Characterization of the Sugars by the Usual Methods.—The molasses yielded very readily an osazone, m. p. 206–210° C., and a semicarbazone, m. p. 178° C. The second derivative, in particular, pointed to the presence of glucose. A methylphenylosazone, m. p. 167–168° C. was also obtained. Methylphenylfructosazone prepared by us from pure *d*-fructose melted at this same temperature.[1] No depression was observed in the melting point on mixing the two derivatives, therefore the presence of fructose was established.

Characterization of the Aldomonosaccharides in the Molasses as Benzimidazole Derivatives.—Following the procedure of Moore and Link (3), the aldomonosaccharides present in the molasses were oxidized to the corresponding aldonic acids and these, in turn, separated as K and Ba salts. These salts were then condensed with *o*-phenylenediamine to obtain the corresponding benzimidazoles.

Table I.—Constants of Benzimidazole Derivatives

Source	Benzimidazole m. p.	Benzimidazole (α_D^{25})	Hydrochloride, m. p.	Picrate, m. p.
K salt from molasses	215	9.6	180	204
K salt from pure *d*-glucose	215	9.5	180	203
Ba salt from molasses	235	−49.0	230	156
Ba salt from pure *d*-arabinose	235	−49.1	230	158

The presence of *d*-glucose, as the principal sugar in the molasses, was further confirmed as large amounts of K *d*-gluconate were obtained. The isolation of a small amount of Ba salt, which yielded *d*-arabobenzimidazole when condensed with *o*-phenylenediamine, is indicative, as pointed out by Moore and Link (3), of the formation of *d*-arabinose from fructose during the oxidation procedure. Therefore, *d*-arabinose is not present as such in the molasses. Its isolation in the form of a Ba salt only serves further to confirm the presence of fructose in the molasses, a fact already established by the preparation of the methylphenylfructosazone.

For the purpose of finding if small traces of benzimidazole derivates have remained in solution in the filtrates, these were treated with a cupric ammonia solution as recommended by Moore and Link (3). The small amount of benzimidazoles, recovered from the Cu salts obtained from both filtrates, was found to be *d*-glucobenzimidazoles. It was concluded then that *d*-glucose was the only aldomonosaccharide present in the molasses.

[1] The melting point for methylphenylfructosazone reported in Browne's "Sugar Analysis," First ed., p. 622, as well as in other handbooks, is 158–160° C.

SUMMARY

The molasses obtained from the alcoholic extractive of the tubers of *Cyperus rotundus* L. contains the following sugars: 41.7 per cent *d*-glucose, 9.3 per cent *d*-fructose and 4 per cent of non-reducing sugars. No other sugars could be detected.

The author is indebted to Professor Karl P. Link and Dr. Standford Moore of the University of Wisconsin for detailed instructions for carrying out the characterization of the sugars by the benzimidazole procedure, which, at the time this investigation was undertaken, still was unpublished.

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The Patron Saints of Pharmacy*

By Leslie G. Matthews†

From the earliest times man has invoked the help of the supernatural—in prehistoric times no less than in the pagan and Christian eras. Those who in historic times early practiced the art of healing came in direct line from the tribal leaders and priest doctors whose healing powers derived partly from knowledge of their art and partly, if not mainly, from their power over others.

"Faith and works" have been nowhere more typically associated than in the sphere of medicine. Although cures depended upon faith in the personality of the healer, the reputation of the healer would often survive his times. Legends grew into a tradition until the stories became not merely those of simple cures but miraculous feats; associated not only with the healer but with his place of abode, the instruments of his art, his tomb, etc. This was certainly the case with the two chief patrons of pharmacy, St.

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† Pharmaceutical Chemist, London, England.

Fig. 1.—Portraits of St. Cosmos and St. Damian in the Church of Sta. Maria, Barcelona.

Cosmos and St. Damian; less so for the others who will be mentioned.

The object of this paper is to recall some of the incidents in the lives of those Saints who have been adopted as the patrons of pharmacy. Those most closely associated with pharmacy have been St. Cosmos and St. Damian, St. James, St. Emilien, St. Nicolas and St. Roche. The two most widely recognized are the two brothers, Cosmos and Damian.

While we may know little of their actual lives, the whole of Christendom early recognized their outstanding character and reputation in medicine, pharmacy and surgery. The practice of pharmacy developed early in Arabia and there is a special association therefore in their Arabian origin.

According to the accepted legend, they were born in the third century A. D. They were brought up by Christian parents at Ægea on the Gulf of Issus in Cilicia, Asia Minor, and here they studied medicine.

The portraits of them, in whatever century painted (and the example from the altar piece by Jaime Huguet, first half of XVth Century, in the Church of Sta. Maria, Barcelona, is typical), show a close facial resemblance, Cosmos the elder being usually differentiated in dress from Damian the younger. It may be explained that the physician's dress in the times in which the artists lived, was invariably more elaborate than that of the surgeon as there was considerable difference in the social status of the two. They became famous for their skill in healing, in which the use of drugs largely figured, combined with prayer and faith in the Christian religion. It is this use of drugs which is typified in so many paintings and statues of the Saints—one with a spatula and portable box of salves, the other with a gallipot or drug jar, usually of albarello shape, or with a pestle and mortar. In some portraits the drug jar may be replaced by a flask possibly for urine examination, as in another Spanish painting now in Madrid.

One painting of the late XVIIIth Century is apparently intended to depict St. Cosmos seeking divine guidance on the operation

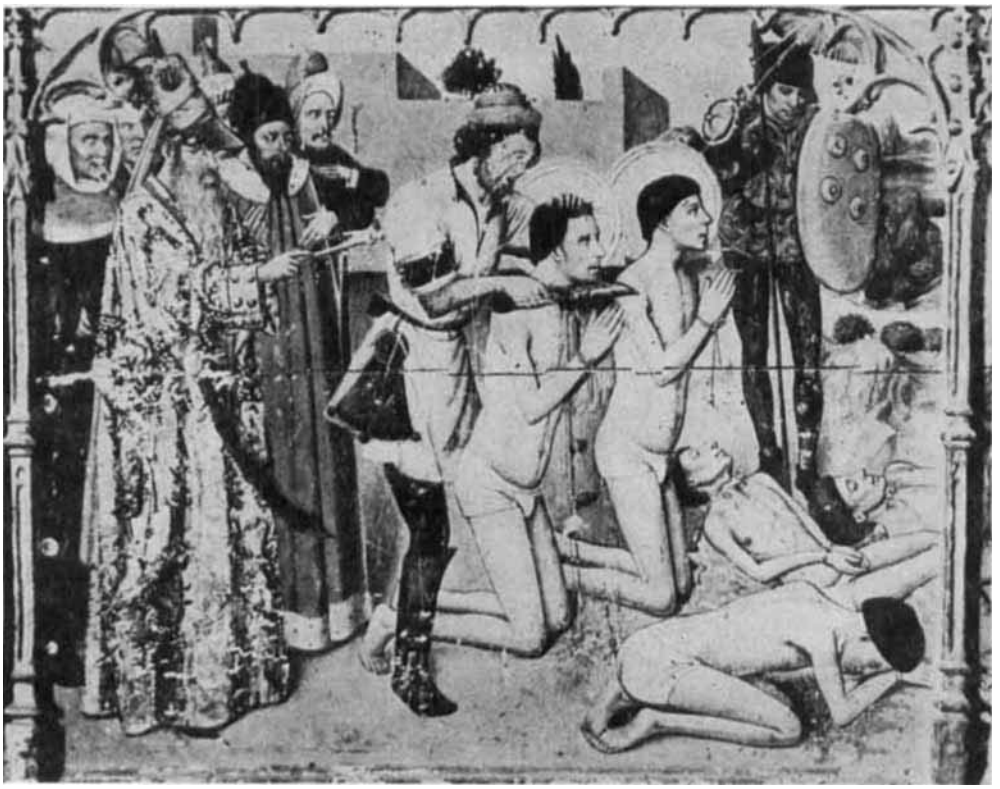

Fig. 2.—Painting by Huguet Showing the Saints Bleeding to Death in Their Martyrdom.

being performed by St. Damian. The surgical instruments are those of the period of the painting. This sense of direct divine intervention is recalled by an incident in Lord Lister's life (1).

He wrote to his sister Jane on 3rd March, 1857, after his second operating day: "though I again felt a good deal before the operation, yet I lost all consciousness of the presence of the spectators during its performance, and did it exactly as if no one had been looking on. . . . Just before the operation began, I recollected that there was only one Spectator whom it was important to consider, One present alike in the operating theatre and in the private room; and this consideration gave me increased firmness."

Since 1581 the skulls of the Saints have reposed as relics in the Convent of the St. Claire Nuns in Madrid, where they have been the objects of veneration. In 1935 a scientific examination of them showed that their martyrdom had taken place late in life, *i. e.*, above the age of 50, as shown by the state of obliteration of the sutures.

According to tradition they were martyred by Lysis, Roman Governor of the Province of Cilicia. As Christians they were tried and sentenced to death by drowning, but their bonds were broken by an angel who rescued them from the sea. Although they came out of a fire unscathed and survived shooting by arrows, they were finally beheaded (2). (One of Huguet's pictures of their martyrdom shows them bleeding to death.) To avoid desecration their bodies are said to have been removed for burial to Cyrus in Northern Syria.

It was while the Saints' remains were there that their cult became famous. Miracles were reputed to have taken place and the Emperor Justinian himself sought a cure at their shrine. He is also said to have fortified and beautified the City of Cyrus on this account. It may have been partly due to his cure but perhaps chiefly to gain renown for the new city of Byzantium that Justinian had the relics brought there and a church built in which to enshrine them (3). It is possible to argue that the Saints might never have been heard of had not Justinian's overweening pride in his city as a setting for

Fig. 3.—Painting by Fernando Gallego, XVth Century Depicting the Saints Operating on a Patient for a Cancerous Condition of a Leg.

himself made him gather there everything that tended to its glory.

The Saints' relics are next heard of in Rome, where in 526–530 A. D. Pope Felix IV had erected a basilica in the Foro Romano, on the site of a former pagan temple dedicated to Romulus. The Pope dedicated the basilica to St. Cosmos and St. Damian, after erecting a tomb in which to deposit their remains which had been transferred from Byzantium. This basilica still stands—it is now the crypt of a church built over it in the XVIIth Century, when the ground level had been raised by about 20 feet.

The tomb may still be seen and on the walls of the apse are some of the most brilliant mosaics in Rome: these were executed in the VIth Century and depict St. Peter and St. Paul presenting St. Cosmos and St. Damian to Christ. For centuries the guild of barbers in Rome has had an annual dedicatory service in the church.

It was in this basilica that there occurred the most famous of the posthumous miracles associated with the saints—the painting by a Spanish artist, Fernando Gallego, XVth Century (now in the Wellcome Historical Medical Museum, London) tells the story. It shows the two Saints operating on a patient who had sought relief from a cancerous condition of the leg. The story goes that having travelled far he came late to the church and found the doors locked against him—after praying to the saints he was over-

come with sleep and dreamed that they appeared to him, examined his leg and decided the disease was too far advanced for treatment to be effective. The Saints not to discourage the faith of the suppliant sought in the cemetery of the Via Appia the body of a man newly buried, whose sound leg they proposed to graft, after amputating the diseased leg of the patient. To the patient's surprise, when he awakened, he had two sound legs but the replaced leg was black. The Saints apparently had been indifferent to the fact that their grafting had been that of the leg of a Moor.

H. Peters (4) suggests it is the effectual grafting of the Moor's leg for this miracle that gave rise in the middle ages to the "Sign of the Moor" as a favorite exterior apothecaries' sign—a black Moor. "Apoteken zum Mohren" is a frequent name for Mid-European pharmacies.

The painters of this subject had full scope for the realistic treatment of martyrdom. Gallego's painting shows St. Cosmos about to graft the black leg—the patient meanwhile peaceful and apparently under the influence of a narcotic.

The reference to the patient's sleep at the church is an interesting example of the carrying over into the early centuries of the Christian era of the principles of pagan "temple incubation sleep." This is recorded as a frequent form of treatment at the temples of Asklepios in Greece: the patient slept in the temple, the god appeared to him in a vision and healing resulted.

In Huguet's version of the subject (Spanish, first half of XVth Century, now in Barcelona), both Cosmos and Damian are engaged in grafting the Moor's leg. The two attendant angels hold the gallipot and box of salves associated with the Saints; others in the background attend to the Moor. This picture may have been intended to portray the surgeon craft of the Saints.

In another by Huguet, the donor of which may have been a Master Apothecary, the Saints themselves are shown with gallipot and salves.

There are many other versions of the miracle, many of them Spanish but two panels of a tryptich in the Antwerp Museum (Ambrosius Francken, late XVIth Century) show the martyrdom and the miracle.

The cult of the Saints extended throughout Christendom. In England the records though scanty are widespread. Three churches were dedicated to the Saints; there were statues erected to their honor on the West Front of Salisbury Cathedral (XIIIth Century) and a XVth Century painted reed screen (Wolborough Church, Devon) pictures the Saints—Cosmos with unguent jar and spatula, and Damian with a flask. Relics were held in the Treasury of Christ Church, Canterbury. Official medicine recognized them: they were adopted as the Patron Saints of the Barber-Surgeons, and they figured as Supporters on the Coat of Arms of the Company of Surgeons, granted in 1492. The lack of recognition subsequently may have been caused by the break with Rome in Henry VIII's time.

In Italy and Spain the healing powers of the Saints were constantly invoked and their patronage recognized.* In Spain as late as 1918, broadsheets were being printed for distribution in Catalonia on the Saints' Day —27th September. Copies of these broadsheets (from a famous collection, now in the Wellcome Museum) depict the Saints with drug jars, spatula and salves. All versions of the story, as told in the verses printed on the sheets, contain the principal elements of the legends of their life, martyrdom and miracles. These broadsheets besides telling the lives of the Saints also included the invocation and prayers to be used—occasionally also the music of the hymn.

Reference has been made to the relics in Madrid—according to a well-documented account (5) the remains of the Saints were removed by Bishop Adaldago from the Basilica in Rome to Bremen (in the Xth Century); later Emperor Henry of the Holy Roman Empire had the skulls taken to Bamburg in Germany. Finally, in 1581, they were removed to Madrid by order of the Empress Maria, daughter of Charles V. Photographs show the skulls, wrapped at

* In Italy the Saints were the patrons of the Medici family and as such appeared on the coins of Florence.

Fig. 4.—Wood Carvings of the Saints in the Pharmaceutical Museum of Basle, Switzerland.

the base in red silk and kept in position with silver bands bearing Greek inscriptions by which they were identified.

In France Cosmos and Damian have been long adopted by pharmacists as patrons of their craft.

In Switzerland busts or figures in wood, sometimes gilded, were found in many pharmacies. Some fine examples are in the Basle pharmaceutical Museum (6), an indication of the recognition there of the Saints' patronage.

In Austria the Saints were recognized as patrons of medicine and pharmacy. The Vienna Medical Society possessed a copy of a card for 1700, inviting physicians, students, druggists and surgeons to take part in a festival celebration on the Saints' Day in St. Stephen's Cathedral, and also had copies of the plates from which the pictures were printed for distribution to those participating (7).

It is recorded that in Greece more than fifty churches were dedicated to the Saints, whose reputation in that country was particularly high.

The records available in Europe show clearly the association of SS. Cosmos and Damian with pharmacy to be a strong one, and one that has been maintained, in catholic countries at least, throughout the centuries.

Of the saints whose patronage is not so closely restricted to pharmacy but who have a definite association with apothecaries, pharmacists and druggists, the following should be mentioned: St. James, St. Nicolas, St. Roche, and St. Emilien.

Saint James, the brother of John, son of Zebedee; the patron saint of apothecaries and druggists, but also of pilgrims, polishers and shoemakers. Perhaps chiefly regarded as the patron of pilgrims since he is so usually depicted with pilgrim staff and scollop shells. The Church of St. James of Compostella in Spain (of which country he is the Patron Saint) is decorated with scollop shells which since that time have been adopted as a pilgrim badge. He is commemorated on the 26th July.

Saint Nicolas, IVth Century. Archbishop of Mire (Saint's Day 6th December). Perhaps no Saint is more highly regarded or invoked by children the world over. Notwithstanding their special claims on him—as shown by his release of three of them from the salt-tub (usually to be seen in

illustrations)—almost the world is his parish, for he is also patron of scholars, school-masters, sailors, butchers, as well as of perfumers and pharmacists. It is of interest that he was adopted as Patron by the Master Apothecaries of Paris.

Saint Roche, born in Montpellier in 1295. His ability to heal the plague from which he himself was cured, when neither physician nor apothecary knew even what to prescribe, naturally caused them to return to him as their Patron. He is shown with a plague spot on his knee, whose cure was assisted by an angel, and whose food, during his banishment on account of the plague, was brought by a dog—hence the picture always of a dog bringing a cake of bread in his mouth. Celebrated on the 16th August.

Saint Emilien, Vth Century, was a physician who suffered tortures during the persecution of the Vandals, under King Huneric. Saint's Day 6th December.

Other Saints were chosen according to special local circumstances, sometimes connected with the Church where the corporation or confraternity of apothecaries or pharmacists held its annual service, and whose name was inscribed on the banner of the Guild—one of the banners illustrated in Bouvet's "Histoire de la pharmacie en France" is that of the Lille Apothecaries whose choice was Saint Madeleine.

Had the Centenary of the Pharmaceutical Society of Great Britain (April 1941) occurred in an earlier century, no doubt at the commemorative service the banners of the Society, emblazoned with the pictures of St. Cosmos and St. Damian, at least, would have been carried in procession round the church in recognition of their patronage of the profession of pharmacy.

I wish to acknowledge the facilities afforded by the Director of the Wellcome Historical Medical Museum (Dr. S. H. Daukes) and also the assistance given in the preparation of this paper by Mr. P. Johnston-Saint, the Conservator who, having visited some of the shrines, has been able to give first-hand information about them.

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Book Reviews

Semimicro Qualitative Analysis, by ARTHUR R. MIDDLETON, Ph.D., Professor of Inorganic Chemistry, Purdue University, and JOHN W. WILLARD, B.S. xi + 446 pp., 7 figs., 23 tables, 14.6 x 22.7 cm. 1939. Prentice-Hall, Inc., 70 Fifth Avenue, New York, New York. Price, $3.50.

This is a laboratory manual combining theory and laboratory work under a single cover. The methods included in the text are the result of a six-year trial in large student classes. According to the authors, the methods described have given exceptionally good results. The advantages of using semimicro quantities for qualitative analyses are stressed.

This book features two ideas of qualitative analysis which have hitherto not appeared in any text. Anions are determined qualitatively by elimination; and analysis of cation group III is performed without removal of arsenate and phosphate, and of cation group IV without the use of the rather unsatisfactory reagent, ammonium carbonate. Much time is saved in the laboratory by the introduction of these new methods.

The book is divided into two parts: Part I deals with the theory of chemistry and Part II presents the laboratory methods.

The section on theory explains the use of units in chemical calculation and the application of logarithms to simplify calculations. Other subjects treated in succession are application of the gas laws, structure of matter, laws of equilibrium, homogeneous equilibrium in aqueous solution, heterogeneous equilibrium, hydrolysis, equilibrium of complex ions, and equilibrium in redox reactions (reduction, oxidation and potential).

The section on laboratory work is divided into twelve chapters: namely, semimicro technique, properties and reactions of the cations, preparation for the laboratory work, introductory study of the cations, systematic analysis of cations, introduction to the analysis of anions, properties and reactions of