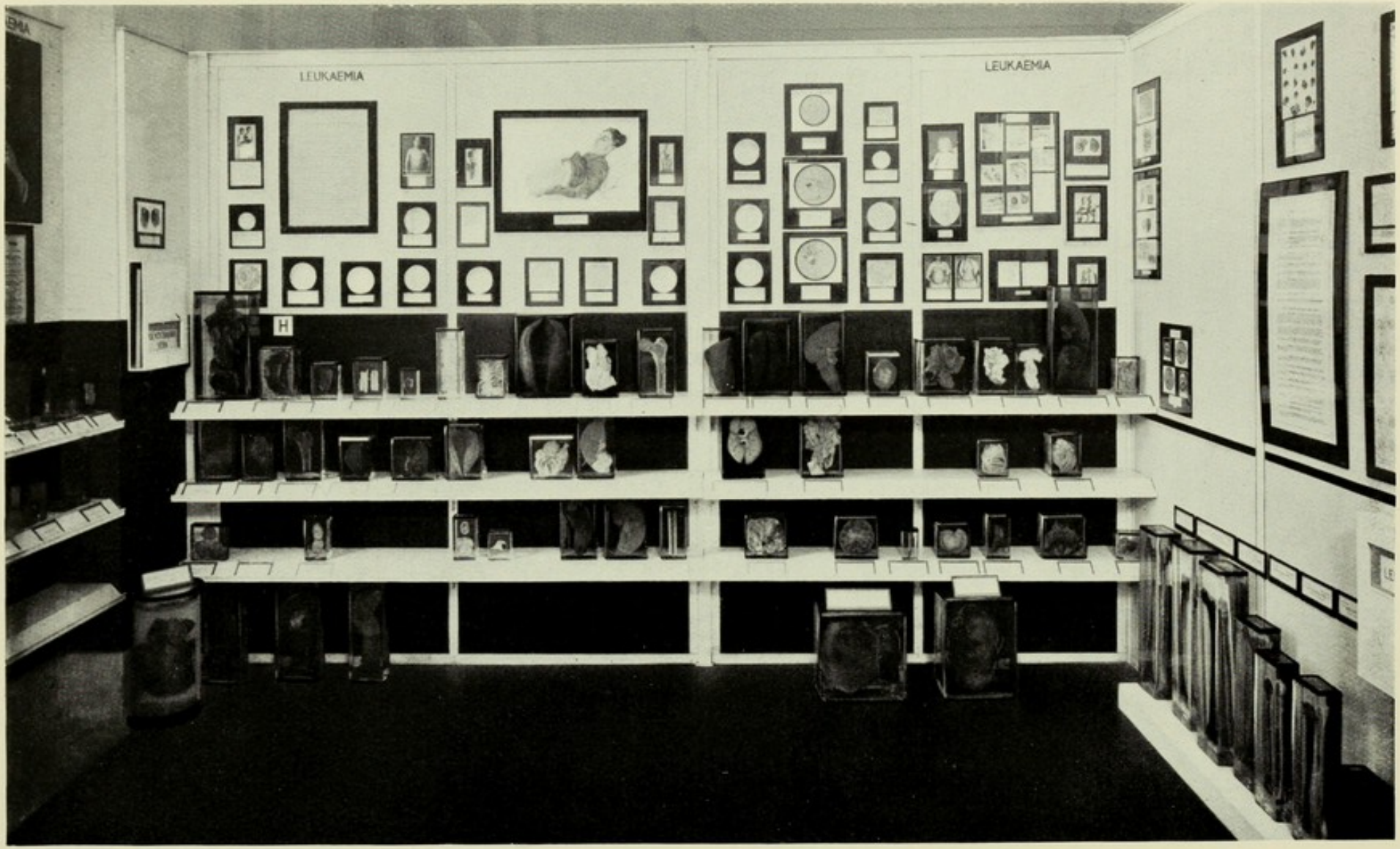
HALL OF SCIENCE

The exhibits of this Research Museum were designed to demonstrate the original methods of display adopted in order to provide *a system of visual teaching giving a general survey of human disease from every aspect.*

ILLUMINATED STATISTICAL DEVICES gave information with regard to the prevention and treatment of disease during the last century.

Here could be seen the reduction in malaria resulting from carefully devised schemes; the reduction in sleeping sickness, by destruction of tsetse flies; the reduction in undulant fever, by prohibition of goat's milk which carries the germs; the reduction in death-rate from kala azar, by the use of antimony compounds; and the reduction in incidence of plague, by prophylactic inoculation.

Other statistical charts dealt with the decline in death-rate from all causes in England and Wales during the last eighty years; the



THE WELLCOME MUSEUM OF MEDICAL SCIENCE, LONDON (ENG.)

LEUKÆMIA

A corner of the Section devoted to Diseases of the Blood-forming Organs

decline in death-rate from tuberculosis, smallpox, typhus, scarlet fever and typhoid fever; and the reduction in tetanus during the Great War, due to the use of anti-tetanic serum.

Malaria Exhibit

Illustrations showed how malaria is caused; how mosquitoes breed and carry the disease; how the parasites assume different forms in the life-cycle.

There was a wax model of *Anopheles costalis*, one of the most important carriers of malaria in Africa; also models of its developmental forms—the egg, larva and pupa *(see page* 108).

Portraits of the British pioneers in malaria work:

Sir Patrick Manson, known as the "Father of Tropical Medicine," who initiated the experimental research work which identified the mosquito as the carrier of malaria.

Sir Ronald Ross, who participated in these investigations.

Photomicrographs in colour showing the parasites of malaria in the human blood and in the mosquito.

Sleeping Sickness Exhibit

A wax model was shown of a tsetse-fly whose bite conveys one of the parasites *(Trypanosoma gambiense)* causing sleeping sickness; also models of the larva and pupa of the fly *(see pages* 108 *and* 109).

Transparencies showing details of the disease, also its effect upon man.

Portraits of two British pioneers in sleeping sickness work:—

(1) Sir David Bruce, who successfully investigated the disease and suggested methods for its control;

(2) J. Everett Dutton, who discovered *Trypanosoma gambiense*, and died of tick fever whilst investigating that disease.

Kala Azar Exhibit

Transparencies were used to show the causative parasite *Leishmania donovani*, physical appearance of sufferers from the disease, and other details.

Portraits of two British pioneers in tropical medicine, Sir William Leishman and Colonel Donovan, who were responsible for the discovery of the parasite.

THE WELLCOME MUSEUM OF MEDICAL SCIENCE, LONDON (ENG.)

NEPHRITIS

Showing Summaries, Illustrations and Specimens grouped together

Leprosy Exhibit

Transparencies illustrating the causal organisms, the possibility of fly transmission or direct passage to food from infected persons.

Four pictures showing clinical conditions of nodular leprosy, nerve leprosy, leprosy in childhood and mutilation due to leprosy.

A leper colony, providing isolation during infective stages, employment, recreation and social amenities during treatment, is illustrated.

A Portrait was shown of Dr. F. B. Power, who, in 1904, while Director of The Wellcome Chemical Research Laboratories, carried out the successful pioneer research work on the Ethyl Esters of Chaulmoogra, which led to the production of the most successful anti-leprotic agents ; and also a Photograph of Sir Leonard Rogers, who has worked extensively upon the prevention and treatment of the disease and is largely responsible for the British anti-leprosy campaign.

Plague Exhibit

Transparencies illustrating the causal organism—*Bacillus pestis* ; the rat flea *(Xenopsylla cheopis)*, which transmits the disease to man ; clinical pictures ; methods of rat destruction and other preventive methods.

Portraits of Sir William Simpson, one of the world's leading authorities on tropical medicine and hygiene, who conducted investigations and researches on the prevention of the disease ; and Bacot, who elucidated the method of its transmission.

Bilharziasis Exhibit

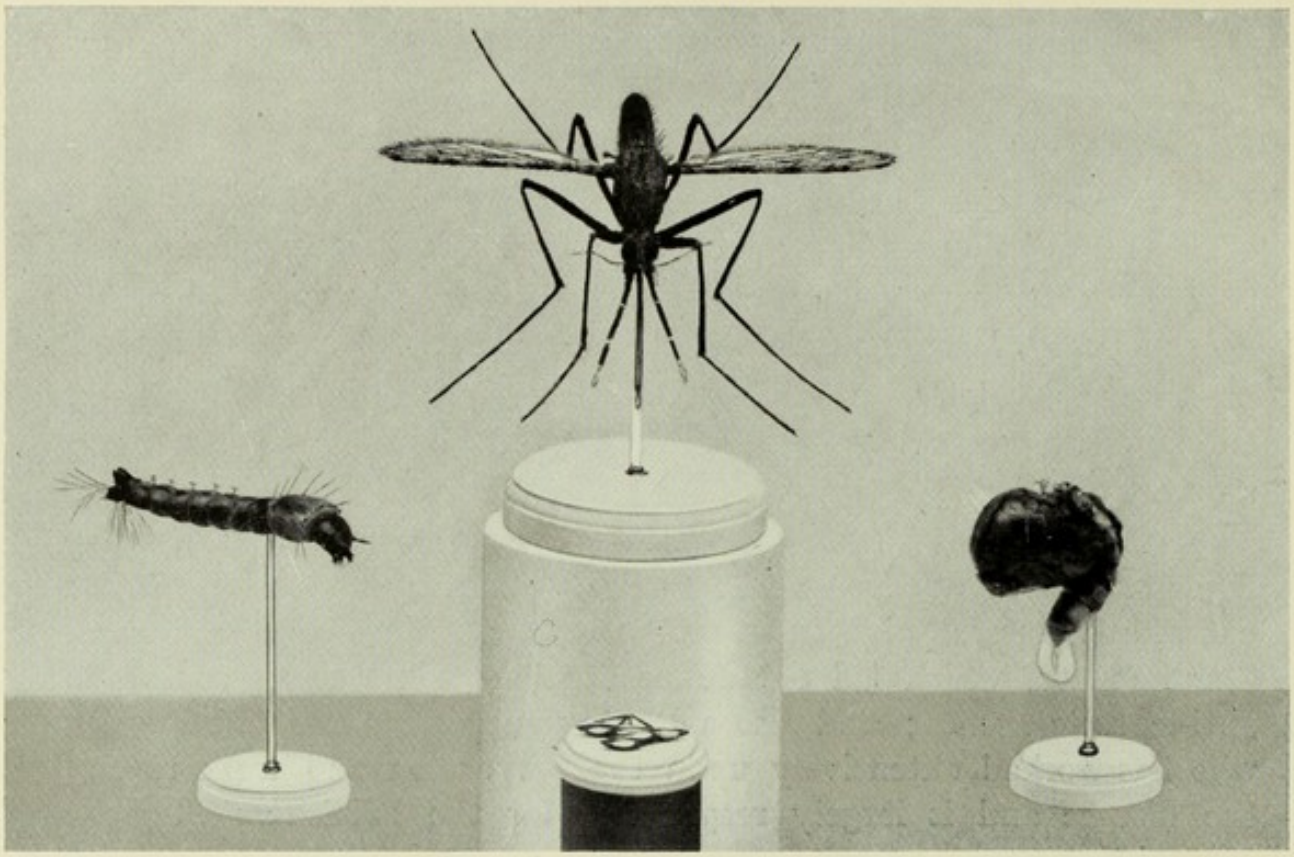
Bilharziasis, a common disease in Egypt.

Transparencies illustrating the worm, *Schistosoma mansoni*, which causes the intestinal form of the disease, its life-cycle in water, snails and man.

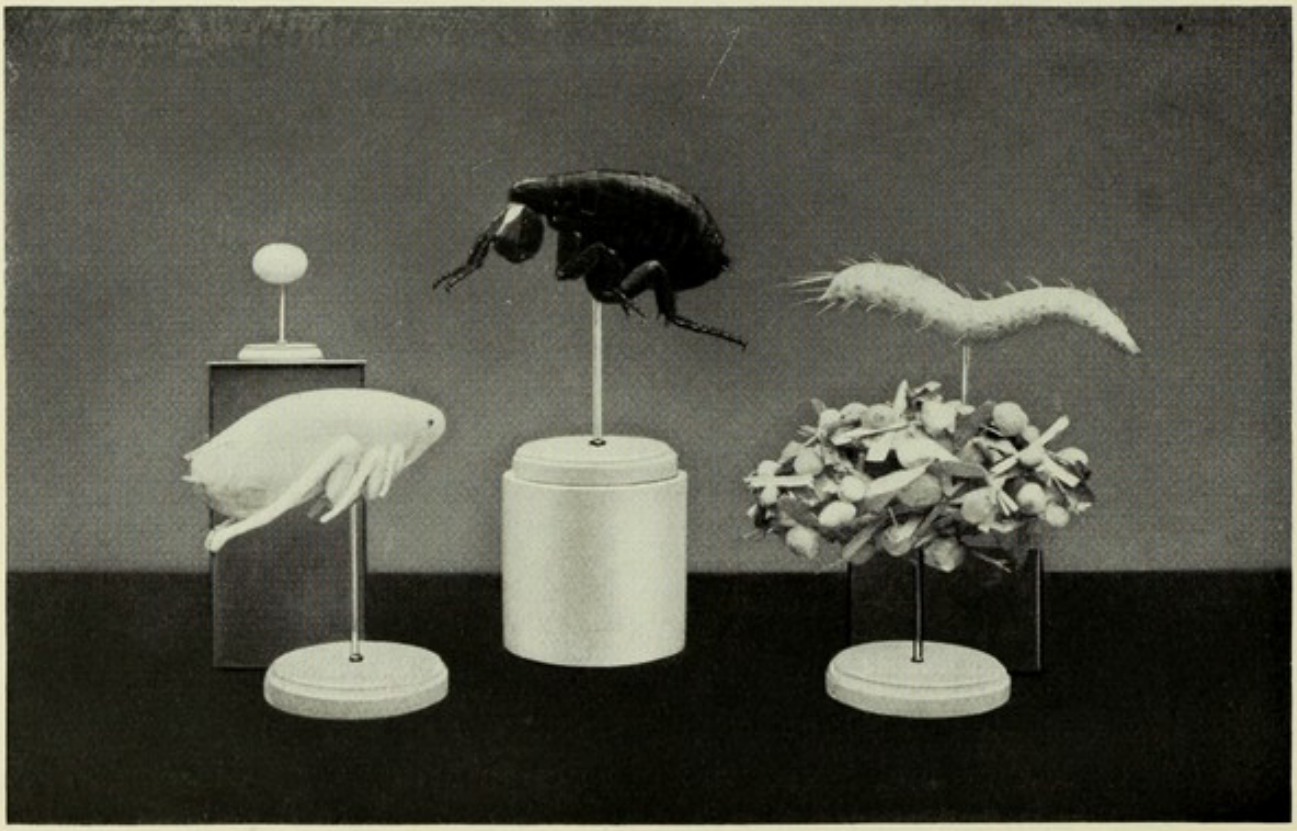
Portraits of two British pioneers :—

(1) R. T. Leiper, who conducted investigations and researches in reference to the mode of transmission in Egypt ;

(2) J. B. Christopherson, who introduced into Egypt widespread treatment with tartar emetic.

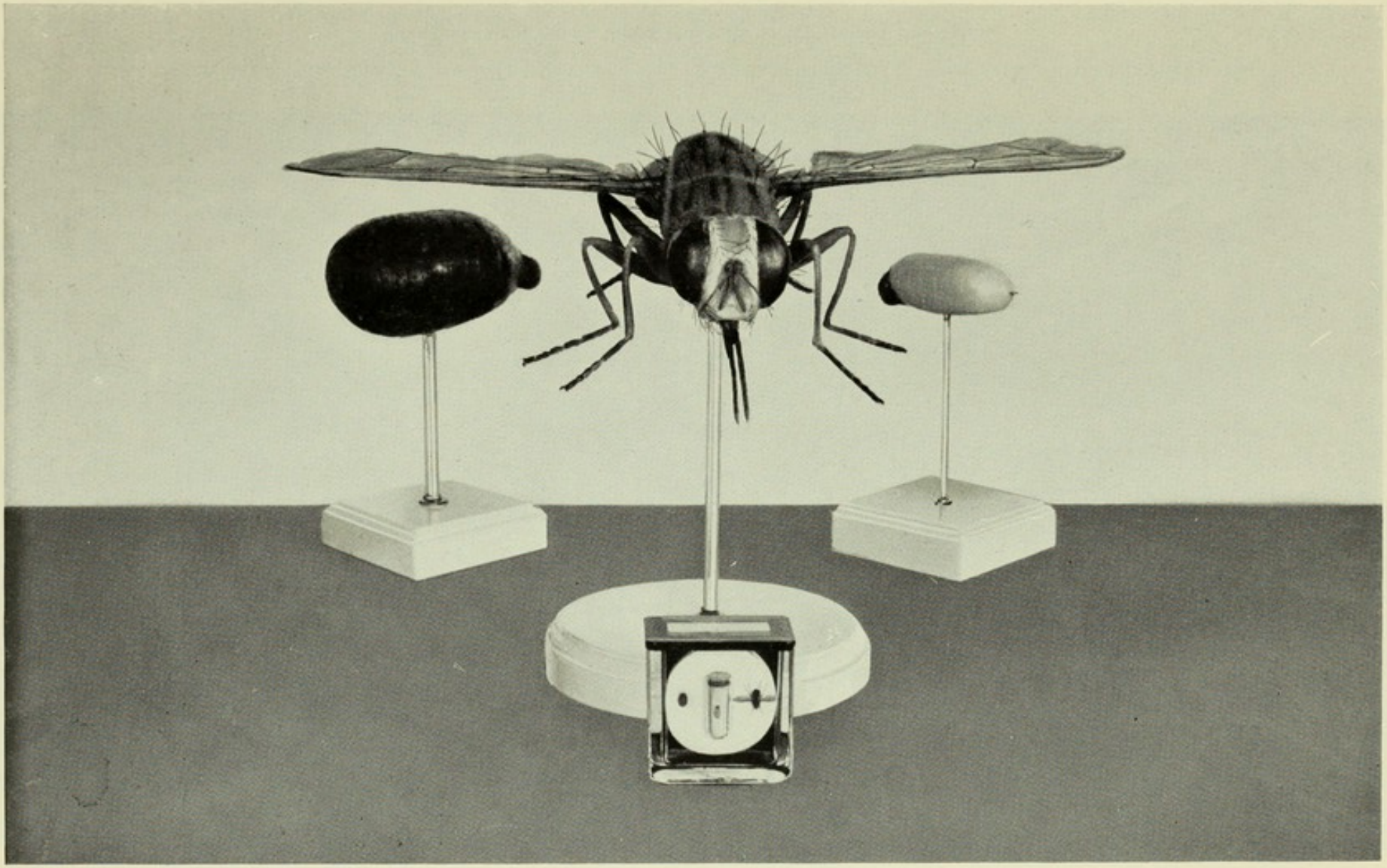


Wax Models showing the Life History of *Anopheles costalis*, Theo., the chief African carrier of Malaria. Eggs, larva, pupa and imago



Wax Models of Plague Flea. Egg, pupa, larva, cocoon

See also illustration of Model of Tsetse-fly, page 109



Wax Models showing Life History of Tsetse-fly *(Glossina palpalis)*, one of the most important blood-sucking flies of Central Africa. Transmits sleeping sickness. Larva, pupa and imago

See also Exhibits illustrated on page 108

HALL OF STATUARY AT THE WELLCOME HISTORICAL MEDICAL MUSEUM, LONDON (ENG.)

Before construction of the new Research Institution Building

FOUNDED IN 1913

THE WELLCOME

HISTORICAL MEDICAL MUSEUM

183, EUSTON ROAD, LONDON, N.W.1

SIR HENRY WELLCOME, LL.D., D.Sc., F.R.S.

DIRECTOR

P. JOHNSTON-SAINT, M.A., F.R.S.E.

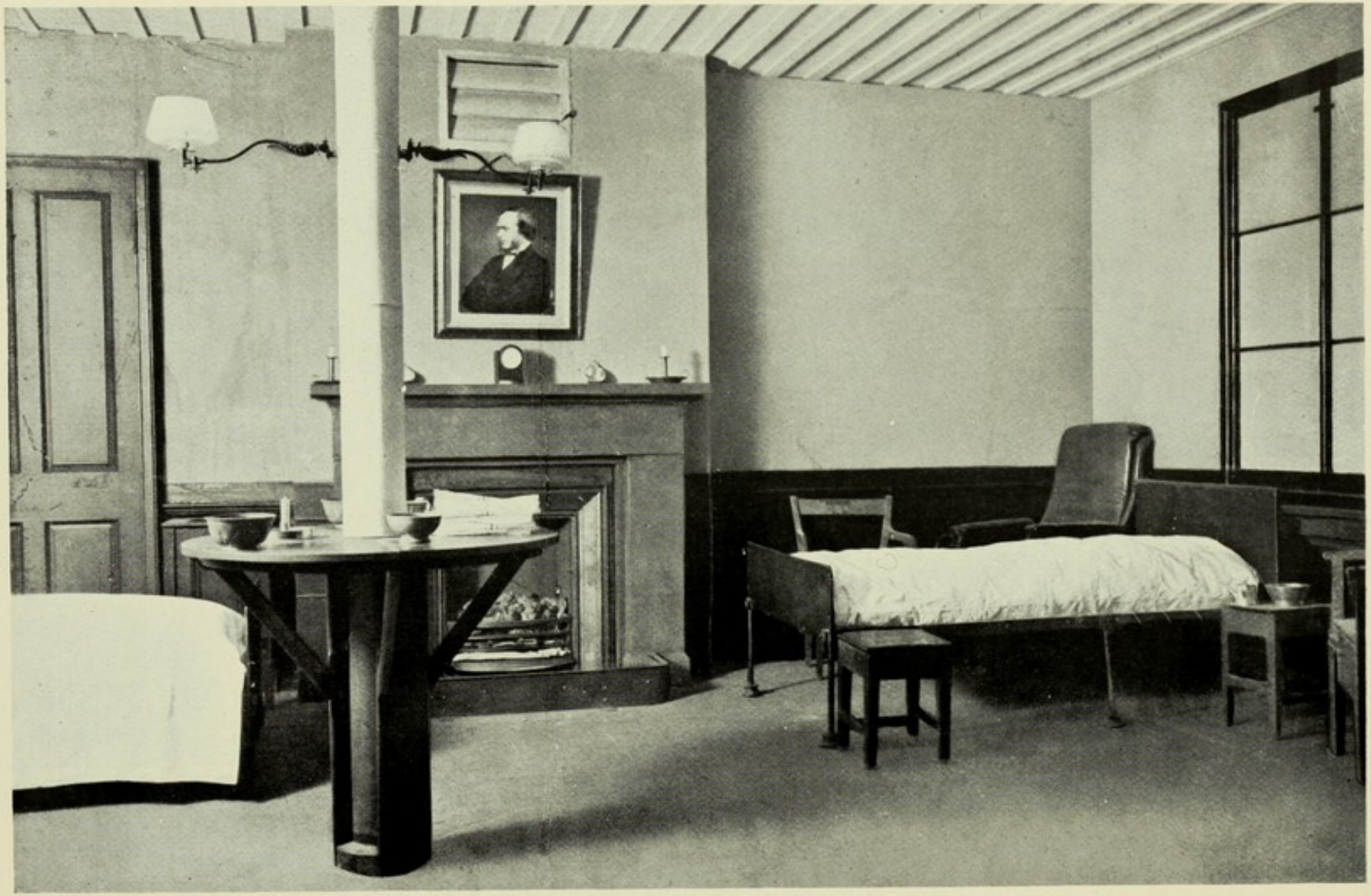
CONSERVATOR

This Museum consists of extensive collections of rare instruments, appliances and other historical objects, also pictures, sculpture, early manuscripts and printed books, etc., illustrating the evolution and practice of medicine, surgery and allied sciences throughout the world from pre-historic times, and includes a section dealing with primitive medicine and surgery amongst the savage and semi-civilised peoples of the world.

It is the result of collections made during many years in various parts of the world.

These historical collections are international in character, and cover a wide field, including Medicine, Surgery, Chemistry, Pharmacy and the Allied Sciences, embracing extensive collections of Anthropological and Ethnological objects. The Museum is designed to represent the history of these various branches of the art of healing throughout the world, and their practice is illustrated by objects, instruments and appliances of historical interest, and by plastic and pictorial art.

Medicine has a history which has touched every phase of life and art, and is, to a large extent, bound up with the records of human existence from the earliest times. By its study fresh fields of medical research are suggested, and the interest in others, still undeveloped, is stimulated. Views of progress, especially with regard to medical



A Section of the Original Lister Ward, now at The Wellcome Historical Medical Museum
183, Euston Road, London (Eng.)

treatment, are often exaggerated, owing to ignorance of the past; and careful research into ancient records has revealed the fact that modern methods are often mere adaptations of those practised in long past ages. Through the study of historical records of the past, discoveries of great value, quite forgotten and buried, have been brought to light.

One of the central aims of the Museum is to connect the links in the chain of human experience and living things from the very beginning and to trace the genesis of the many branches of the healing art and their development, this undertaking being illustrated by instruments, appliances and other objects connected therewith.

MEMORIAL COLLECTIONS. It is an important feature in the plans of this Museum to preserve the relics and other objects, manuscripts, drawings, etc., associated with workers who have made history by their discoveries, inventions and improvements in the various departments of medicine and allied sciences. It is the special aim and purpose to hand down to posterity the names and records of pioneers who, in the course of time, might be forgotten, thus rendering honour to whom honour is due. Such relics, etc., when placed in this Museum, form a permanent memorial and tribute to the work and achievements of those who have distinguished themselves in various realms of science in past years.

Many of these collections have been presented to the Museum by the families, executors, friends and admirers of such workers. Gifts or loans of this description will always receive the greatest possible care and be permanently preserved. Special Sections are devoted to such MEMORIAL COLLECTIONS. Amongst these collections are the following :—

The JENNER COLLECTION. An extensive collection of manuscripts, paintings, sculpture, drawings, instruments, personal relics, etc., of Dr. EDWARD JENNER, connected with his development of vaccine treatment of smallpox.

1 2 3 4 5 6 7 8

1. Sir Anderson Critchett 2. Sir Thomas Lauder Brunton 3. Sir Francis Laking and Sir Frederick Treves 4. Sir Patrick Manson
5. Sir Rickman J. Godlee 6. Sir Norman Moore 7. Sir James Cantlie 8. Sir Morel Mackenzie

SECTION OF PORTRAIT GALLERY AT THE WELLCOME HISTORICAL MEDICAL MUSEUM
LONDON (ENG.)

THE LISTER COLLECTION. An extensive collection of appliances, chemical reagents and apparatus, and various other materials originated and used by LORD LISTER in the development of his methods of antiseptic surgery, as practised by him in the Lister Ward of the GLASGOW INFIRMARY and elsewhere. A section of the actual ORIGINAL LISTER WARD, transferred from the Glasgow Infirmary when it was dismantled, is now erected in The Wellcome Museum, together with the original fittings and equipment, including Lister's portable experimental research laboratory containing the remainders of his reagents with which he carried out his original antiseptic experiments.

A special endeavour is being made to illustrate the work of the great French Scientists, and, owing to the willing response and valuable help given by the descendants of the great Savants of the past, it will be possible eventually to demonstrate the great part played by France in the development of modern medicine and science, by means of these MEMORIAL COLLECTIONS.

Such eminent names as

AMBROISE PARÉ

LAVOISIER

GAY-LUSSAC

PASTEUR

and many others will figure in this representation.

The importance of Museums as an integral part of teaching is now being more fully recognised by Universities, Medical Schools and other Educational Institutions. By practical study, scientific classification and systematic grouping of objects, it is the aim and purpose to make The Wellcome Historical Medical Museum of distinct educational value to research workers, students and others interested in the subjects with which it deals.

PUBLICATIONS

DE ARTE PHISICALI ET DE CIRURGIA of Master John Arderne, Surgeon of Newark, dated 1412. Translated by Sir D'Arcy Power, K.B.E., 1922.

MAGISTRI SALERNITANI NONDUM COGNITI: A Contribution to the History of the Medical School of Salerno, by Doctor Pietro Capparoni, 1923.

THE ICONOGRAPHY OF ANDREAS VESALIUS, Anatomist and Physician. 1514–1564. By M. H. Spielmann, F.S.A., 1925.

THE LISTER CENTENARY EXHIBITION, 1927, SOUVENIR AND HANDBOOK OF. To commemorate Lister's discovery of antisepsis.

THE HICKMAN CENTENARY EXHIBITION, 1930, SOUVENIR AND HANDBOOK OF. To commemorate Hickman's discovery of the principles of anæsthesia.

HISTORY OF SCOTTISH MEDICINE. By John D. Comrie, M.A., B.Sc., M.D., F.R.C.P., Lecturer on History of Medicine in the University of Edinburgh. First Edition, 1927. Second Edition, 2 vols. 1932.

CINCHONA TERCENTENARY CELEBRATION AND EXHIBITION, SOUVENIR OF, 1930.

Etc., Etc.

General Index

Page numbers of Illustrations are given in heavy-faced figures

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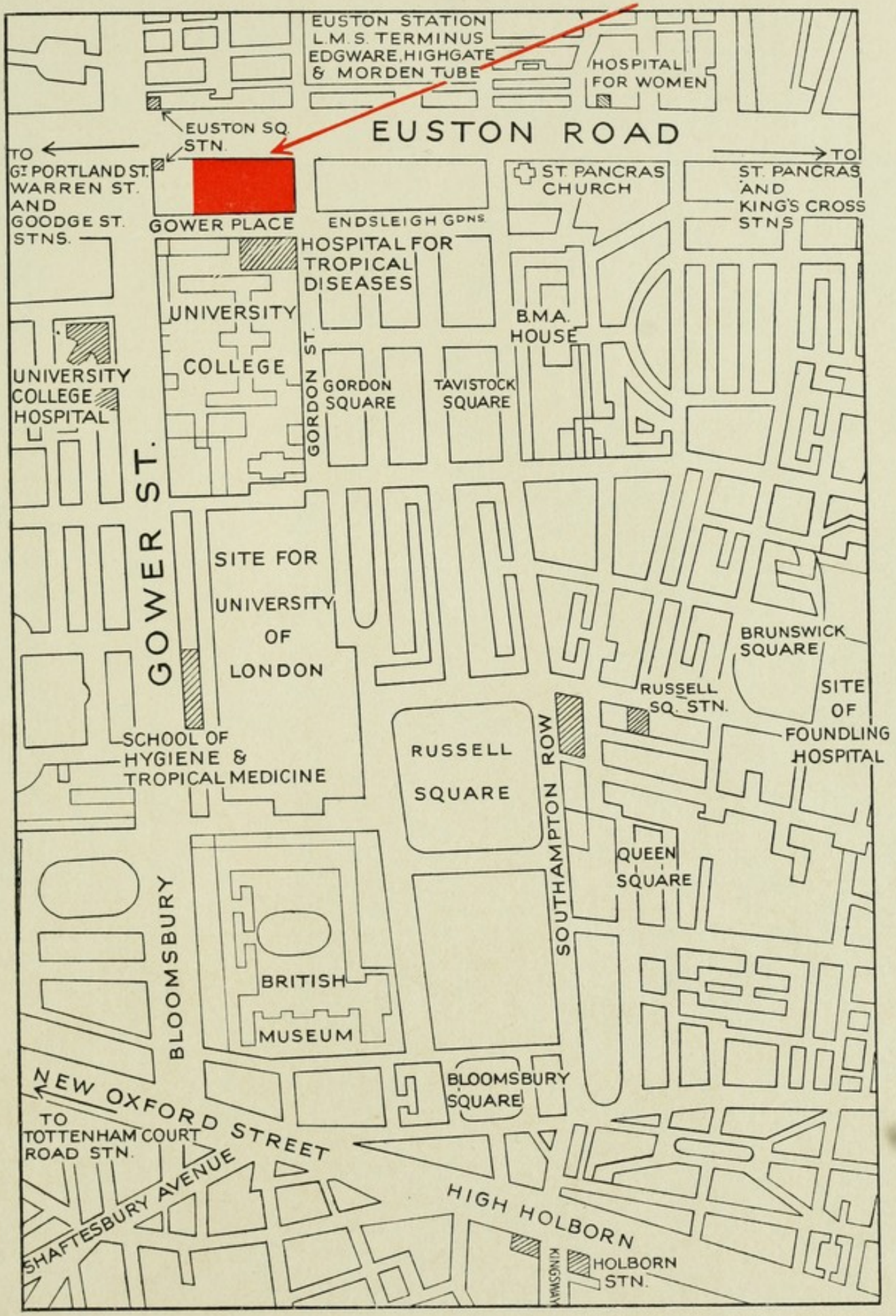
THE WELLCOME RESEARCH INSTITUTION
183-193, EUSTON ROAD, LONDON, N.W.1



Plan showing location of THE WELLCOME RESEARCH INSTITUTION in relation to other Institutions, Museums, etc.

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