



Medicine's 'green revolution'



Photo © Adrian Bodek, Mexico

TREASURES
OF
WORLD ART

144

Mexico

The swinging Totonacs

Apprehension rather than appreciation seems to be the expression caught by the sculptor of these solemn-faced Totonac girls as they sit on a swing dressed in their best skirts and rounded *quechquemil* capes and adorned with disc earrings and necklaces. Dating from between 500 and 750 AD, this hollow figurine, from Veracruz, Mexico, is a relic of the Middle-American Totonac civilization. The Totonacs, an offshoot of the Huastecs, are believed to have built the famous Pyramid of Niches at El Tajin.

PUBLISHED IN 20 LANGUAGES

English	Italian	Turkish
French	Hindi	Urdu
Spanish	Tamil	Catalan
Russian	Hebrew	Malaysian
German	Persian	Korean
Arabic	Dutch	Swahili
Japanese	Portuguese	

Published monthly by UNESCO

The United Nations
Educational, Scientific
and Cultural Organization

Sales and Distribution Offices
Unesco, Place de Fontenoy, 75700 Paris

Subscription rates

1 year : 35 French Francs

2 years: 58 FF

Binder for a year's issues: 24 FF

The UNESCO COURIER is published monthly, except in August and September when it is bi-monthly (11 issues a year). For list of distributors see inside back cover.

Individual articles and photographs not copyrighted may be reprinted providing the credit line reads "Reprinted from the UNESCO COURIER", plus date of issue, and three voucher copies are sent to the editor. Signed articles reprinted must bear author's name. Non-copyright photos will be supplied on request. Unsolicited manuscripts cannot be returned unless accompanied by an international reply coupon covering postage. Signed articles express the opinions of the authors and do not necessarily represent the opinions of UNESCO or those of the editors of the UNESCO COURIER. Photo captions and headlines are written by the Unesco Courier staff.

The Unesco Courier is produced in microform (microfilm and/or microfiche) by: (1) University Microfilms (Xerox), Ann Arbor, Michigan 48100, U.S.A.; (2) N.C.R. Microcard Edition, Indian Head, Inc., 111 West 40th Street, New York, U.S.A.; (3) Bell and Howell Co., Old Mansfield Road, Wooster, Ohio 44691, U.S.A.

The Unesco Courier is indexed monthly in the Readers' Guide to Periodical Literature, published by H.W. Wilson Co., New York, and in Current Contents - Education, Philadelphia, U.S.A.

Editorial Office

Unesco, Place de Fontenoy, 75700 Paris - France

Editor-in-chief: Jean Gaudin

Assistant Editor-in-chief: Olga Rödel

Managing Editor: Gillian Whitcomb

Editors:

English	Edition: Howard Brabyn (Paris)
French	Edition:
Spanish	Edition: Francisco Fernandez-Santos (Paris)
Russian	Edition: Victor Goliachkov (Paris)
German	Edition: Werner Merkli (Berne)
Arabic	Edition: Abdel Moneim El Sawi (Cairo)
Japanese	Edition: Kazuo Akao (Tokyo)
Italian	Edition: Maria Remiddi (Rome)
Hindi	Edition: H.L. Sharma (Delhi)
Tamil	Edition: M. Mohammed Mustafa (Madras)
Hebrew	Edition: Alexander Broïdo (Tel Aviv)
Persian	Edition: Fereydoun Ardalan (Teheran)
Dutch	Edition: Paul Morren (Antwerp)
Portuguese	Edition: Benedicto Silva (Rio de Janeiro)
Turkish	Edition: Mefra Ilgazer (Istanbul)
Urdu	Edition: Hakim Mohammed Saïd (Karachi)
Catalan	Edition: Cristian Rahola (Barcelona)
Malaysian	Edition: Azizah Hamzah (Kuala Lumpur)
Korean	Edition: Lim Moun-young (Seoul)
Swahili	Edition: Domino Rutayebesibwa (Dar-es-Salaam)

Assistant Editors:

English Edition: Roy Malkin

French Edition: Djamel Benstaali

Spanish Edition: Jorge Enrique Adoum

Research: Christiane Boucher

Illustrations: Ariane Bailey

Layout and Design: Robert Jacquemin

All correspondence should be addressed to the Editor-in-Chief in Paris.

page

- | | |
|------|--|
| 4 | Avicenna
HEARTS AND FLOWERS
<i>by Hakim Mohammed Saïd</i> |
| 6 | MEDICINAL PLANTS MAKE A COMEBACK
<i>by Michel A. Attisso</i> |
| 8 | MEDICINE'S 'GREEN REVOLUTION'
<i>by Jean-Marie Pelt</i> |
| 17 | AFRICAN MEDICINAL PLANTS
UNDER THE MICROSCOPE
<i>by Donald E.U. Ekong</i> |
| 19 | UNESCO AND THE BASIC CHEMISTRY
OF NATURAL PRODUCTS |
| 20 | A MEDICAL THESAURUS
FROM THE ROOF OF THE WORLD
<i>by Lydia Khundanova</i> |
| 21 | FOUR PAGES IN FULL COLOUR |
| 25 | CHINA : A NEW MEDICINE BORN OF TRADITION
<i>by Wei Wen</i> |
| 29 | NEPTUNE'S PHARMAPOEIA
<i>by Mario Piattelli</i> |
| 33 | MEXICAN PLANTS AND HUMAN FERTILITY
<i>by Pierre Crabbé</i> |
| 35 | PLANT PROPHYLACTICS FROM TROPICAL BRAZIL
<i>by Otto R. Gottlieb and Walter B. Mors</i> |
| 38 | HERBAL THERAPY IN THE WAR ON DRUG ADDICTION |
| 39 | BULGARIA'S FOLK REMEDIES STAND THE TEST OF TIME
<i>by Vesselin Petkov</i> |
| 2 | TREASURES OF WORLD ART
MEXICO: The swinging Totonacs |
| I-IV | NEWS FROM UNESCO
Special supplement |

Cover

The discovery in plants of active substances which, in themselves or after further chemical transformation, have powerful therapeutic effects has led to what might be termed a "green revolution" in medicine. In many cases, chemists are finding scientific confirmation of the healing properties of plants traditionally used in popular medicine. Taken from the *Atlas of Indo-Tibetan Medicine* (see article page 20), our cover photo, published here for the first time ever, represents the "Tree of Therapy". The left hand stem, the "stem of nutrition", represents dietary treatments for various illnesses; the second stem from the left, the "stem of the way of life", recommends appropriate life styles for patients; the third stem, "the stem of medicines", demonstrates the properties of various medicines; the fourth stem, the "stem of corrigents", illustrates acupuncture, massage and surgical operations.



Photo © V. Shumakov, Russian edition of the Unesco Courier, Moscow - Buryat Department, Siberian section of the USSR Academy of Sciences

Avicenna

Hearts and flowers

Type of plant: *Rosa Damascena* (red damask rose) "Owing to its aromatic volatile matter, it resembles the vital spirit in temperament. Used to cure unconsciousness and fainting, especially when these are due to hot abnormal temperament."

Avicenna (980 to 1037 AD),
Treatise on Cardiac Drugs

"Flower buds are astringent and are used in cardiac troubles, and as a tonic and aperient. Rose water prepared from the petals is said to have a cooling effect."

The Wealth of India, Volume IX (1972)

DESPITE the tremendous scientific advances that have been made in the close on one thousand years that separate the *Treatise on Cardiac Drugs*, written by the great Islamic physician-philosopher-scientist Avicenna, from the late twentieth century inventory of India's natural resources, *The Wealth of India*, little has changed in the scientific assessment of the medicinal properties of the red damask rose. Indeed, Avicenna's evaluation of many of the sixty-four cardiac drugs mentioned in his *Treatise* closely resemble the assessment made by modern scientists.

Divided into seventeen sections, the treatise explains the psychological and physiological basis of the principles of treatment of cardiac patients together with the action of the relevant drugs. The left human ventricle is mentioned as the place of origin and repository of the cardiac soul which is the vehicle of animal faculties of all organs of the body. Illustrating further he says that when the cardiac soul reaches the brain it acquires such a temperament there that it becomes capable of receiving the faculties of sensation and movement and when it reaches the liver it acquires there such a temperament as is capable of receiv-

HAKIM MOHAMMED SAID, of Pakistan, is adviser on traditional Islamic medicine to the Pakistan Ministry of Health, Social Welfare and Population Planning. President of the Hamdard National Foundation, he is editor of the journal Hamdard, the organ of the Institute of Health and Tibbi Research. He is also editor of the Urdu edition of the Unesco Courier.

ing the faculties of nourishment and growth. Similarly on reaching the reproductive organs it acquires such a temperament as to befit it to accept the faculties of procreation.

Proceeding further Avicenna mentions that the cardiac soul is particularly affected by and reacts to emotions such as pleasure, sorrow, fear, etc. This means that the heart is the place where emotions make themselves felt. But the organ which reacts to them and the faculty of reacting to stimuli is possessed by all individuals but in different degrees.

Recording his findings about sensation he says that it is dependent on the difference or changes between, the perceiving organ and the object of perception. When this difference is lost, the perception of it also disappears. This, according to him, is illustrated by the feeling of discomfort experienced in fever and the indifference of a tubercular patient to his raised

temperature. Discussing these points in detail he holds that sick persons are not capable of enjoyment because of the temperamental imbalance of the soul. Similarly old persons or those who have excess of black bile, whose soul is thick, coarse and dark are incapable of enjoying themselves.

Later in the *Treatise* he discusses the physiological causes of the capacity for enjoyment or grief and suggests measures for creating this capacity. He distinguishes between the weakness of the heart and disquietude which is felt as a pressure on the chest. He discusses the relation between qualities of blood and soul and analyses the difference between anger or malice and the mode of action by virtue of which cardiac medicines produce exhilaration. He states that the soul is intrinsically attracted towards fragrant and sweet substances and describes the meanings of the words temperament, property and the action of



DORONICUM HOOKERI
(doronicum)

"Its action as a cardiac tonic and exhilarant is extraordinary."

(Avicenna)

"Used as an aromatic tonic. Some species are reported to prevent giddiness during high-altitude mountain ascents. The roots of the European species are used as a constituent of cardiac and nerve tonics."

(*The Wealth of India*, Vol. III)

ROSA DAMASCENA (red damask rose)

Photos and drawings © H. Saïd, Karachi, Pakistan

by Hakim Mohammed Saïd

substances. He also explains the occasion and the aim of using drugs and ends by giving prescriptions which he himself found useful.

Thus a careful and critical study of the whole *Treatise* gives an insight into the mode of treatment of cardiac patients with drugs, diet and environmental adjustment. It is therefore worth scientific study so that humanity may reap the benefit from the researches of the past in the curative sciences. ■



OCIMUM BASILICUM (sweet basil)

"Contains volatile matter; acts as an astringent and an exhilarant; has a warming effect."

(Avicenna)

"Diuretic; useful in diseases of the heart and brain, chronic pain in the joints, asthma and enlarged spleen."

(*Indian Medicinal Plants, Vol. III, 1962*)



MELISSA OFFICINALIS (lemon balm, sweet balm)

"Regarded as an extraordinary drug which exhilarates and strengthens the heart."

(Avicenna)

"A cardiac tonic also used as a gargle for sore throat."

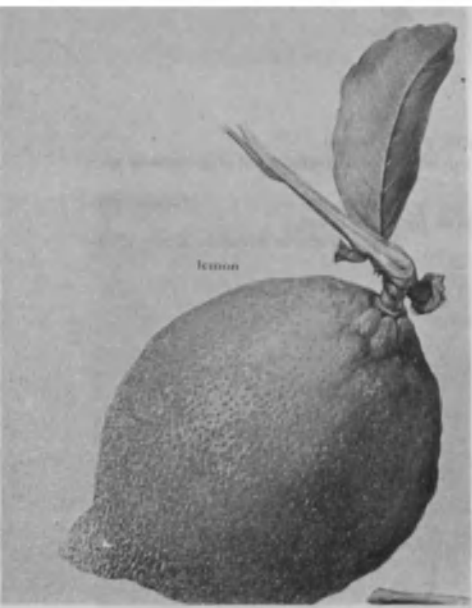
(*Indian Materia Medica, Vol. I, 1954*)





CROCUS SATIVUS (saffron)
"Tones the vital system and exhilarates; produces a sense of luminosity, brilliance and well-being; regarded as a cardiac tonic."
 (Avicenna)

"Stimulant, aphrodisiac and stomachic; slightly anodyne and anti-spasmodic; in overdose it is a narcotic poison; owing to its essential oils it stimulates the central nervous system."
 (Indian Materia Medica, Vol.I)



CITRUS MEDICA (limette)
"Citron is also a cardiac tonic and regarded as a useful remedy for cardiac neurosis and palpitation."
 (Avicenna)

"Fruit is expellent of poisons; pulp is aromatic, stomachic, bitter; rind is aromatic, stimulant, tonic and anti-scorbutic; distilled water of the fruit is sedative, refrigerant and digestive."
 (Indian Materia Medica, Vol.I)



KOREAN SCHIZANDRA
 Used in traditional medicine as a tonic and an analeptic, as a remedy for coughs and shortness of breath, and to improve eyesight. In modern medicine: lessens fatigue and is used as a preventive against senility and arteriosclerosis; contains active vitamin F and vitamin E.

Photo © Permanent Delegation to Unesco of the Democratic People's Republic of Korea

HEARTS AND FLOWERS (continued)



ONOSMA BRACTEATUM
"As a cardiac stimulant and exhilarant it is a drug of choice."
 (Avicenna)

"Used as a tonic, alterative, demulcent, diuretic and refrigerant; also reported to be useful as a spasmolytic."
 (The Wealth of India, Vol.VII)



LAVANDULA STOECHAS (Roman lavender)
"An exhilarant and cardiac tonic; purifies the intellectual faculties of the mind."
 (Avicenna)

"In Eastern medicine it is known as the 'broom of the brain'; strengthens the brain; it is a good stimulant, aromatic, general carminative, diaphoretic, expectorant and anti-spasmodic."
 (Indian Materia Medica, Vol. I)

Photos and drawings © H. Saïd, Karachi, Pakistan

by Michel A. Attisso

MICHEL A. ATTISSO, of Togo, is director and chief pharmacist of the University Hospital Centre and professor at the Faculty of Pharmacy, Montpellier University, France, where earlier he had been a student. Before returning to Montpellier he taught for twelve years at the Faculty of Medicine and Pharmacy of Dakar University, Senegal. He is a consultant to the World Health Organization and was formerly vice-chairman of the International Narcotics Control Board of the United Nations Economic and Social Council.

Right, mountain herbs and plants are identified, cleaned and cut before being sent to a drug processing factory at Kanzikode, India. In collaboration with the Indian Council of Medical Research, the World Health Organization (WHO) has initiated a four-year scientific study on the therapeutic qualities of Ayurveda, the traditional Indian healing system based on homeopathy and naturopathy. In April 1979, as part of its programme on traditional medicine, WHO held a meeting in Rome on research and training in traditional systems of medicine in developing countries with particular reference to medicinal plants and herbs. The meeting called for the creation of a task force for the organization of traditional medicine programmes in Africa, including the establishment of training facilities for young African scientists, botanical gardens for medicinal plants, and provisions for testing traditional therapies.

Photo A. Kochar © WHO, Geneva

Medicinal plants make a comeback

PHYTOTHERAPY, the treatment of illnesses by pharmaceutical preparations based on vegetable drugs, was the mainstay of the therapeutic arsenal until the mid-nineteenth century. This practice gradually gave way to the use of medicines produced from pure molecules of the active ingredients of medicinal plants which had a more specific or precise pharmacological activity. Thus medicinal plants to some extent faded away into oblivion and were replaced by treatments using wholly or partly synthesized chemical substances.

In recent years, there have been unmistakable signs that phytotherapy is making a come-back. Statistics from the International Centre of Commerce show that medicinal plants have lost none of their importance despite the constantly increasing use of chemotherapy, the treatment of

disease by chemical substances. The proportions of medicinal plants used in the preparation of pharmaceutical products in the world today is about one-third that of synthetic chemical substances.

The global value of imports of raw materials of plant origin destined for the pharmaceutical and cosmetic industries soared from \$52.9 million in 1967 to \$71.2 million in 1971, with an annual progression of some 7 per cent since then.

The annual quantities of some of the drugs consumed world-wide since 1974 in the form of pharmaceutical preparations are as follows: 3,000 tonnes of aloes; 10,000 tonnes of fresh artichoke leaves; 5,000 tonnes of quinquina bark; 1,000 tonnes of belladonna, henbane and datura leaves; 5,000 tonnes of senna pods; 1,000 tonnes of digitalis leaves.

In addition, it has been estimated that in 1974 the industrialized countries consumed in the form of infusions: 150 tonnes of lime blossom; 250 tonnes of mint; 100 tonnes of camomile; 200 tonnes of vervain; 30 tonnes of orange blossom; 30 tonnes of Chinese anise; and 45 tonnes of eucalyptus.

These figures alone should be enough to show that there is a renewed interest in medicinal plants, inspired neither by charlatanry nor by any modish desire to return to nature. To understand the underlying reasons for this phenomenon we must look elsewhere.

An understanding of the distinction, ignored by many people, between medicinal plants and vegetable drugs, may help to explain why medicinal plants are today enjoying a new lease of life.



Medicine's 'green revolution'

by Jean-Marie Pelt

ALL over the world, a revival of interest in medicinal plants is making itself keenly felt. Anxiety concerning the excesses of industrial civilizations and the threats which they pose to physical and mental health is leading more and more men and women to seek herbal remedies for their suffering and illness, in a movement of reconciliation with nature.

At the dawn of history, when the first glimmerings of knowledge began to pierce the darkness of men's ignorance, both the therapeutic and the toxic properties of plants were subjects of

▶ A medicinal plant is one which contains in one or several of its organs substances that can be used directly for medicinal purposes or in chemical and pharmaceutical semi-synthesis, while the term vegetable drug refers to that part of the medicinal plant used directly in the preparation of medicines.

As raw materials, medicinal plants are vital as a source of pure molecules which, though not medicines themselves, can be used for the partial synthesis of pharmacologically active derivatives. This is notably the case of various kinds of aloes, agaves and dioscorea which contain steroids that can be used in the partial synthesis of cortico-steroids (hormones secreted by the outer region of the adrenal glands) and their derivatives, of progestational substances and oral contraceptives.

Through their active ingredients, medicinal plants also constitute ideal models for pharmaceutical research. Substitutions and artificial mutations of natural molecules have enabled new kinds of medicines and more specific pharmaceutical products to be obtained. Examples include the synthetic local painkillers which have been derived from the cocaine molecule, medicines used in the treatment of high blood pressure, and derivatives of the alkaloids found in the roots of the Rauwolfia plant.

Finally, when medicinal plants have been picked and checked for quality, parts of them or their secretions can be used as vegetable drugs in phytotherapeutic preparations. In this form they are either prescribed in addition to specific chemotherapy or as major medication for certain ailments, especially psychosomatic complaints, various cardio-vascular diseases (including high blood pressure and certain kinds of heart disease where there are no organic lesions), digestive troubles, disorders of the liver and gall-bladder, and as antiseptics for internal and external use. "Aromatherapy", for example, (treatment using preparations with a base of essential oils of medicinal plants) has made great strides in the last five years.

It is likely that these trends will continue to grow in the next few years. The scientific study of medicinal plants in developing countries will provide new molecules that will directly enrich the present range of medicines or provide a basis for further chemical and pharmacological research.

■ Michel A. Attisso

In a factory at Kottakal, 'India, medicines are prepared according to the precepts of Ayurveda, the classical system of Indian medical science. Traditional Ayurvedic remedies use herbs carefully selected on the basis of a highly elaborate theory which takes into account the taste of the plants and their heat-giving properties. Ayurveda, which literally means the Science of Life, was once widely practised in Asia and is today enjoying a revival. Faithful to Indian traditions, Ayurvedic healers look at the mind and body as a whole before prescribing the appropriate remedy for a disease.

Photo © J.L. Nou, Prades, France

equal interest. Sorcerers, "medicine men" and witch doctors were as familiar with poisons as with cures, and this knowledge gave them an aura of supernatural authority.

In its turn, modern medical science has been enriched by the investigation of plants that were known to primitive societies. Thus the poisonous seed of a West African climbing plant, the calabar bean, once used in trial by ordeal, today yields the drug known as eserine, which contracts the pupil of the eye.

Another modern drug, the powerful heart stimulant ouabain, is obtained from the *Strophantus* plant of tropical Africa and Asia, used to poison arrows for hunting and war. Curare, another arrow-tip poison; used by the Indians of Amazonia, is applied in modern surgery—and abdominal surgery in particular—to produce muscular relaxation.

But how were these plants persuaded to part with their secrets? Doubtless as the result of a lengthy process of trial and error, during which man—whose very existence was intimately bound up with natural processes and whose survival depended on endless stratagems—had to learn to recognize and distinguish between plants which were useful and plants which might do him harm, plants which might be used as food and plants which might cure his illnesses, and plants which were capable of killing him.

JEAN-MARIE PELT, of France, is professor of plant biology and the science of drugs at the University of Metz. Chairman of the Administrative Council of the European Institute of Ecology, Metz, he has undertaken a number of research and teaching missions in Africa and Asia. He has published several works, both scientific and of general interest, including: *Evolution et Sexualité des Plantes* (*Evolution and sexuality of plants*), 1970, *Drogues et Plantes Magiques* (*Magic drugs and plants*), 1971, and *l'Homme Re-naturé* (*Man's links with nature renewed*), 1977.

At a later stage in history, this accumulated knowledge found expression in a number of theories which may give rise to smiles today, the most widespread of which was certainly the so-called "doctrine of signatures".

According to this doctrine, every medicinal plant indicates by a sign its healing properties. "Everything that Nature creates", wrote the Swiss physician Paracelsus in the sixteenth century, "is shaped in the image of the virtue she intends to conceal therein". Thus, plants which secrete the milky substance known as latex will serve to prepare medicines that stimulate lactation. If this latex is yellowish in colour, as in the case of the celandine, the plant is considered helpful in the treatment of jaundice.

Fleshy plants put flesh on human bones. The shape of the walnut is a sign of its usefulness as a medicine for brain diseases, while that of the bean predestines it as a treatment for kidney complaints. This "therapy by analogies", developed by Arab physicians and the medieval alchemists, was in direct opposition to the theories of Hippocrates and of Galen, whose famous aphorism *Contraia contrariis curantur* lay at the foundations of a "therapy by opposites".

Beliefs of this kind, which are found among the traditional healers of Africa, the physicians of China and the empiricists of South America alike, would appear to reflect a characteristic, "pre-scientific" stage in the development of knowledge.

At first sight, the doctrine of signatures may provoke amusement. It is difficult to believe that the leaves of the lungwort are a remedy for chest diseases, just because their vein structure resembles that of the air-cells in the lung; that saxifrage (from the Latin *saxum*, a stone, and *frangere*, to break) splits gallstones as effectively as the rocks in whose crevices it grows; or that bamboo stems help to strengthen the spine because their knotty excrescences resemble vertebrae.



On the other hand, the uncontested virtues of such present-day drugs as colchicine and aspirin seem to confirm this doctrine, which in reality constitutes a means of committing to memory, by means of "signs" and in civilizations which do not keep written records, the remedies which medical experience has shown to be efficient.

If the corm of the colchicum or meadow saffron is shaped like a gout-swollen toe, the extract which it yields, colchicine, is in fact the only effective treatment for this painful affliction. And as for aspirin, its story is worth telling as an example of the evolving relationship between traditional plant medicine and modern pharmacology.

The origins of this drug are to be found in the bark of the willow, a tree of the genus *Salix*, which usually grows in watery places and is only truly happy when its feet are wet. According to the doctrine of signatures, this indicates that the willow does not catch cold, and that it should thus be capable of curing feverish chills, rheumatic pains and similar conditions. And since it is the bark of the willow that keeps it well wrapped up and warm, it is here that one may expect to find the active property in question.

In the eighteenth century, willow-bark was found to be comparable in its bitterness to the bark of a tree found in Peru, the cinchona, an extract from which, quinine, was known to be the supreme remedy for the feverish disease malaria. Thus a decoction from willow-bark came to be used for the treatment of fevers. In 1829 the Frenchman Leroux succeeded in extracting from willow-bark a substance which he called salicine (from the Latin name of the tree).

Not long afterwards, a Swiss pharmacist named Pagenstecher distilled the flowers of meadowsweet, a plant of the genus *Spiraea*, which also likes to have its feet in the water, and obtained a substance very similar to salicine, methyl salicylate. And now the story moves to Germany where, a few years later, yet another similar substance, salicylic acid, was produced artificially for the first time; this in turn yielded a derivative, acetylsalicylic acid, which (with its echo of *Salix*, the original willow) is none other than the official name for aspirin, our common remedy for aches

Photo © Osler Library, McGill University, Montreal, Smithsonian Institution, Washington D.C.



1

and pains, where the syllable "spir" reminds us of its other vegetable ancestor, the meadowsweet *Spiraea*.

Similar processes have given birth to a great many modern medicines, the origins of which are to be found in plants known to man since time immemorial. Ephedrine, for example, which is used in the treatment of asthma, is derived from the *Ephedra* herb, employed in Chinese medicine for at least 5000 years. Sovereign pain-killers like henbane, mandragora, opium and asafetida are listed in the earliest pharmacopoeias of Babylon and Sumer.

In fact, the capacity to relieve pain was probably the first great triumph of medicine, and came long before the ability to heal. Sedatives were used in Ancient Egypt, and a medical treatise drawn up in Thebes in about 1600 BC contains an inventory of seven hundred plants, including purgatives like senna and the castor oil plant, and plants such as those of the genus *Scilla*, used in the treatment of heart conditions.

It was Greek medicine, under the influence of such physicians as Hippocrates and Dioscorides, that established the therapeutic value of herbal remedies, as distinct from their significance in ritual and magic. But sorcery and occult science made a powerful comeback after the fall of the Roman Empire, while knowledge of medicinal plants took refuge in monasteries and convents, and medical learning flourished in the work of Arab scholars.

We now know that certain pathological states described by medieval authors, like the inflamed skin condition called "St. Anthony's fire", can be induced by a minute fungus that attacks grain and grasses, and that collective poisoning can occur, accompanied by the hallucinations in which medieval man detected satanic influences at work, when large numbers of people eat bread made from contaminated flour. But it was not until the eighteenth century that ergot, the fungus in question, was identified. Curiously, ergot serves today to produce a large number of medicines used in the treatment of high blood pressure and other circulatory ailments.

The discovery of America by European explorers and the opening of the sea route to India added new plants and spices to the ancient pharmacopoeias, and thus led to the enrichment of the vast inventory of herbs used in modern medicine.



Photo © National Library, Vienna

A variety of blackberry is depicted on this page from the sixth-century *Codex Aniciae Julianae*, the oldest surviving herbal, or illustrated manual of medicinal plants. The *Codex* is a version of a famous herbal by the Greek physician and pharmacologist Pedanius Dioscorides (1st century AD) who described with remarkable accuracy the therapeutic properties of many plants used in medical practice until modern times.



Photo © J.C. Revy, Paris

2



Photo © University Museum, Philadelphia

3



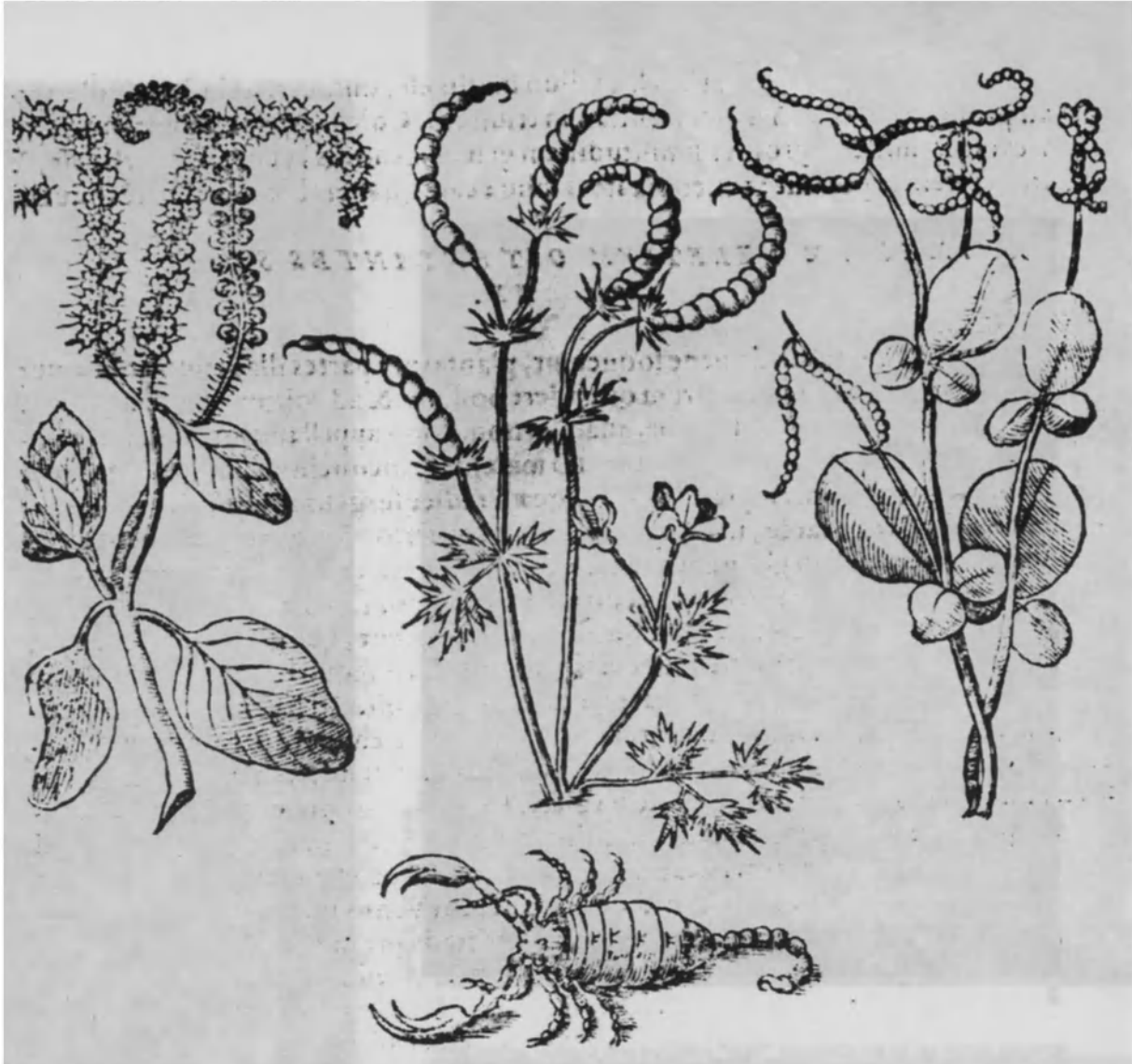
Photo © Bibliothèque Nationale, Paris. Leipzig University Library, Leipzig

4

Documentary milestones in the story of man's long quest for mastery of the art of healing : (1) Illustration from the Arab physician Ahmad al-Ghafiq's classic study on the cultivation and use of medicinal plants (Cordoba, 12th century). Shown here, a stylized representation of the myrtle plant, widely cultivated in northern Africa and the Iberian peninsula. (3) Over 4,000 years old, this tablet unearthed in the ruins of the Sumerian city of Nippur has been proclaimed the world's oldest treatise on medicine. Inscribed on it are recipes for plant medicines, although their uses are not specified. (4) Fragment of the oldest known Egyptian medical manual, the Ebers papyrus. Dating back to the second millennium of the pre-Christian era, it was acquired by the German Egyptologist Georg Ebers in 1873. (2) Birch-bark, as well as the tree's leaves and sap possess blood-cleansing, antiseptic, diuretic, stimulant and sweat-inducing properties. In the 12th century birch flowers were extolled by St. Hildegard as aiding the formation of scar tissue.

"God has imprinted on plants, herbs and flowers hieroglyphics which are in some wise the very signature of their virtues", wrote the 17th-century English botanist Robert Turner. According to this "theory of signatures", which held sway for centuries, medicinal plants possess some feature such as the shape of their roots, leaves or flowers which relates them to the ailment they can heal. According to one variant of the theory (right) propounded by the Italian scientist Giambattista della Porta (1538 - 1615) a scorpion bite can be countered by heliotrope, cumin and scorpionus, plants whose appearance has marked affinities with that of the deadly creature (pictured at bottom of document).

All Rights Reserved



The nineteenth century marks a watershed in the manner in which medicinal plants are used, and the transition from use of the plants themselves or preparations made from them for therapeutic purposes, to use of the active molecules they contain. This is, in fact, the period when the productivist ideologies of young industrial societies begin to overthrow the traditional image of nature, which is no longer regarded as anything but a vast source of readily available raw materials. The resources are there to be exploited, and modern man indeed exploits them, sometimes to an excessive extent.

Where the plant world was once composed of individual "personalities", it is now considered merely as a mine, whose sole purpose is to yield the substances it contains. In many cases, it must be said, this new approach has its advantages: no one would dream of sweetening their coffee with a lump of beetroot, when it is much more convenient to extract the sugar from the beetroot first!

When this process is carried further, and chemists succeed in reproducing artificially a specific active substance, there is no further need for the plant from which it was originally obtained. And the next stage, when one synthetic product is transformed into a series of derivatives, which are tested first on animals and then added to the steadily lengthening list of "chemical" medicines, can be carried so far that the fact that once upon a time there was a plant which produced the same effects is all but forgotten. Who today remembers that the amphetamines, prescribed as a stimulant in cases of depression, are merely synthetic "descendants" of a natural extract of the *Ephedra*?

The shelves of modern pharmacies are stocked in this way with artificial products, many of which originated in the active constituents of medicinal plants. To an ever-increasing extent, man is producing artificial molecules, which have no counterpart in the natural world, and using them to concoct potions of his own making.

Produced in greater and greater quantities and designed to serve a huge variety of purposes, these synthetic compounds tend to result in what we may call "medicinal pollution", with the grave at-

tendant problem posed by the daily consumption, on a constantly growing scale, of vast amounts of medicines by people who are not really ill. Tonics, tranquilizers, all kinds of psychotropic treatment, contraceptive pills and so on, these are the "convenience medicines", absorbed in huge quantities by masses of basically healthy individuals in the belief that they will feel better as a result. "In the belief" only, for there are no means of telling whether, in the long run, the effect will be beneficial.

However, more and more people are asking themselves what will happen if uncontrolled industrial development, based on the production and consumption of ever-increasing quantities of new commodities, is permitted to continue.

There is a powerful public demand for research into "softer", less aggressive therapeutic techniques, which will subject the human system to less strain, accompanied by a steep worldwide increase in the production and consumption of medicinal plants.

But before breaking with the excesses of our chemistry-based civilization, and inventing or re-inventing new therapies designed to place man on better terms with his environment, it would be wise to clarify, once and for all, the relationship between inductive science and the empiricism of the ancient physicians and healers, a relationship which resembles that of a couple in which the partners are somewhat weary of living together, but at the same time incapable of living alone! A speedy reconciliation is called for. Here lies the interest of the research carried out by the World Health Organization, which is encouraging all its Member States to draw up a completely fresh inventory of their therapeutic resources, in which medicinal plants continue to occupy a prominent place.

There can be no doubt that such a research programme will lead to the discovery of new medicines and the development of new attitudes to the treatment of illness. It is hardly necessary to recall that their wisdom and keen sense of observation frequently led our ancestors on different continents to use the same natural medicines for the treatment of the same afflictions. Thus, the continents with tropical climates each produced popular remedies for the same disease, leprosy, based on extracts from the same family of plants, the *Flacourtaeae*. In other words, healers working

thousands of kilometres apart, unaware of each other's existence, discovered the same medicines, based on very similar plants which modern botany groups in the same family. Both the Incas and the Chinese, for example, considered that the water lily had sedative and anaphrodisiac properties!

Such convergences, when they occur, draw attention to the usefulness of drugs discovered at different times by different civilizations. Today a number of countries are devoting considerable resources to the reappraisal and scientific investigation of their therapeutic traditions. Identical efforts in this connexion in every continent would not only enrich the cultural heritage of each people, society and civilization, but also place additional resources at the disposal of modern medicine.

Progress of this kind, however, presupposes an entirely new approach to medicinal plants. After decades of analytical research aimed at the extraction of specific active substances, the accent should now be placed on utilization of the entire plant. In this respect, some of the radically new concepts of ecology may be of help.

To the ecologist, a given effect is never the product of a single cause, but rather the outcome of interplay between a number of simultaneously occurring phenomena. In a complex system, therefore, the whole is more than the sum of its components; and understanding of the former depends on more than familiarity with the latter. The "working" of nature's machine is not the sum of the actions carried out simultaneously and in juxtaposition by all its

parts, but the consequence of the many interactions between them. Expressed more simply, it is as if, once a certain threshold of complexity has been passed, matter and life acquire new properties.

In application to medicinal plants, whose composition is invariably complex, this theory confirms *a posteriori* the traditional theories according to which a plant in its entirety has properties which differ from those of its constituent parts. The overall properties of ergot, opium or digitalis, which are clearly different from the properties of the individual substances which they contain, are examples most frequently cited in support of such notions, but they are not particularly convincing, since a minimum of Cartesian logic is enough to show that the properties of a mixture constitute an algebraic summation of the properties of its ingredients.

Our experiments with the artichoke would appear to yield more significant results in this connexion. According to the doctrine of signatures, this bitter-tasting plant ought to assist the functioning of the liver, and this is in fact the case. The property involved was initially attributed to a single substance, and then it was discovered that a number of other substances are also partially responsible. When, however, these were tested separately on mice, it rapidly became clear that the majority of them — in isolation — were totally inactive. On the other hand, the administration in equal doses of mixtures of these substances revealed that the greater the number of ingredients involved, the more pronounced was their activity. In other words, this was a spectacular demonstration of how new

CONTINUED PAGE 16

An intriguing feature of this 16th-century sculpture of St. George and the Dragon, which stands in the palace of Prague (Czechoslovakia) is that the clash takes place in a field of stylized artichokes (detail below right). Experiments seem to show that the bitter leaves of the artichoke, a plant of Mediterranean origin, assist the functioning of the liver, as suggested by the "doctrine of signatures".

Photo Jaroslav Jerabek © Narodni Gallery, Prague

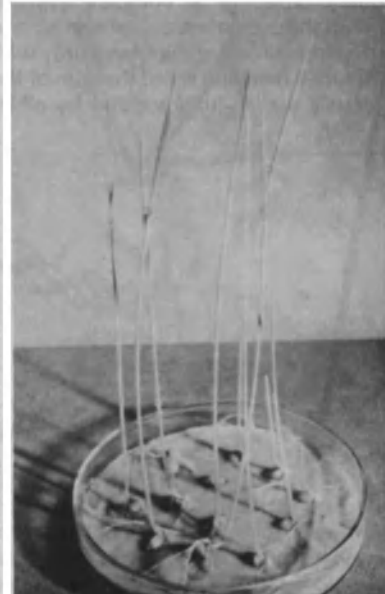




1



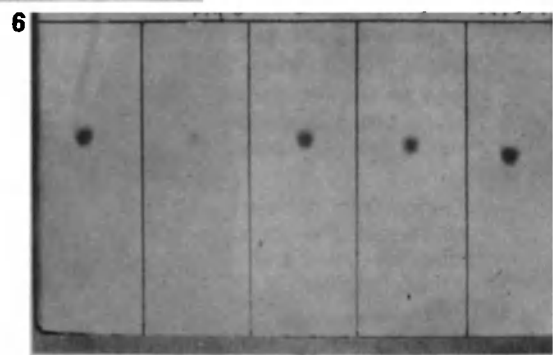
2



3



5



6

Pine-tree therapy for the vascular system

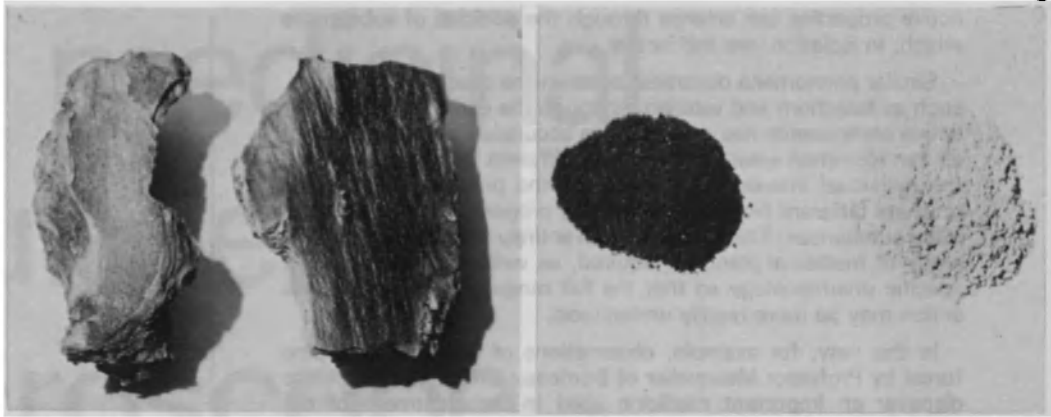
The Maritime Pine has a tendency to inhibit the growth of other plant-life. Its needles and bark contain a substance of the pycnogenol group which is dissolved by rain and impregnates the soil, thus inhibiting grasses from germinating and taking root.

Photo 1, a forest floor carpeted with pine-needles. Photo 2, grasses cannot get a foothold at the base of trees whose bark has been stripped. This phenomenon can be reproduced in the laboratory. Wheat seeds placed on dampened paper, photo 3, germinate and grow very rapidly, but in the presence of coarsely-ground pine-needles, photo 4, germination is virtually eliminated. Similarly, a poplar cutting placed in water grows roots within a few

days, photo 5 bottom, whereas on a cutting placed in an infusion of pine-needles no roots appear, photo 5 top. This is a question of hormonal activity. The pycnogenol in the pine inhibits the activity of the enzyme whose task is to maintain the optimal level of the growth hormone ; as a result the excess accumulation of the hormone upsets the growth mechanism. This effect can be seen in photo 6; the dark spot in the first frame (from left to right) indicates a high hormonal level. The second frame, in which the spot is almost invisible, shows the regulatory effect of the enzyme. The third, fourth and fifth frames show the inhibition of the enzyme by the action of the pycnogenol and the consequent high

hormonal level. In mammals, however, pycnogenol from pines acts like a vitamin and is used as a therapeutic for the vascular system. The vitamin is extracted from the bark of the pine, photo 7. It is a virtually colourless substance which has to be separated from the dark red tannin in which the bark is rich, photo 8. The separation is effected by an industrial process based on the specific solubility of the vitamin in certain organic solvents. Photo 9 shows the substance accumulated in the upper layer formed by one these solvents. The action of this vitamin is studied by means of carbon 14 labelling. This is achieved by photosynthesis in an atmosphere of radioactive carbonic gas,

7



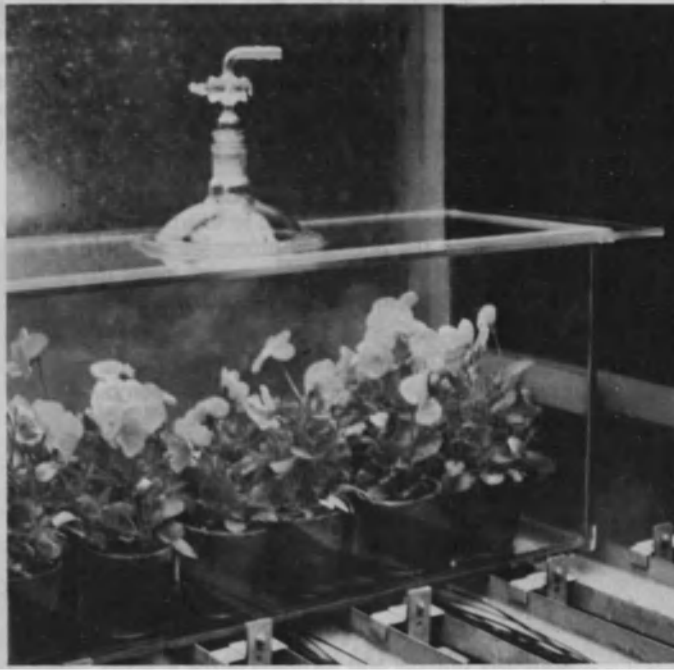
4



9



8

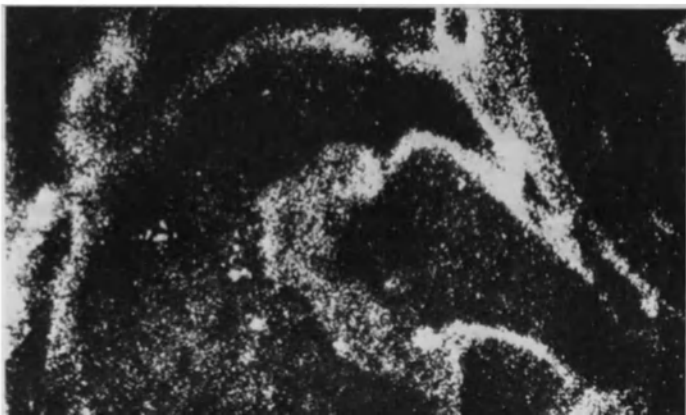


10

Photos © Professor J. Masquelier, Faculty of Medicine, Bordeaux



11



12

and, since it is difficult to cultivate a pine-tree in a laboratory, the yellow pansy, which contains a precursor of pycnogenol, is used instead, photo 10.

After oral administration to mice, the vitamin, being radioactive, can easily be detected in the animals' bodies. In photo 11, the white areas are due to radioactivity and demonstrate that the vitamin has spread throughout the entire organism, even to the skin and the vertebral discs. Photo 12 is a photographic enlargement of the heart showing the walls of the large blood vessels. The vitamin isolated from the pine acts in conjunction with vitamin C to maintain the vascular system in good condition and for this reason is often referred to as "vitamin C₂".

active properties can emerge through the addition of substances which, in isolation, are ineffective.

Similar phenomena doubtless occur in the case of other plants, such as hawthorn and valerian, although the exact nature of their active components has not yet been accurately determined. Just as the "common weal" is something different from the sum of all the individual interests concerned, so the properties of a given drug are different from the sum of the properties of all its constituent substances. This means that an entirely new approach to the study of medicinal plants is required, as well as development of specific pharmacology so that the full range of their nature and action may be more readily understood.

In this way, for example, observations of the floor of a pine forest by Professor Masquelier of Bordeaux University, led him to discover an important medicine used in the treatment of circulatory disorders. Noting that grass is virtually non-existent on the floor of such forests, Masquelier wondered whether the cause of its absence might not be found in a substance contained in the dead pine-needles, which inhibited the germination of the grass seeds. Tests made with a decoction of dead needles revealed that such inhibition did in fact occur, and powerfully so (see photo story pages 14 and 15).

Professor Masquelier succeeded in extracting the substance responsible, which was found to exercise a profoundly disturbing influence on the hormonal processes governing the division and elongation of vegetal cells. It was also found that this substance inhibited the growth of malignant cell cultures of human origin.

When attempts were made to reproduce it synthetically, however, it was found that only the polymers possessed such a property (polymers are substances composed of very large molecules that are multiples of simpler chemical units called monomers). However, when reduced to dimers (a dimer is a compound formed by the union of two molecules), these substances were found to strengthen the resistance of the capillary blood vessels and thus to fortify the cardiovascular system. Observation of woodland undergrowth, coupled with the quest for new therapeutic compounds thus led to the discovery of a new treatment for circulatory diseases, based on an extract of pine-needles.

This shows how scientific research must sometimes follow curiously original and tortuous paths in order to arrive at positive results.

Of a simpler nature are the tests which are systematically carried out on plants in order to determine their activity. Every year, such tests are applied in industrial and university laboratories to thousands of species used by purveyors of herbal remedies in all corners of the world.

Of more than ten thousand species investigated in this manner, in the quest for a cure for cancer, only 10 per cent have revealed—and only to a minor extent—such properties. Some fifty of these have been examined in greater detail, and it may be hoped that some at least may one day form the basis of a useful therapy.

Another fruitful line of research consists in the investigation of genera, species and subspecies of plants which are rich in active substances. Reasoning by analogy suggests that if a certain substance is found in the members of one species, it is likely to be present in the members of a closely similar species.

Despite appearances, there is order in nature's affairs, and the chemistry of botanical species is by no means a haphazard process. There is a "family spirit" among plants, and each family is specialized in its own type of chemical reactions, just as each produces its own type of flower.

At all events, and irrespective of the chosen path of research, the study of medicinal plants is enjoying a new lease of life throughout the world, and there are encouraging signs in the keen interest now shown by the developing countries in their own traditional pharmacopoeias. With the encouragement of the World Health Organization, they are endeavouring to meet public health requirements from their own resources, drawing on all that is richest in the age-old medical traditions of their own civilizations and thus reducing to a minimum the import of costly foreign drugs, whose superiority is not always evident. Today, as in the past, the world of medicinal plants remains a vast one, offering its horizons to research and medical progress.

■ Jean-Marie Pelt

THE study of extractives of medicinal plants is without doubt the most commonly chosen field of research among organic chemists in Africa. Many people think that it is an obvious and natural subject of study for an African chemist.

This is not only because of the abundance of plants in our environment but also because of the important role they have played in our system of traditional medicine. It has been virtually assumed that if only one took the trouble to find out what the African herbalist uses, and extracted it, one would without fail come up with something new to modern medical science.

Indeed the study of African medicinal plants is a field with many promising prospects and one which should be given high priority in terms of research effort and funding. But this is not because plant use in traditional medicine is unique to Africa. Most countries of the world at one time or another have had a traditional system of medicine similar to that of Africa which involved the use of plants.

In countries such as those of North America, Europe, Australasia, Japan and the Indian subcontinent in which scientific investigation of plants has been intense and of long standing, few of their medicinal plants if any at all have survived *as such* in present-day medical practice. However these investigations have made tremendous contributions to scientific knowledge, particularly organic chemistry, and inspired the development of new synthetic

DONALD E.U. EKONG, of Nigeria, is professor of chemistry at the University of Ibadan and first Vice-Chancellor of the University of Port Harcourt, Nigeria. He is the author of a number of papers on the chemistry of natural products in which he has a special interest.

African medicinal plants under the microscope

by Donald E.U. Ekong

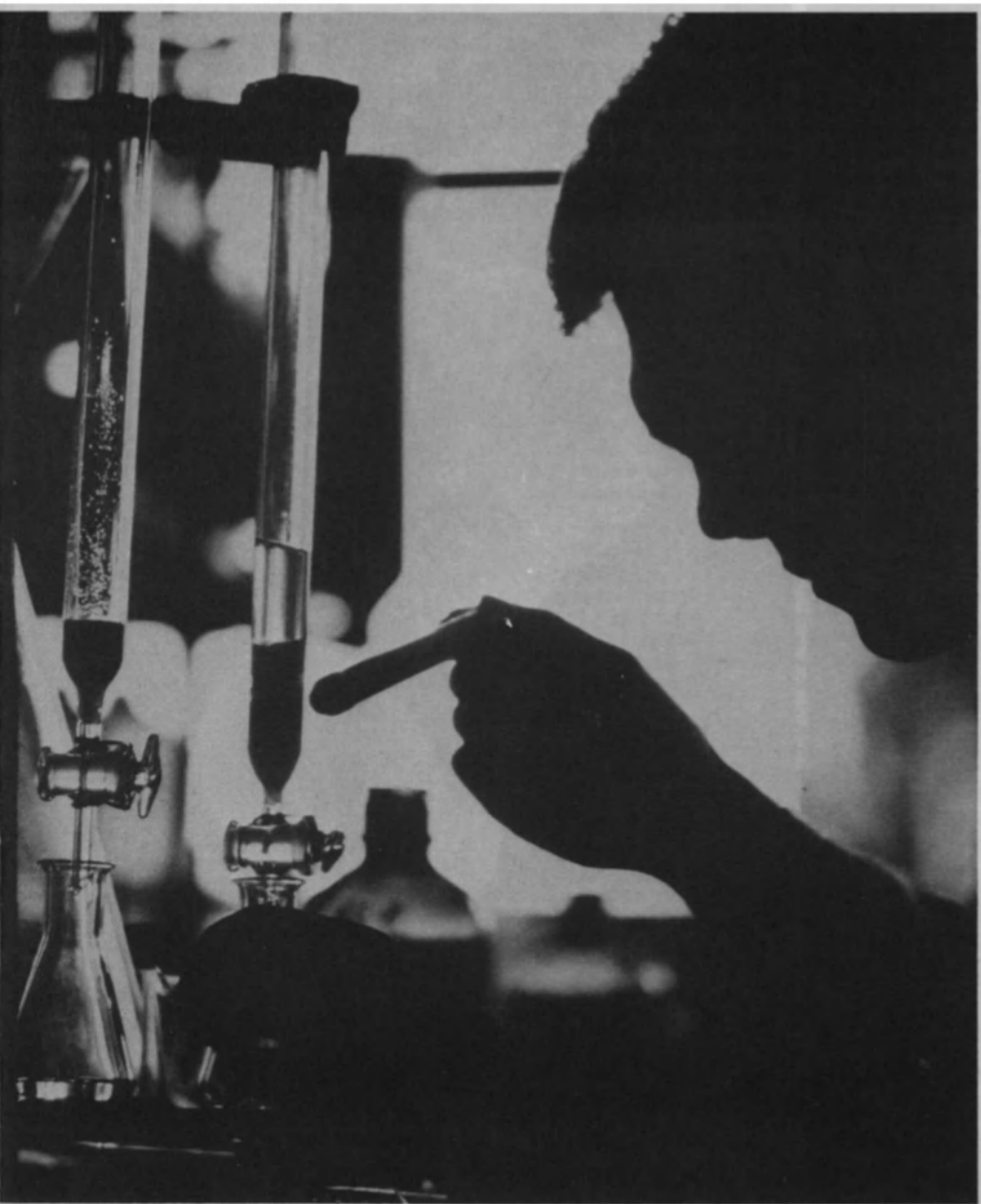


Photo © CNRS, Paris

Plant extracts being separated by a process known as column chromatography at a laboratory of the French *Centre National de Recherches Scientifiques*. Using this technique, chemists can separate the components of a mixture without having detailed prior knowledge of the type, number or relative amounts of the substances present.

medicines with far superior properties to those of the traditional medicinal plants.

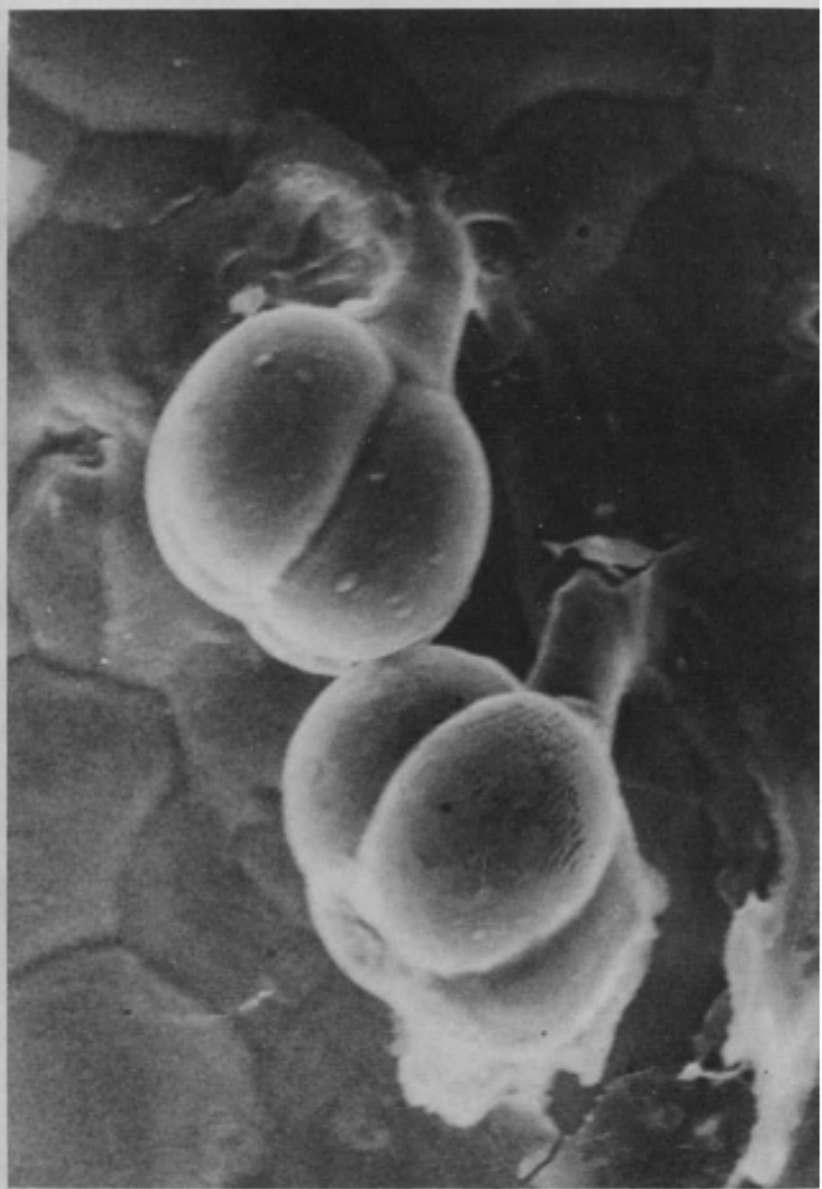
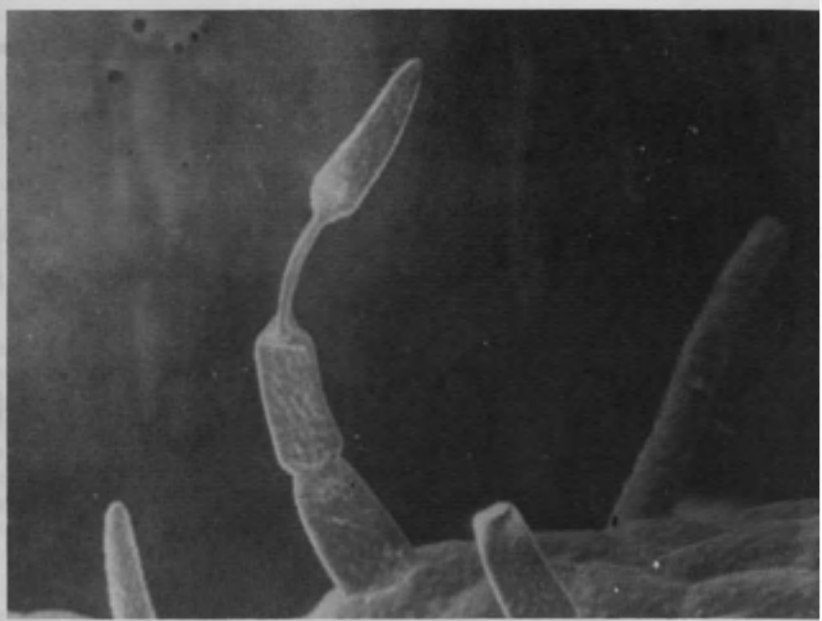
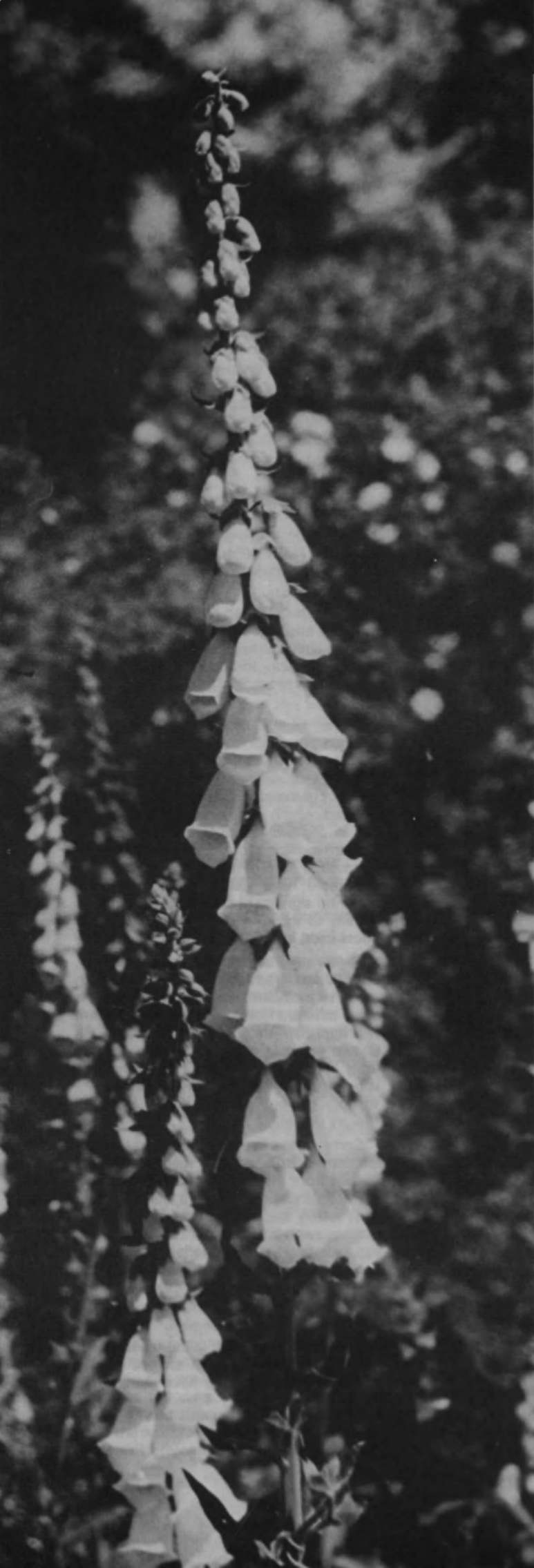
Not that African medicinal plants have not been investigated before. Indeed there is hardly any common African plant which has not been studied, mostly in Europe and North America, and the results of the investigations recorded in the world scientific literature.

Some of them have yielded active substances which were already known from other sources. An example is the bark and latex of *Antioris africana* from which cardiac glycosides (heart poisons) were isolated, which were already known to occur in *Digitalis* species, and are used in modern medicine for the treatment of heart diseases. Most of the plants already investigated have yielded substances with either no significant activity or with inferior activity to those of other well-known products used in modern medical practice.

A few new substances have, however, been discovered and are now used in modern medicine although such use is often different from that to which the plant was applied in traditional medicine. A well-known example is physostigmine isolated from the "esere bean" (*Physostigma venenosum*) which is now used in ophthalmology, but was traditionally used for trial by ordeal.

Some of the importance of research on extractives from African medicinal plants derives from the fact that naturally occurring substances which have biological activity often inspire chemists not only to synthesize them, in order to obtain them more easily than by extraction from plants, but also to synthesize derivatives of the parent drug which often have superior medicinal properties to the natural products.

Some of our research in Ibadan (Nigeria) has been concerned with studies of this nature. For instance we have studied the



Photos © A.D. Pasquale, University of Messina, Italy

Photo Georges Viollon © Rapho, Paris

▶ roots of the tree *Fagara xanthoxyloides* commonly used in traditional medicine and also as chewing sticks which are chewed to a brush and used to clean the teeth. Various natural products were isolated including a good yield of xanthoxylol which had earlier been isolated from the wood of the same tree and its structure elucidated. It was reported that crude aqueous extracts of the roots had antimicrobial and anti-sickling activity. Sickling makes affected red blood cells assume strange crescent forms, deprives them of the ability to transport oxygen, and causes their destruction by dissolution of the cell. This prompted us to have bioassays—tests of the strength of a substance by comparing its effect with that of a standard preparation—carried out on the pure compounds that we had earlier isolated from the roots.

In a preliminary bioassay carried out at University College Hospital, Ibadan, xanthoxylol seemed to possess some anti-sickling activity. In an attempt to enhance this activity, various modifications of the

structure of the compound were carried out. This was facilitated particularly by the fact that the substance could be obtained in good yield from the roots of the plant. Of the modified products, a compound called DBA appeared the most interesting and detailed bioassay studies carried out in the Sickie Cell Centre, Harlem Hospital, New York, showed it to be a very active anti-sickling agent. DBA has many properties such as lack of acute toxicity and non interference with oxygen delivery which make it superior to most known anti-sickling agents and suggest that it might be a useful therapeutic agent for sickle cell anaemia.

Another promising approach to the study of extractives of African medicinal plants arises from the possibility of isolating in adequate yield certain compounds which, though themselves not active medicinally, might provide the raw materials for the synthesis of already known and accepted drugs. For instance most of the steroids, which represent a

CONTINUED PAGE 42

The development of the scanning electron microscope, which can provide three-dimensional images of the surface structure of plant cells and tissue, has enabled researchers to study in detail the sites at which biochemical activities take place within the plant. Far left, a fine specimen of *Digitalis purpurea*. Left, two photos of the upper face of a leaf of the *Digitalis purpurea*, as seen by a scanning electron microscope, showing the protective and glandular hairs of the leaf magnified about a thousand times. *Digitalis purpurea*, the common, purple foxglove, is cultivated commercially as the source of the heart-stimulating drug digitalis.

Unesco and the basic chemistry of natural products

BEHIND a barrage of test tubes, retorts and, to the layman, seemingly obscure symbols and formulae, scientists working in the field of the basic chemistry of natural products are quietly writing a new page in social and economic as well as scientific history.

Research in one specific corner of this field, the basic chemistry of medicinal plants, is proving particularly exciting and has already achieved notable successes. Development of the compounds on which the contraceptive pill is based, for example, has sparked off a chemotherapeutic, social and demographic revolution; development of pyrethrin pesticides, as powerful as DDT but without the latter's harmful side-effects, offers new hope of controlling certain widespread human diseases and of curbing crop depredation by pests.

A particularly interesting aspect of research into the basic chemistry of medicinal plants is that the lead time between basic research and practical application is now comparatively short. Furthermore, it is a field which offers virtually limitless possibilities for original work with high economic returns and which is accessible to workers over a wide range of capability and sophistication (rudimentary student projects of considerable educational value can be attempted at high school and university level). It is therefore an ideal growth area for many developing countries.

With all these factors in mind, Unesco has established the South-east Asian Regional Network for the Chemistry of Natural Products which links research institutions in eleven Member States.

The network is founded on the principle of self-help and mutual co-operation. It concentrates on existing facilities and resources and provides an organizational structure which allows each institution to contribute as best it can, and to seek assistance directly from colleagues in other countries.

This system allows for the realistic use of the very limited funding available provided in the main by the participating countries themselves, most of whom are developing countries, by a generous annual grant from the government of Japan of US \$50,000 and from Unesco's regular programme budget. It encourages the development of research directly related to the needs of the region, as determined locally by local chemists.

Directed by a co-ordinating board consisting of one chemist from each participating Member State, the network's major activities include the organization, in local universities, of training courses for young chemists in techniques and interpretation of data; the holding of seminars at both national and regional levels; exchange programmes which allow institutions to invite eminent chemists to assist in the development of their research programmes and which enable individual young research workers to obtain short term research fellowships to travel to other institutions in the region for further training; collaborative research projects which normally involve teams in three or more institutions. The co-ordinating board also publishes a regional newsletter, "Chemistry", a triannual publication which now has a reading public both inside and outside the region in some twenty-one countries.

A medical thesaurus from the roof of the world

by Lydia Khundanova

Text and photos © copyright

Reproduction prohibited

WIDELY practised in many countries of south-east Asia as far back as two to three thousand years ago, the Tibetan system of medicine was a synthesis of the traditional medicines of Tibet, India, China, Mongolia and other countries.

The system was based on the notion of the integrity, the wholeness of the organism, and treatment, by a combination of natural medicines of animal, vegetable or mineral origin, was aimed at the entire organism and not at curing any individual part of it.

Among the many treatises and manuals on Tibetan medicine, the main canonical work and the fullest manual is the four-volume *Rgyud-bzhi* (literally, the four principles) which contains both theory and practice. According to tradition it was written in Sanskrit in the fifth century BC and was translated into Tibetan in about 820 AD. The original Sanskrit manuscript has long been lost.

The four volumes which make up the *Rgyud-bzhi* consist of: Volume I, *Basic Principles*, which presents a six-chapter outline of the framework of the manual and an introduction to Tibetan medicine; Volume II, *Theoretical Foundations*, in which the general theory of Tibetan medicine is developed, in thirty-one chapters; Volume III, *Fundamentals of the Doctor's Art*, ninety-two chapters dealing with general pathology and practical prescriptions for treatment; Volume IV, *Supplementary Principles*, twenty-seven chapters giving additional information on diagnostic methods and treatment.

Towards the end of the seventeenth century, a high-ranking Tibetan physician wrote the *Vaidouria-onbo*, a 1,283-page commentary on each of the 156 chapters of the *Rgyud-bzhi*. The commentaries contained in the *Vaidouria-onbo* were illustrated by the *Atlas of Indo-Tibetan Medicine*. This consisted of seventy-seven stylized colour plates containing a total of over ten thousand individual illustrations (see front cover and colour pages 22, 23 and 24).

Compiled at the monastery of Serkog-Manba in north-eastern Tibet, the Atlas was acquired by a Buryat doctor who had gone there to study medicine; it is now preserved in the Ethnographical Museum of Ulan Ude in the Autonomous Soviet Socialist Republic of Buryat.

Only twelve of these plates, including that reproduced on page 24, have been published before; the plates shown on our cover and central colour pages are here published for the first time ever.

Tibetan physicians still use many of the methods and remedies handed down from ancient days and, today, in India and a number of European countries, Tibetan medicines are being scientifically investigated. In the USSR, the Siberian section of the Academy of Sciences has established a special department at which the biologically active components of Tibetan medicines are being tested under experimental laboratory conditions.

LYDIA KHUNDANOVA, of the USSR, is director of a unit of the Buryat branch of the Siberian section of the USSR Academy of Sciences that is studying the biologically active components of Indo-Tibetan medicine. A physician, she is the author of some sixty works including an important monograph on Tibetan medicine.

Colour page

In the Middle Ages, Islamic scholars made a great contribution to the study of botany and in particular of medicinal plants. Compiled in the 9th century al-Dinawari's six-volume *Book of Plants* was of outstanding importance. It combined a philological, historical and botanical approach to the study of plants whose medicinal properties he listed in detail. Avicenna dealt with medicinal plants in his pharmacological studies and al-Biruni listed in his *Book of Drugs* some 850 drugs of every conceivable origin, giving their names in several languages. The first Arabic work on drugs in their simple or natural state, compiled by Masarjis, preceded by a century the translation into Arabic of the famous *Materia Medica* of the Greek physician Dioscorides. The first Arabic version of the *Materia Medica* was compiled in the 9th century. Colour photo right is of a page of a 15th-century Persian edition of this work, now preserved in the Topkapi Museum, Istanbul. It shows, top left, the formula for the preparation of a remedy extracted from various aquatic plants such as papyrus. The main text describes a powder preparation used in the treatment of hepatic infections, disorders of the spleen and menstruation problems.

Photo Roland Michaud © Rapho, Paris.

Central colour pages

Coloured plates from the *Atlas of Indo-Tibetan Medicine* which illustrates the *Vaidouria-onbo*, a commentary on the most famous and most complete manual of Tibetan medicine, the *Rgyud-bzhi* (see article this page). Colour page 22: plate 24 from the *Atlas*, with illustrations referring to chapter 20 of the *Rgyud-bzhi* on *Medicines and Official Plants*. Colour page 23: top left, detail from plate 24 and, top right and bottom, details from plate 30 which illustrates some of the remedies given in the same chapter. Although the first two volumes of the *Rgyud-bzhi* were translated into Russian at the turn of the century, the complete text has never been translated into any European language. Today, at Ulan-Ude, in southern Siberia, orientalist, historians, physicians, pharmacists and linguists are working together on a new, more accurate translation of the *Rgyud-bzhi*, a task made more difficult because the text contains many cryptic passages inscribed in numbers or in the form of allegories.

Photos © V. Shumakov, Russian edition of the *Unesco Courier*, Moscow — Buryat Department, Siberian section of the USSR Academy of Sciences

صنعت بقرون بنایت که میرود در پیشها و آبها بسیار و این ادویه است بسیار آب
 و سردست و اکثر دم میدهد و از ویکنه گاعدی سوخته که صلاحیت آن دارد که داخل شود



ت طرفا یعنی
 کز او دور است



نوع الثاني من البهردي

روید برکنار باد پیشها و دریا ماه آبها بسیار و آبها مشابها شکوفه مخلطه
 دریا مثل دیگر نوعها است که میرود در بر وجه الکن شتره برید مشابها زوست و بقبض طعمه است او نیست و صلاحیت آن
 عوض مازو واقع شود در سه ماه و ادوی دمان است و شراب او میند خون رقتن است و رقتن سنگم و از جهت جبین
 یرقان و کزین نوعی از ما که در تیلای سوزانند فایده کند و منع کند آماه را هرگاه که بهالند یا و

بسیار آب
 و سردست و اکثر دم میدهد
 و از ویکنه گاعدی سوخته
 که صلاحیت آن دارد که داخل شود
 و عارض شود او را قطن جمع شود
 و باک کرد و آنکه بکند از آنجا که
 و عارض شود او را قطن جمع شود
 و باک کرد و آنکه بکند از آنجا که
 و عارض شود او را قطن جمع شود
 و باک کرد و آنکه بکند از آنجا که



صورة الشجرة الطرفا
 و من کز

نوع الثاني من الشجرة الطرفا
 و من کز

رقتن سنگم و از جهت جبین
 یرقان و کزین نوعی از ما که در تیلای سوزانند فایده کند و منع کند آماه را هرگاه که بهالند یا و
 میکند فعل شراش و آبی که بخته بود در بر کل کزوتی که
 بکند از دیحال را و منع کند در
 منفضه کند با و
 و زبان را که
 جبین همیشه روان
 باشد نافع بود
 کزین
 در و باک کند
 با و
 خور او جبین
 نافع است کسی را که شتر
 پیدا شود و خاک کز نافع است از سیلان رحم و بعضی از
 مردم میگفت آنرا جبهاد کز و ج او کاه سها و آب
 دهند با و کسافی را که بهر زبان



China: a new medicine born of tradition

by Wei Wen

Colour page

This plate, like those on our front cover and central colour pages, is taken from the *Atlas of Indo-Tibetan Medicine*. It illustrates various mineral and vegetable medicinal substances mentioned in chapter 20 of the famous Tibetan medical manual, the *Agyud-bzhi*, including precious stones (after pulverization), mineral salts, plants and the fruit and leaves of trees. The original of this illustration is now preserved at the Institute of Tibetan Medicine, Lhasa, People's Republic of China.

Photo © China, *Illustrated Review*,
People's Republic of China

A new, highly effective antimalarial drug has been successfully extracted in China from a medicinal herb. This is a breakthrough comparable to the development of chloroquine, which is accepted throughout the world as the most effective treatment for malaria.

The new drug, *Ching Hao Su*, is a substance obtained from wormwood, a plant which, according to ancient Chinese medical records, was used in the treatment of malaria more than 1,000 years ago.

Research began at the Institute of Chinese Materia Medica, which is attached to the Academy of Traditional Chinese Medicine. Members of the Institute's staff succeeded in extracting *Ching Hao Su* in 1972. Later dozens of other scientific organizations joined in the work. Clinical tests and experiments in chemical pharmacology, preparation and production processes were studied and herbal resources were surveyed. The clinical effectiveness and chemical structure of the drug were ascertained. Its crystalline chemical structure is entirely different from those of the antimalarial drugs now being used throughout the world, and in this respect *Ching Hao Su* is entirely new.

The new drug can be administered orally or by intramuscular injection. Reliable though it is, it has one shortcoming: it is unable to prevent short-term relapses. Efforts are now being made to remedy this defect.

Traditional medicine is part of China's cultural heritage. As early as the Warring States period (475-221 BC) herbal medicine began to develop as an independent branch of Chinese medical science. As time went by, more and more medicinal herbs were discovered and experience in using them against disease grew richer.

China's health services are making great efforts to develop and popularize both the traditional and the western schools of medicine, with the aim of creating a new integrated medical science based on a synthesis of the two schools. To date, more than 5,000 varieties of medicinal herbs have been catalogued in China, as against some 2,000 before liberation. Many therapeutic herbs and treatments have been collected from the Chinese people, some more effective than certain western drugs.

In this field, China is focussing on herbs for the prevention and treatment of common and recurrent diseases. One example is chronic bronchitis, which affects from 3 to 5 per cent of the population in some parts of northern China. Since 1971 the government has sent 290,000 medical workers to the countryside, factories and mines to study the prevention and treat-

WEI WEN, of the People's Republic of China, is a specialist in medical information who writes for the *New China Agency*, Peking.

China's herbal drugstores

Traditional Chinese medicine, known throughout the world primarily for its acupuncture, has used plants and herbs since very ancient times. Today, in conjunction with Western medical techniques, the use of medicinal plants is helping China to spend less on synthetic drugs and its people to achieve better health. Far right, boxes brimming with herbs in a chemist's shop give a glimpse of the variety of Chinese herbal remedies. Top right, medicinal herbs being dried by growers and "barefoot doctors" at Huangshan (Ankwei province). Bottom, right, at a Peking pharmacy, staff prepare herbal prescriptions while the customer waits.

Photo © H. Saïd, Karachi, Pakistan



Photo © WHO, Geneva

ment of this disease. Along with the village "barefoot doctors", these medical workers have investigated the impact of the disease and collected some 100 effective drugs, including a plant named *Muching* which with nine others is being introduced all over the country. Dozens of compounds have been produced.

Clinical reports made in the past few years show that *Muching* (*vitex negundo* var. *cannabifolia*) has been highly effective in treating 60 per cent of the 2,000 chronic bronchitis patients tested. Laboratory tests show that this herbal medicine is effective for clearing up phlegm. It stimulates the body responses, promotes the functions of the cortex of the adrenal glands, and acts as an antihistamine (used to relieve the symptoms of hay fever and other allergies) or as a sedative.

The work done on *Muching* shows how western techniques may be integrated into traditional Chinese medicine. The use of *Muching* dates back many centuries, but ancient pharmacological works recorded that only the fruit and the roots of the herb

were effective in treating chronic bronchitis. No previous sources have been found to indicate that the leaves are useful. However, modern chemical analysis shows that the medicinal quality of the fruit is due to the volatile oil content of its calyx, the outer circle of leaflike scales at the base of the flower, and that the leaves contain four to six times more volatile oil than the fruit. This important discovery has opened wide possibilities for the extraction of oil from *Muching*. The case of *Muching* demonstrates that there is much to be learned from the experience of traditional Chinese medicine and, on the other hand, that traditional medicine must be made more effective by applying modern scientific methods.

The Chinese herb medicine *salvia miltiorrhiza* is now being used to treat diseases of the coronary artery, another common illness. This medicine was known in ancient times for its efficacy in activating the circulation of the blood. The herb has been made into injectable solutions for the treatment of angina pectoris and has proved ef-

fective in 87 per cent of cases. Electrocardiograms showed some improvement in 53 per cent of the patients thus treated. Laboratory tests reveal that in patients given injections of *salvia miltiorrhiza* there is a noticeable increase in the volume of blood circulated. Tests also show that treatment with this drug causes a drop in blood viscosity. It also hastens the flow of red cells, in some cases bringing this flow back to normal. These results show that the medicine promotes blood circulation and dissolves clots of red intercellular bodies.

A large number of effective herbal remedies have been found for treating burns, hypertension and even cancer. They are abundant and inexpensive, but they work slowly. Since 1958 a hospital affiliated to the Shansi Medical College has successfully treated more than 800 cases of extra-uterine pregnancy with herbal medicine. In 90 per cent of them no surgery was used. Pharmacological studies showed that the various decoctions of medicinal herbs used checked bleeding, improved cir-



Photo E. Reber-Lleras © WHO, Geneva

ulation and hastened the disappearance of blood clots.

Chinese specialists are also carrying out research into the selection of safer, more effective and more convenient contraceptives both for men and women from among herbal prescriptions (see article page 33).

In China, where many farm production brigades grow medicinal herbs on their own plots, a wide-ranging study of medicinal herbs is under way as part of the development of rural medical and health services. This includes a further survey of plant resources, the domestication of wild herbs and the improvement of drug preparations. One achievement resulting from research carried out in the past dozen years by the Institute of Medicine of the Chinese Academy of Medical Sciences and other bodies, is the successful cultivation of the rare and widely needed plant *gastrodia elata*, used for 2,000 years for treating dizziness, headaches and infantile coma.

■ Wei Wen

Right, a tree of the *Cephalotaxus hainanensis* *Li* species and its seeds (inset). From the bark of this species, indigenous to Hainan Island in southern China, scientists have isolated substances which inhibit the formation of tumours and have yielded promising results in the treatment of certain kinds of leukaemia.



Photo Roland Michaud © Rapho, Paris

Above, 19th-century miniature depicting the great Chinese botanist Han Kang (2nd century AD). "The nobles decked out in their finery sought him out in vain", reads the inscription. "He walked alone, happy in the mountain of clouds". Indifferent to worldly distractions Han Kang devoted his life to the search for new plants.



Photo © Permanent Delegation of the People's Republic of China to Unesco

Himalayan herbalists and healers



Photos J.F. Dobremez © Faculty of Sciences and Medicine, Grenoble, France 5

Partly owing to its wide variety of natural conditions, Nepal is exceptionally rich in medicinal plants and herbs and can boast one of the world's oldest traditions of herbal medicine. (In the Rgveda, a collection of over 1,000 sacred hymns written between 4500 and 1600 BC, it is recorded that Himalayan plants were used for healing.) Some parts of this country in the heart of the Himalayas are a mere 50 metres above sea level, others rise to over 8,000 metres, while the range of climatic conditions (tropical, subtropical, temperate, Alpine) also contributes to the profusion of different types of vegetation. The Nepalese Government plays an active role in promoting the production, processing and export of medicinal plants. More than 500

species grow in Nepal today, sales to other countries accounting for 3 per cent of the country's export earnings. (1) Immediately after being harvested, the roots of *Picrorhiza Scrophulariaeflora*, used as a sedative and in the treatment of chronic bronchitis, are laid out to dry. (2) 4,500 metres up in the Himalayas, a *Picrorhiza* gatherer prepares his cargo before embarking on the journey to the valleys of southern Nepal. (3) Vendors arrive at Kathmandu market bearing loads of *Acyranthes Aspera*, a purgative and diuretic plant. (4) Press for crushing mustard seeds which yield an oil possessing curative properties. (5) A healer selling medicinal plants at Kathmandu.

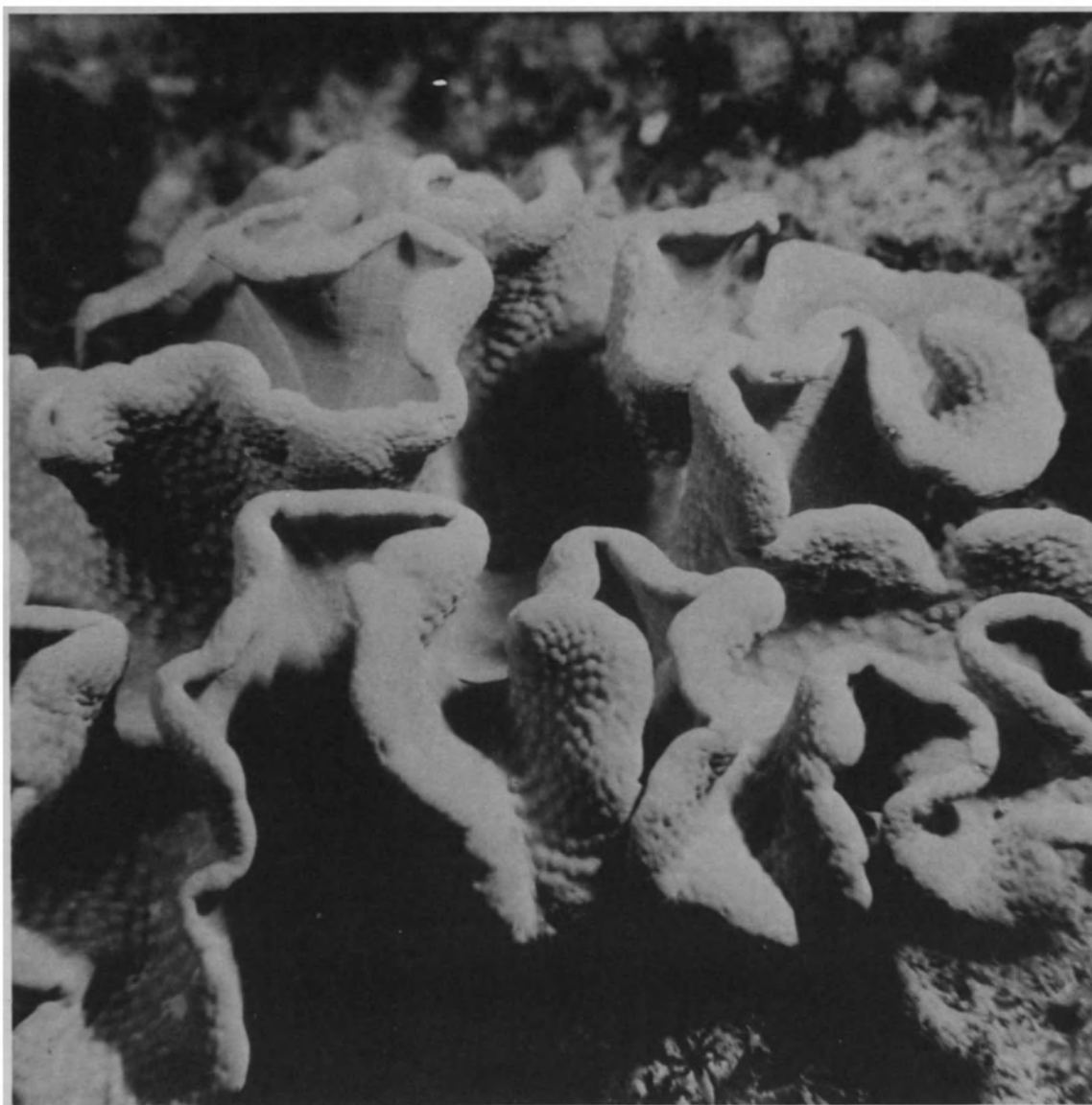


Photo Gerard Munsch © Jacana, Paris

Corals, jelly-fish and sea anemones are among the 9,000 species that make up the group of aquatic invertebrates known as *Cnidaria*. Many cnidarians live in very close relationship with certain forms of algae and some substances apparently extracted from corals, for example, for possible medicinal use may be derived from the algae living in symbiosis with them. Above, a soft coral of the *Cnidaria alcyonaria* family.

Neptune's pharmacopoeia

by Mario Piattelli

MARIO PIATTELLI, of Italy, is professor of organic chemistry at the University of Catania. The author of some hundred scientific publications, his research work has been concerned mainly with the biochemistry of natural products. In recent years he has concentrated on the study of compounds of marine origin.

THE seas and the oceans, which cover two-thirds of the earth's surface and contain around five hundred thousand species, including twenty thousand algae, represent an immense and almost untapped reserve of natural, biologically active and potentially useful products.

Yet the abundance of medicines extracted from land organisms, particularly from higher plant forms and micro-organisms, is in striking contrast with the scarcity of those obtained from marine organisms.

The lack of interest that organic chemists have until recently shown in marine products is probably due to a combination of several factors: the general perception of the sea as a hostile milieu, the relative difficulty of gathering material, and the particular problem of identifying marine species.

It is reasonable to assume that marine organisms, being adapted to an entirely different milieu than that of earth species, have developed different secondary elements not universally found in living species. A significant number of elements

of rare composition have already been isolated. The most recent research has been concerned primarily with products derived from organisms which are sedentary and relatively primitive from an evolutionary point of view, that is to say, invertebrates (particularly sponges, jelly-fish, corals) and algae.

Because of the great interaction that exists between plants and animals which inhabit the oceans, it is not always easy to ascertain the true origin of a compound extracted from a particular species. For example, many substances which have been extracted from jelly-fish and corals and therefore are usually considered animal are probably derived from monocellular algae which live in symbiosis with such invertebrae.

Awareness of the possible biomedical benefits to be had from algae is certainly not new. Ancient Chinese pharmacology suggested their use in the cure of many diseases from cancer and dropsy to menstrual disorders. Popular remedies in fashion during past centuries and in certain cases still employed today, used marine algae for their therapeutic properties. For instance, a red algae known as "Dulse" was used in the 18th century in England to stimulate sweating.

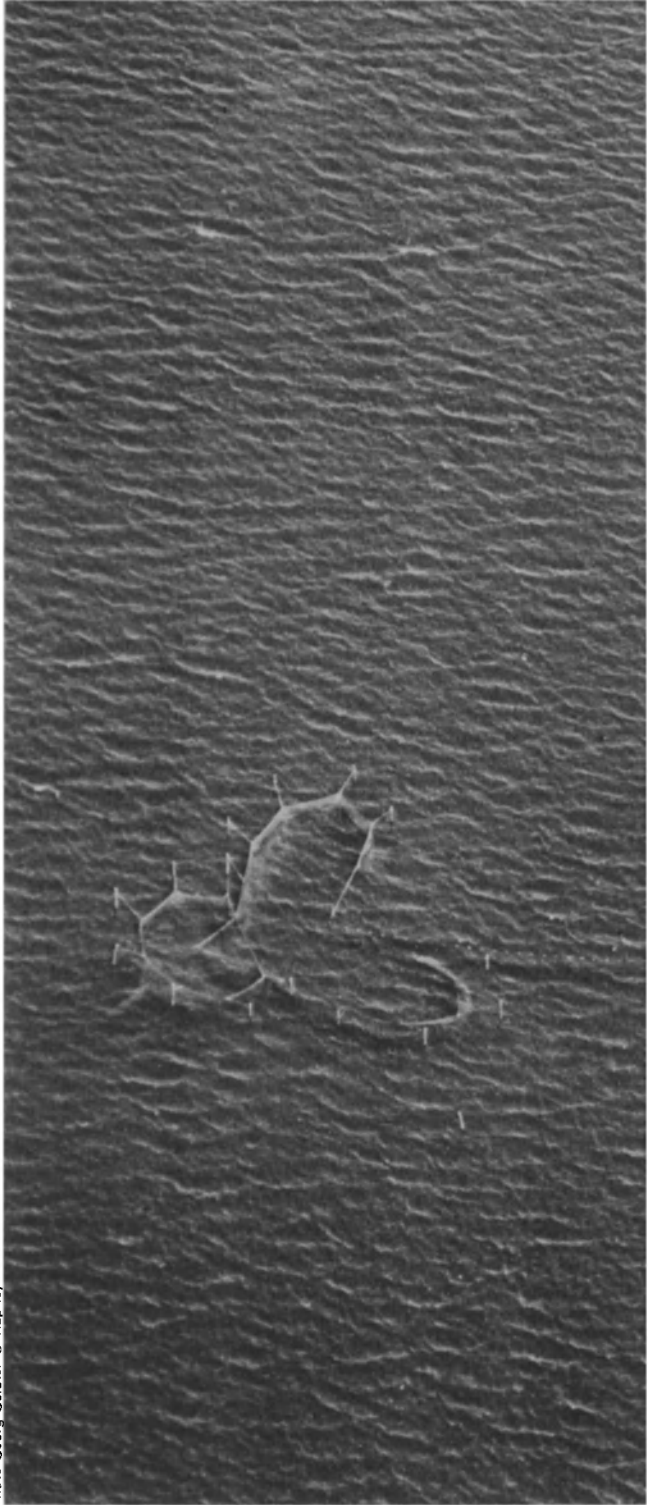
Other red algae, including one popularly known as "Corsican moss", are employed in many countries in the treatment of worms. Varieties of the Sargasso weed are used in India for bladder infections and in South America as a remedy for kidney disease and goitre (the rarity of this last disease among the Chinese or Japanese is certainly due to the high iodine content in the algae which is part of their diet).

If the idea of using algae for therapeutic purposes is old, however, scientists are now exploring this form of marine life, using new methods which are often extremely refined (and expensive). Some thousand marine species have been examined for the purpose of establishing the presence of potential anti-cancer agents. These studies have revealed that algae cannot be considered particularly suitable material in the search for substances which could eventually be used in cancer therapy.

The prospects look better with regard to antibiotics, even if only one compound of marine origin has up till now been adapted for clinical use. *Cefalosporina C*, the compound in question, extracted from a fungus gathered in the vicinity of a sewage

The oceans of the world cover some seventy per cent of the surface of the globe. They have been described as "inner space" and "the last unexplored frontier", expressions which evoke their vast resource potential. Fish have long been an important food source and today scientists are examining marine plants as a possible source of new medicinal extracts. Photo shows fish traps off the coast of Sjaelland, Denmark.

Photo Georg Gerster © Rapho, Paris



discharge along the coast of Sardinia, has a similar composition to penicillin and is effective against a wide spectrum of bacteria, including penicillin-resistant ones, a characteristic which it owes to its lack of sensitivity to penicillinase, a bacteria enzyme capable of destroying penicillin.

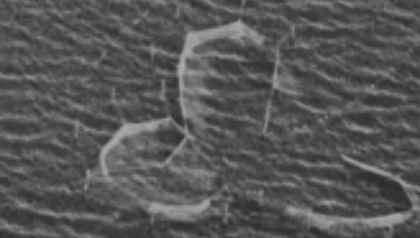
In addition to this example, which has reached the stage of practical application, there exists a lot of data concerning the antibiotic activities of marine flora, particularly with regard to species of red, brown and green algae. The percentage of species which present these characteristics (antibacterial, antifungal) is rather high, probably greater than 10 per cent.

Another potentially useful pharmacological activity is found in the sterols of marine algae, which are known to reduce the level of cholesterol in the blood,

or in the hypotensive properties of an amino-acid isolated from brown algae.

Numerous more or less recent works have been devoted to the pharmacological study of complex carbohydrates known as polysaccharides extracted from algae. The most common compounds of this category, whose composition is the result of the union of many molecules of plain sugar, are agar and carrageen, both extracted from red algae, and laminarin and alginates, both found in brown algae.

These compounds are used widely and often in fields other than pharmacology and present remarkable biomedical properties—agar, for example, is extensively used in bacteriology in the preparation of cultures, and alginates are used in the nutritional sector. Agar and carrageen, as



well as laminarin after the appropriate chemical reaction has transformed it into a sulfate, have anticoagulant properties.

These polysaccharides also have anti-peptic and antiulcerous properties : in many cases of ulcers the oral administration of carrageen has proved to be an effective remedy. Introduced intravenously, carrageen and laminarin sulfate lower the fat content in the blood serum and prevent the development of arteriosclerosis. Alginates and carrageen, administered orally, inhibit the absorption of cholesterol by the intestines. The polysaccharides of the algae have also shown inhibiting action with regard to numerous viruses.

The ability of alginic acid to form salts with metal ions is at the origin of its use as a protective agent against radio-strontium contamination. The presence of alginic

acid in the intestinal tract effectively checks one of the most harmful consequences of radioactive fallout, the absorption and fixation of strontium in human tissue. The acid combined with the radioactive metal creates an insoluble alginate which is eliminated in the faeces.

The usefulness of alginic acid is not restricted to the field of preventive medicine but extends to therapeutic medicine as well. Alginic acid is effective not only in the prevention but in the treatment of radioactive strontium poisoning, since the substance already deposited in the bones is resecreted into the intestines where in the presence of alginic acid it is immobilized, to become an insoluble form.

The pharmacological study of algae should not be limited to compounds which

may possibly be used in the treatment of disease but should also include the toxins which some algae produce. These toxins, whose effects are known to be particularly strong (a toxin derived from *Gonyaulax catenella* is one of the most lethal venoms known today), sometimes accumulate in edible organisms such as mussels and other bi-valve molluscs, crustaceans and fish, where they can cause serious food poisoning if ingested. It is clear that food poisoning due to such toxins can be treated more effectively if we have greater knowledge of their effects. Moreover, the composition of these toxins can serve as models for analogous synthetic chemical compounds which would conserve their medicinal properties.

This rapid and necessarily incomplete review of the present state of research con- ▶

cerning active substances which can be found in marine flora may appear rather discouraging, particularly since researchers may sometimes present the results of tests for biological activity in a far too optimistic light in the hope of being granted further funds to continue their studies. Furthermore, the clinically useful results we possess—and these are far from substantial—have mostly been obtained by sporadic and not very recent research.

Nevertheless, in order to evaluate the question properly we must consider two very important points: above all, considerable and continued efforts in this field of scientific research have only begun in the last few years and it is well known that the development of a new medicine from the time of its discovery to its use usually takes from three to ten years, in some cases longer. In the second place only one biologically active compound out of thousands succeeds in overcoming the severe tests of its efficacy and reliability before being put to practical clinical application.

In the light of such considerations, it is reasonable to believe that a systematic study of substances produced by marine algae (and by other marine organisms) should be actively pursued in the hope of obtaining useful results within the next decade.

■ Mario Piattelli

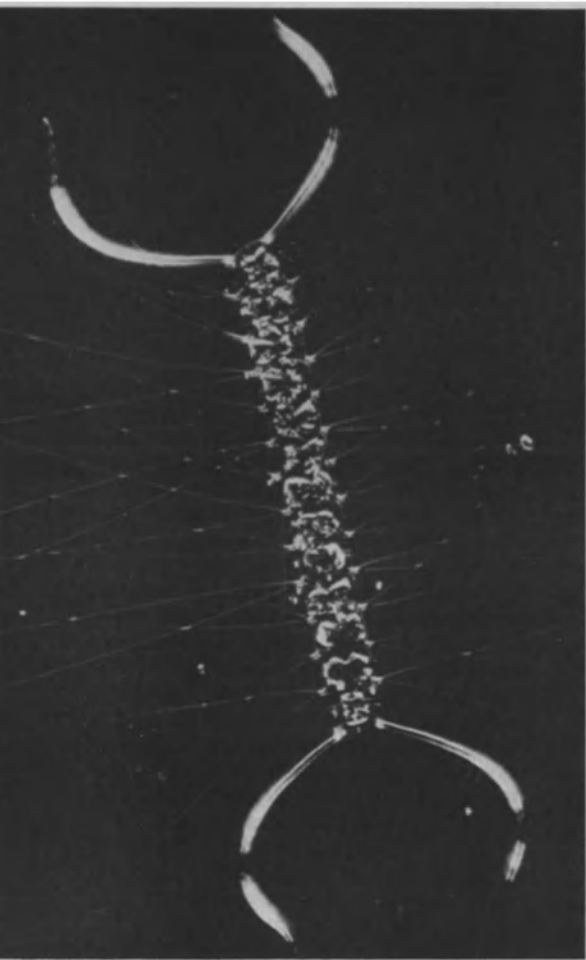
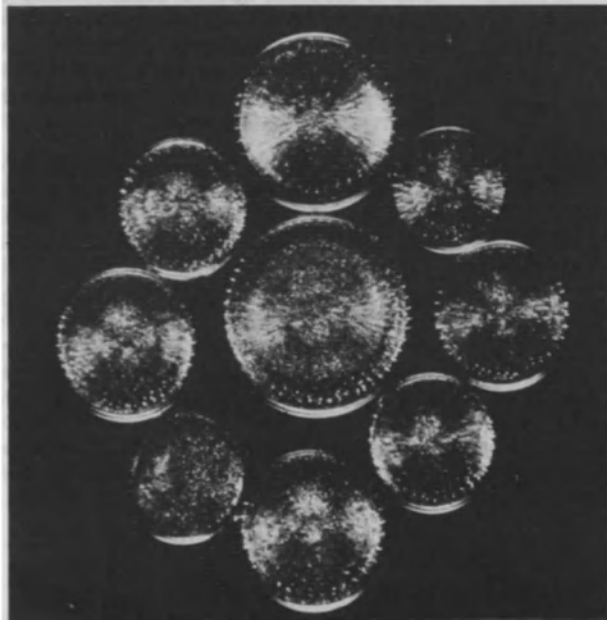
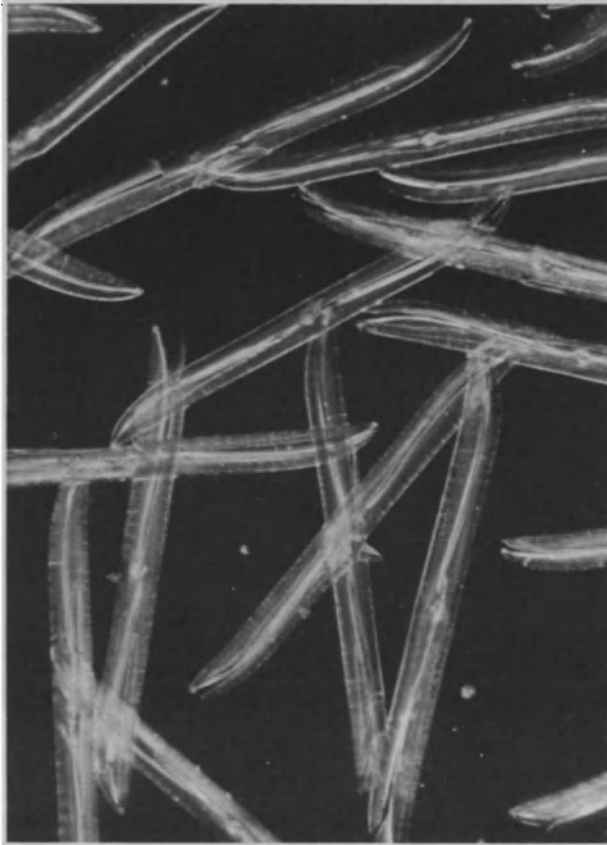
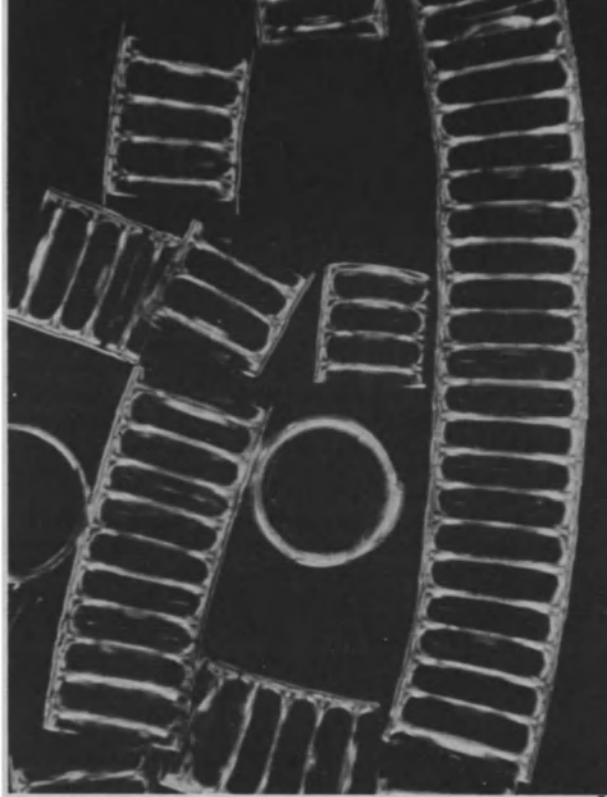


Photo © Claude Carré, Station Marine, Villefranche-sur-Mer, France



The jewels of the sea

With their intricate shapes and geometric designs, diatoms, the microscopic, single-celled algae to be found in all the waters of the earth, have been aptly called "the jewels of the sea" (photos left). Among the most prolific sea organisms — one litre of sea water is said to contain from a few thousand to a few million diatoms — they serve as food for many marine creatures. They are divided into two orders on the basis of their symmetry and shape: the round *Centrales* have radial patterns and the elongated *Pennales* have feather-like markings. Diatoms are believed to have contributed to the formation of oil deposits and a substance composed of fossil diatoms is used in filters, abrasives and some paints and varnishes. More recently, certain diatoms have been found to possess antibacterial and antifungal properties.

Photos Oxford Scientific Films © Parimage, Paris



Photo © Ken Heyman, New York

The population question is one which concerns the whole world, but the nature of the problem varies widely from country to country and from continent to continent. Different aspects of the problem call for different solutions. Today, synthetic steroids derived from extracts from plants make it possible to increase or inhibit human fertility and thus to influence birth rates in either direction. These steroids are obtainable cheaply and in abundance from sapogenins, substances originating from plants of the *Dioscorea* family.

Mexican plants and human fertility

by Pierre Crabbé

PIERRE CRABBE, of Belgium, is chairman of the Department of Chemistry of the University of Missouri, Columbia, U.S.A. The author of a number of scientific books and papers, he has served as a consultant to Unesco's new programme on the chemistry of natural products.

A little under forty years ago, chemists discovered in plants from the Mexican jungle a raw material which created a revolution in the pharmaceutical industry. These plants, which belong to the *Dioscorea* family, contain products whose chemical structure is closely related to that of certain organic chemical compounds known as *steroids*.

Steroids are a group of naturally occurring substances and their derivatives that are of great importance in biology, medicine and chemistry. They occur

naturally in the human body and include the main categories of sex hormones (androgens, oestrogens and progestogens) which control the human reproductive system, and adrenocortical hormones.

These adrenocortical hormones or corticoids keep the individual alive from day to day by regulating his metabolism, that is, the chemical process in living cells by which raw material is assimilated and energy is released to the body. For instance, corticoids regulate mineral metabolism by keeping sodium, potassium and water in adequate balance. Corticoids also promote the metabolism of carbohydrates, fats and proteins. Additionally, the corticoids somehow help to protect the individual from the effects of stress and shock.

Synthetic steroids prepared from extracts from a wide range of vegetable sources are today used in the treatment of rheumatoid arthritis, allergies, inflammatory diseases, sterility and various heart conditions, and form the basis of modern oral contraceptives.

But when, during the 1930s, the properties and nature of steroid hormones were becoming better known, the sources of steroids were rare. They were obtained exclusively from animal sources such as the adrenal glands of livestock.

It was at this point that the American chemist Russell Marker appeared on the scene. In 1935 Marker embarked on research into steroids at Pennsylvania State college. He became actively engaged in the search for a cheap and abundant source of steroids and concentrated his attention on certain substances of botanical origin called sapogenins. By 1940 he had developed an efficient process for the conversion of various sapogenins, including diosgenin, into progesterone.

Interested in exploring sapogenins of new types and hoping to discover a practical source of diosgenin, Marker launched a series of extensive botanical collection trips in the south of the United States and in Mexico. He worked in collaboration with seventeen American and Mexican botanists. Over four hundred species in the amount of forty thousand kilograms of plants were collected. About half of the plant species yielded interesting substances and a total of twelve new sapogenins were discovered.

In the early 1940s, Marker transferred his activities to Mexico. He found an abundant source of diosgenin in a species of *Dioscorea*, known in Mexico under the name of *cabeza de negro* (*Dioscorea macrostachya*), a vine growing wild in the jungles of the States of Veracruz and Chiapas.

On subsequent trips, Marker collected different specimens of *Dioscorea*, mainly in the state of Veracruz. During one of his expeditions, near Tierra Blanca, he found *Dioscorea composita*, called *barbasco* by the natives, and which contains nearly five times as much diosgenin as *cabeza de negro*. However, for many years *barbasco* could not be exploited commercially, since there was no road allowing an easy access to this part of the Mexican jungle. Accord-

ing to a saying in Mexico, local Indians utilized these roots for fishing, as their saponins are poisonous to fish.

With the help of Mexican collaborators, Marker produced additional quantities of progesterone, enough to have a sizable impact on the world market. This was the birth of the steroid hormone industry using plant products as starting materials.

After developing methods for producing progesterone from diosgenin, attention was focused on more difficult undertakings, such as the production of testosterone. *Barbasco*, found to be a better botanical source, richer in diosgenin than the *cabeza de negro*, became the favourite plant for extraction. Since that time, related *Dioscorea* species have also been found in Central and South America, as well as in China, India and South Africa.

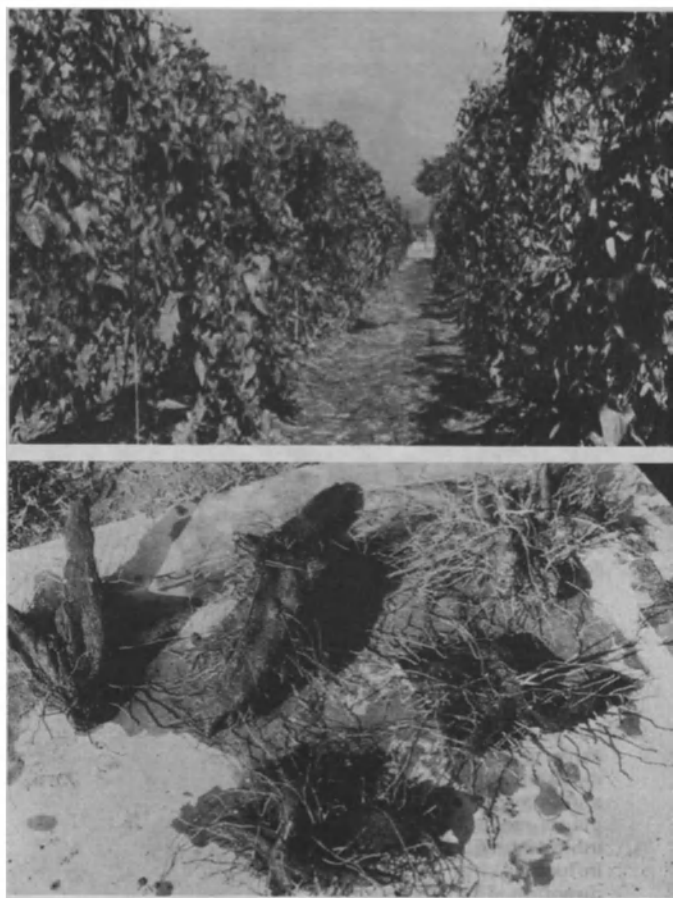
Chemicals from crops

In Latin America experiments are being made in the cultivation (photo right) of plants of the *Dioscorea* family. These plants yield a substance called diosgenin, a form of sapogenin, which can be converted into the steroid hormone progesterone. Progesterone is used to inhibit ovulation, and therefore conception, in women. Diosgenin is obtainable in large quantities from the roots of the *barbasco* (*Dioscorea composita*), a plant (lower photo) found in the forests of the State of Veracruz, Mexico.

Further research carried out in the early 1950s by Carl Djerassi in Mexico (he is now professor of chemistry at Stanford University) and an Australian chemist, Arthur Birch, at Oxford set the stage for Gregory Pincus to propose an important practical application for some of these new steroids, to develop what has come to be known as "the Pill" and to begin the initial clinical tests. But the value of these developments was not limited to the inhibition of the reproductive process. Pincus concluded one of his reports as follows: "If we are on the brink of finding numerous methods for the inhibition or disruption of various stages in reproductive processes, it means that we are also armed with means for the repair of natural defects. Fertility and sterility are two sides of the same coin."

Today although more than eighty million women are using oral contraceptives, those in current use are still fairly costly and women have to be educated in their use. What is now urgently needed is a cheaper contraceptive pill with a long-term effect. Research is continuing and the World Health Organization (WHO) is conducting a research programme at ten centres throughout the world where more than two hundred new steroid compounds with potential long-term contraceptive properties are being synthesized.

Recently, scientists from the People's Republic of China have reported significant anti-fertility effects associated with two substances, anordrin and dinordrin, prepared with steroids derived from the sisal plants *Agave sisalana* and *Agave americana*. These agents, whose anti-fertility properties have been confirmed by



Photos © Autonomous National University of Mexico

scientists in Sweden and the United States, constitute a new family of contraceptives with the great advantage of having to be taken orally only once or twice instead of the twenty times per month necessary with the ordinary pill.

Another recent publication from scientists from the People's Republic of China has reported that gossypol is being tested as an orally administered male contraceptive. Gossypol, which is isolated from cottonseed oil and is not a steroid, begins to take effect about four to five weeks after daily oral doses are administered. Gossypol is a leading candidate for a male contraceptive and could very well be the first molecule of another interesting chapter of scientific discoveries.

■ Pierre Crabbé

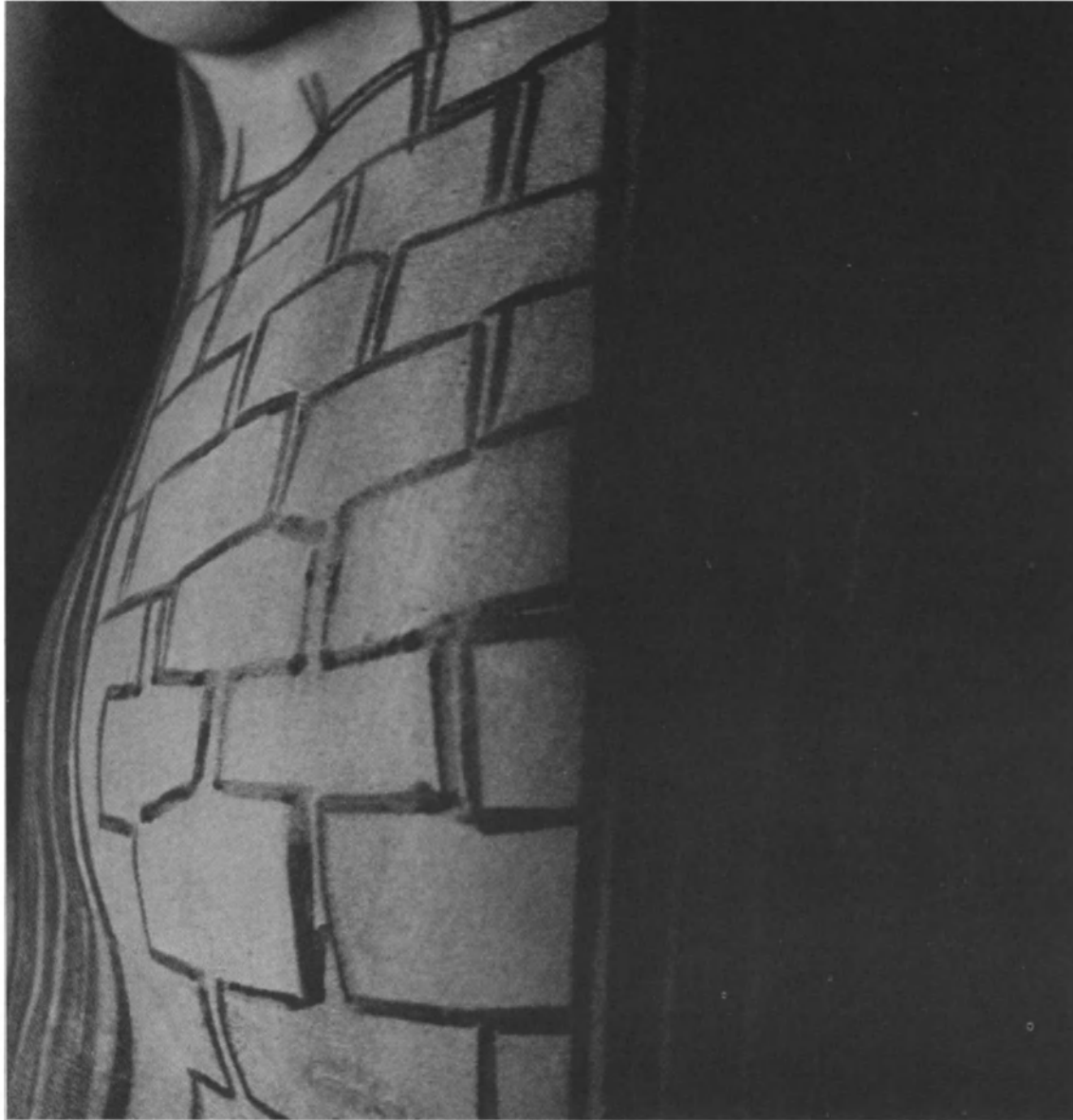


Photo © J. Baziliat, Sao Paulo, Brazil

The latticework of lines that decorates the torso of this mother-to-be of an Amazonian Indian tribe, the *Je*, was painted with an extract from the genipapo tree. The extract, which turns black in contact with human skin, also has antibacterial properties.

Plant prophylactics from tropical Brazil

by Otto Gottlieb and Walter Mors

OTTO R. GOTTLIEB, a Brazilian of Czechoslovak origin, is professor of chemistry at the University of Sao Paulo, Brazil. A member of the Brazilian Academy of Sciences, he is a leading specialist in the chemistry of natural products and biochemical systematics.

WALTER B. MORS, of Brazil, is a member of the Brazilian Academy of Sciences and an expert at the Ministry of Agriculture. He is a specialist in the chemistry of natural products and the economics of botany.

BRAZIL is blessed with a wealth of plant life—one estimate suggests some 120,000 different species—and plant extracts, so botanists and ethnologists tell us, have played an important part in Brazilian life, being used throughout the ages as medicines and as arrow poisons in hunting.

While a great deal of research on these plants has been carried out in recent years, much still remains to be done. This is a matter of urgency since, with the advance of modern society and the deforestation this entails, the natural habitat of many plant species is being destroyed and several of them are now on the verge of extinction.

The first methodical description of plants used for medicinal purposes by the indigenous people of Brazil was undertaken by a scientific mission brought by Maurice of Nassau to the north-eastern part of the country during the Dutch occupation (1630-1654). William Pies, physician to the expedition, described the most important medicinal plants, including ipecacuanha, jaborandi and tobacco.

One hundred and seventy years later, another mission, brought to the newly-independent State by Leopoldina of Austria, the bride of Pedro I, the country's first emperor, was to play a decisive role in the beginning of scientific activity in Brazil. ▶

Two of the mission's most famous members, the zoologist Johann Baptist von Spix and the botanist Karl Friedrich Phillip von Martius, carefully documented their thorough observation of the country's natural wealth. Then, in 1847, at the instigation of Martius, Theodor Peckolt, a little-known pharmacist from Silesia, arrived in Brazil and with admirable drive and enthusiasm analysed over 6,000 plants, publishing his results in more than 150 papers.

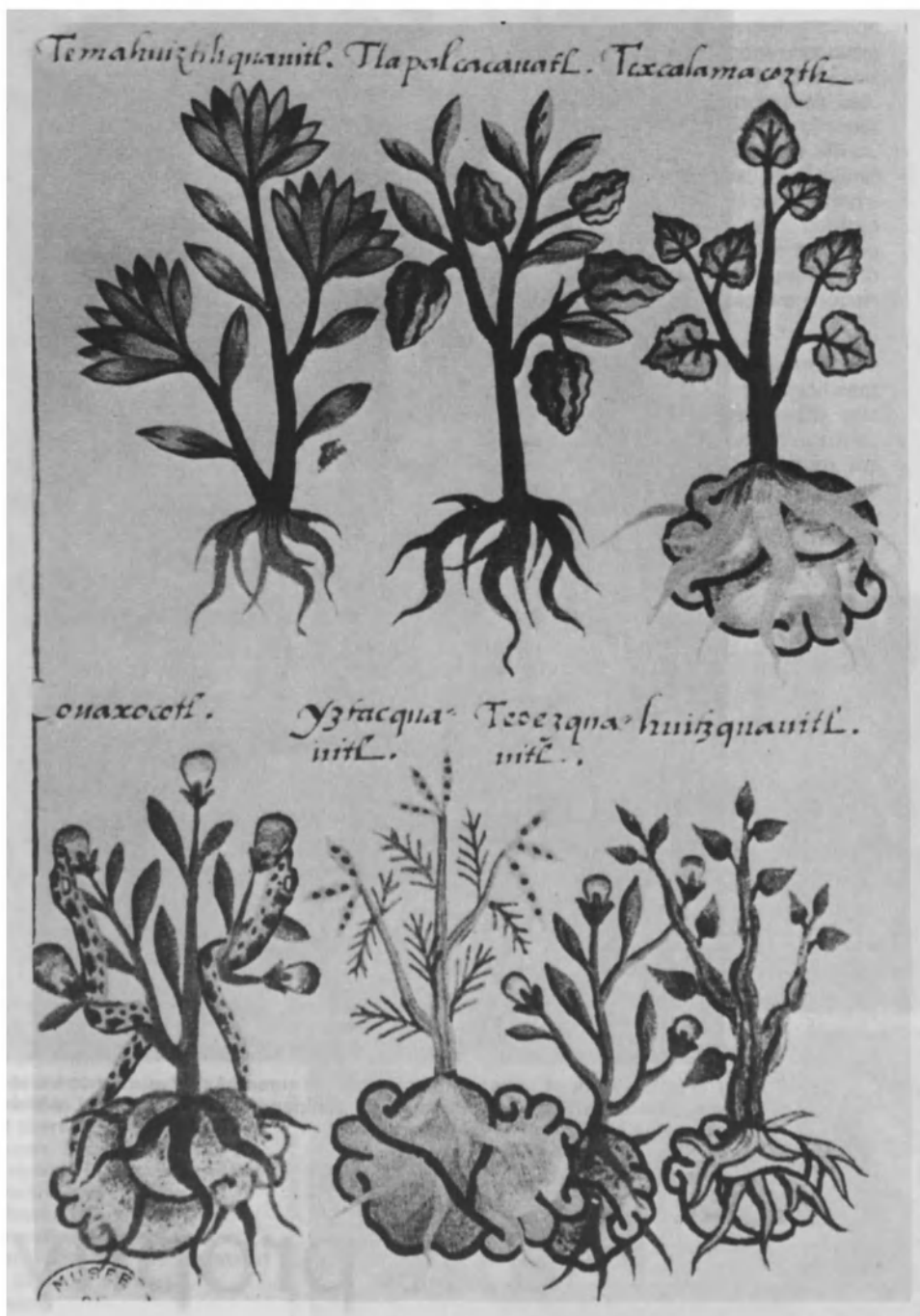
Although his analyses were necessarily crude by present-day standards, his descriptions of a number of chemical entities have withstood the rigour of modern scrutiny. Peckolt was probably the first, in 1870, to isolate and describe a new substance which he extracted from the bark of the agoniada shrub and which he named agoniadin. Its structure was elucidated eighty-eight years later. Agoniadin and related compounds are antimicrobial and sometimes have a purgative effect. One related compound, genipin, isolated in 1960 from the genipapo tree, forms a black pigment in contact with skin, a property exploited by Amazonian Indians in their warpaint.

These and many other investigations on naturally occurring compounds were sparked off by observation of the use made by local populations of the plants from which they were derived. Thus emetine is obtained from ipecacuanha, pilocarpine from jaborandi and curarizing alkaloids from several *Loganiaceae* and *Menispermaceae*; these are all classic drugs widely used in modern medicine.

Ipecacuanha is a small herb encountered in the undergrowth of the virgin forest of the Mato Grosso. The plant requires special ecological conditions and its cultivation is therefore rather difficult. The roots, which look rather like knotted rope, are the source of the drug. This is taken in the form of a powder or syrup as an emetic, or in smaller doses as an expectorant. Its action is due to emetine, an alkaloid present in a proportion of about 1.5 per cent. Emetine is also a most important remedy for amoebic dysentery.

Although ethnobotanical sources contain many references to *Pilocarpus jaborandi* and suggestions as to its use in the treatment of a variety of diseases, a recent study failed to pin down the use of jaborandi to any particular purpose among South American Indians. The plant occurs in north-eastern Brazil which includes Pernambuco, the native State of Symphronio Coutinho who, in 1873, called the attention of French physicians to the copious sweating and salivation brought about by jaborandi leaves. Soon these were used in the treatment of many diseases. Their active constituent, pilocarpine, was discovered in 1875 and was used in the treatment of eye diseases; it is still used to alleviate pressure in the eyeball in glaucoma.

The curares are the famous arrow poisons of South America. Innocuous if taken by mouth, a single drop in the blood stream paralyzes the prey without killing it. This particular muscle-relaxing action is due to a blocking of the nervous impulses at the nerve/muscle junction.



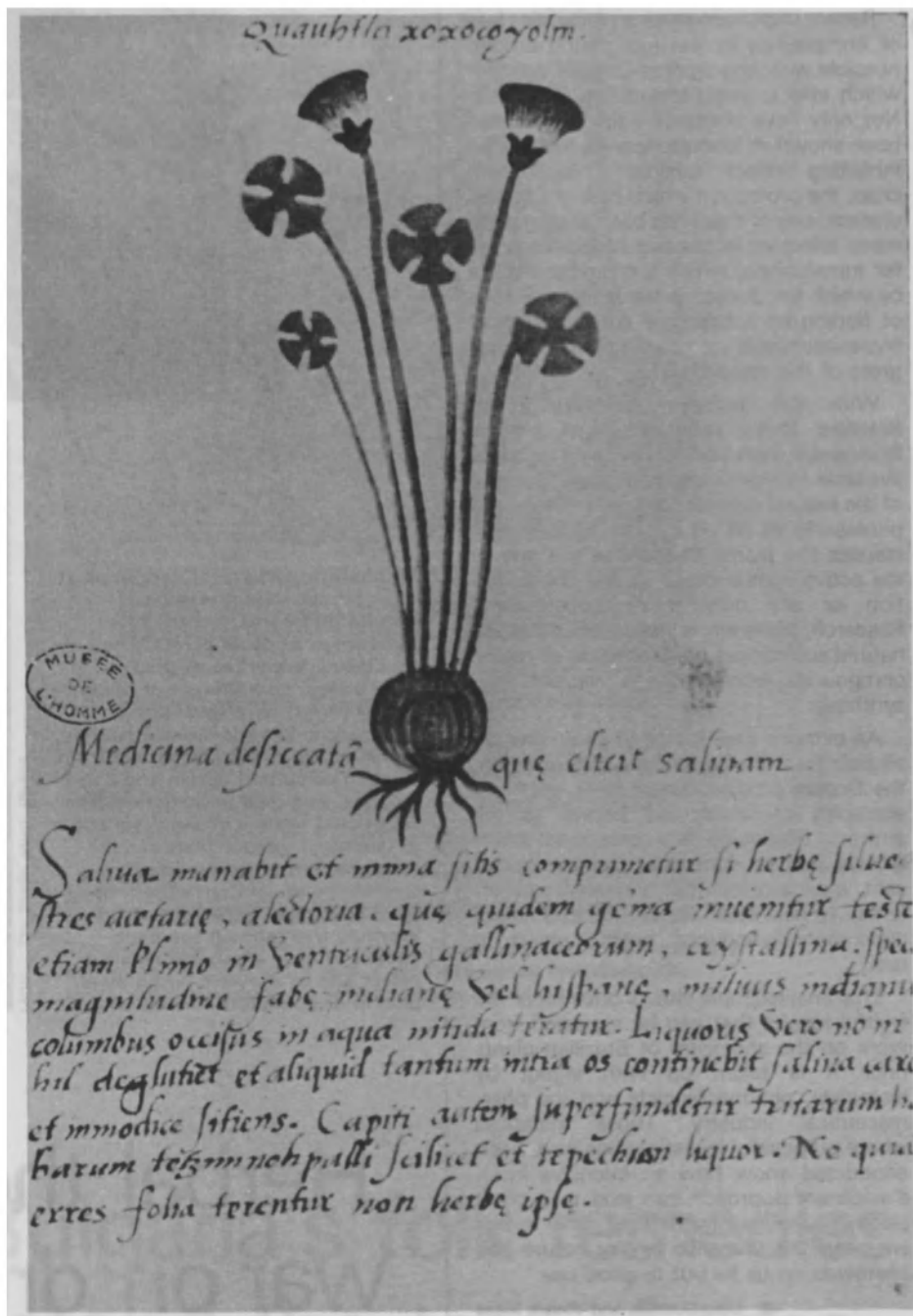
The natural curares can be divided into two classes: tube-curares, which were kept in bamboo tubes, and calabash-curares, which were stored in gourds or clay vessels. They were in use in different geographical areas, being of different botanical origin and chemical nature and being handled in different ways. Curare and its derivatives, both natural and synthetic, are used to this day as local anaesthetics or as pre-anaesthetic muscle relaxants, as well as for the treatment of the symptoms of various kinds of spastic conditions.

Brazilian pharmacologists have only very recently begun to make detailed studies of the aetiopathic properties of plant products, that is to say their action against organisms which are the causative agents of diseases such as schistosomiasis and Chagas' disease which affect millions of

people throughout the world.

Although non-existent in Europe and North America, schistosomiasis affects one tenth of the population of Brazil and is spreading. It is caused by a blood fluke, the *Schistosoma mansoni*, which localizes itself in the liver and the intestines. The females produce hundreds of eggs which, by clogging capillaries in the liver, spleen and intestines, cause severe malfunction of these organs and, consequently, physical disability of the host.

In order to complete its larval cycle, the parasite depends upon an aquatic snail as an intermediate host. Eggs of the fluke are carried from the faeces of affected humans into the waterways in the vicinity of their dwellings. From these eggs, the first larval forms are hatched and these infect the snails. Inside the snail the parasite multiplies to emerge later as fork-tailed lar-



Ancient Mayan medicines

Before the arrival of the Spaniards, the peoples of Mexico, like those of other ancient cultures, made use of certain plants for medicinal purposes. These plants, and the use to which they were put, were recorded in the *Codex Barberini*. This document was compiled in 1552 in the Náhuatl language by Martín de la Cruz, "an Indian doctor... whose sole qualification was his practical experience", as an inscription on the title page tells us. It was later translated into Latin by another Indian, Juan Badiano. The Codex found its way to Spain where it was acquired by the papal nuncio Cardinal Francesco Barberini (hence its name), later passing into the possession of the Vatican Library. Colour paintings of plants adorn most of its pages, three of which are reproduced here. Left, seven medicinal plants and their names: *temahuiztilli cuahuatl*, *tlapalcacahuatl*, *texcalamacoztli*, *cohuaxocotl*, *iztac cuahuatl*, *teozcuahuatl* and *huitzcuaahuatl*. Their therapeutic properties are not given. Above, the *tlatocnochtli*, a plant used to treat burns. Right, the *cuauhtla xoxocoyolin*, used to encourage salivation and thus to assuage thirst.

Photos Almasj, Unesco. © Mexican Institute for the Study of Medicinal Plants, Mexico

vae known as *cercariae* which eventually again invade humans by penetration of the skin.

The problem is being attacked from every angle: education, hygiene measures, elimination of snails, etc., but progress in combating the disease has been extremely slow. The discovery of chemical agents which inhibit skin penetration by the larvae has, however, drawn attention to a possible new approach. In practice, application of these active compounds on to the skin constitutes, at present, the only possible prophylactic measure. It has been shown experimentally in mice, however, that one compound introduced internally appears to have an inhibiting effect.

The first compound recognized as inhibiting skin penetration by *cercariae* was discovered in 1967 and was derived from the leguminous species *Pterodon*

pubescens. Another compound, lapachol, which occurs in the heartwood of a number of tropical trees, and several of its derivatives are among the most active agents inhibiting skin penetration.

Although lapachol was originally isolated about one hundred years ago, its pharmacological properties and those of many derivatives and transformation products have been extensively investigated only in recent years. They have the effect of preventing the abnormal division of cells (and therefore may be of use in cancer therapy) and they are antimicrobial, as well as acting as a prophylactic against schistosomiasis. Lapachol is now produced in the State of Pernambuco for oral administration as an adjuvant to other drugs in cancer therapy and, in view of its low general toxicity, has been approved for human clinical trials.

Recent important studies place this class of compounds in the foreground among possible weapons against Chagas' disease, which affects some ten million Brazilians. Not only have some of these substances been shown in laboratory tests to have an inhibiting effect against *Trypanosoma cruzi*, the protozoon which causes Chagas' disease, one of them has been shown to be most effective in treating blood intended for transfusions, which is often the vehicle by which the disease is transmitted. Hopes of finding an actual cure for this form of trypanosomiasis are growing with the progress of this research.

With the increasing exploration of Brazilian forest reserves many extracts from wood, bark and leaves could be made available in significant quantities. But use of the natural substances themselves is not necessarily to be advocated. In many instances the plants themselves are rare or the active agents occur in low concentration or are only minor constituents. Research, however, is well justified if these natural substances are looked on as model compounds whose effects warrant their synthesis.

An extreme case is that of glaziovine, an alkaloid from the bark of the very rare tree, the *Ocotea glaziovii* (*Lauraceae*), only two examples of which are known to the authors. Glaziovine is a compound which relieves anxiety states but has no depressant, muscle-relaxant or anticonvulsant effects. It has been shown to counteract experimentally-induced gastric ulcers in rats.

This final example shows once more the fruitful results that can be expected from work on the chemistry of Brazilian plants once it is taken up with vigour by biologists, pharmacologists and the pharmaceutical industry. Those instances where purposeful investigations have been conducted show how an intensive interdisciplinary approach can lead to a complete knowledge of the facts. Only in this way can the immense legacy nature has bestowed on us be put to good use.

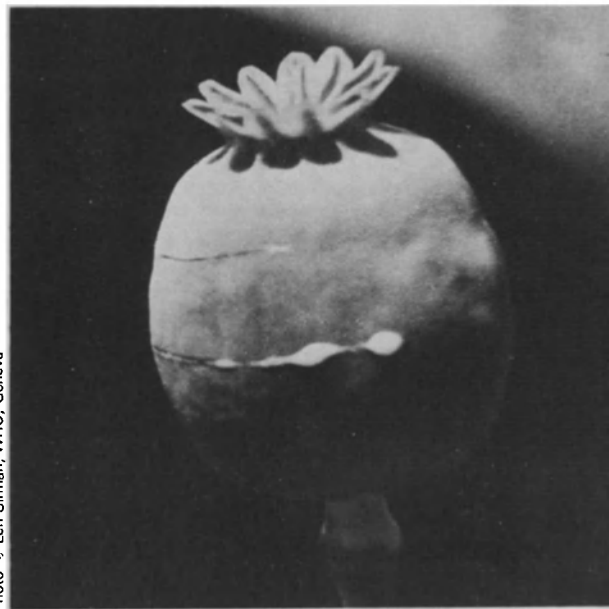
■ Otto Gottlieb and Walter Mors

Photo Brian Hawkes, © Jacana, Paris



The harmful effects of certain plant extracts can sometimes be countered by treatment with derivatives of other plants. The medicinal properties of the fruit of the *Papaver somniferum* or opium poppy (right) have been known since antiquity, but unfortunately abuse of the narcotics derived from it, such as opium, heroin and codeine, can lead to addiction. The traditional healers of Malaysia use infusions of various plants in the management of drug-addiction. One such infusion, an extract of *buah mengkudu*, the fruit of the morinda tree (above) has been shown to have a general sedative effect and to alleviate withdrawal pain in drug-addicts treated with it.

Photo © Len Sirmam, WHO, Geneva



Herbal therapy in the war on drug addiction

THE poppy may be considered one of the first medicinal plants known to man. Sumerian records from 5 000 BC refer to the poppy and Assyrian tablets record its medicinal properties; Hippocrates made extensive use of opium and its virtues were extolled by Galen. Indeed the opiates from the poppy—opium, heroin, codeine, etc.—are still among the most powerful pain-killing, sleep-inducing agents available to man.

Unfortunately, this boon of nature has another face; abuse of these drugs can lead to physical dependence upon them, or drug-addiction. In the addict, the cells of the central nervous system become accustomed to the presence of an opiate and eventually become unable to function in its absence, the euphoric effects decline and the addict requires ever higher doses. If the supply of the drug ceases, the addict suffers severe withdrawal effects including vomiting, convulsions, respiratory failure and even death.

Drug abuse is a problem which affects, to some degree, many countries of the world. Various methods of treatment including the

use of substitute chemical drugs such as methadone and psycho-social therapy have been tried but, for a variety of reasons, have only met with partial success.

In recent years, however, scientists in a number of countries of the south-east Asian region have begun to look again at traditional approaches to the management of drug addiction. Acupuncture is the most often quoted example of this approach, but yoga, meditation, bio-feedback and the use of various medicinal plant remedies are also commonly practised. Sometimes, two or more of these methods are used in combination.

In Malaysia, as part of the national programme of research on drug addiction, the National Drug Dependence Research Centre, under its director, Dr. V. B. Navaratnam is making a scientific evaluation of the efficacy of traditional methods of drug-addiction management, especially those involving the use of medicinal plants.

The traditional healers of Malaysia are reluctant to reveal the exact ingredients of their medicinal concoctions and each of them has his own treatment methods. But

certain similarities can be observed. All healers use one or more medicinal "teas" during the detoxification phase and these concoctions are given regularly for periods varying from three days to one month. As part of the treatment programme a spiritual component is often included.

In general, the medicinal teas appear to be made up from roots and tubers and from the leaves of various herbs. One healer used a tea consisting of a mixture of water and the ground-up leaves of a creeping herb and of turmeric. The same healer indicated that he used another concoction to be taken in small amounts internally and to be applied externally as an ointment during massage of the patient. This concoction contained black turmeric, white turmeric, leaves from the white hibiscus tree and of the macarange plant, the roots of the "stone banana", of rough grass and of the "dragon shrub", as well as ginger, the fruit of the *Acorus calamus* and other ingredients.

The therapeutic value of these teas is still not clear. However interviews with patients who have undergone treatment by traditional healers indicate that the consumption of these concoctions does alleviate somewhat the severity of withdrawal pain.

Research into the pharmacological profile of some of these concoctions is currently being carried out at the School of Pharmaceutical Sciences of the University of Science, Penang. Studies have been made of two teas supplied by traditional healers and of an extract of *buah mengkudu*, the fruit of the morinda tree.

Preliminary results show that the extract of the pulp of the *buah mengkudu* suppresses precipitated withdrawal jumping in mice but has a spasmogenic effect on guinea pig muscle. It was found that one of the teas examined also suppressed precipitated withdrawal jumping. Both teas had a general depressant action on mice as well as inducing hypothermia. Both teas were found to have a marked pain-relieving effect and to reduce motor activity in experimental animals. Both samples were found to be devoid of any opiate type substance. Preliminary results therefore seem to indicate that both teas and the *buah mengkudu* extract have the ability to suppress withdrawal symptoms in addicts and to induce a general depressant effect.

It is very tempting to assume that other traditional treatment procedures may have similar effects. But until such time as adequate scientific data are made available on these traditional treatment approaches they must remain classified among the many possibilities that have yet to be proven or discredited on a scientific basis.



The first page of John the Exarch's *Hexameron*, a 9th-10th century Bulgarian religious work with a glossary annex describing the therapeutic properties of various plants and trees.

Photo © National Library, Sofia

Bulgaria's folk remedies stand the test of time

by Vesselin Petkov

A basic characteristic of popular medicine is that the information it gives—about medicinal plants and other healing substances, about hygiene habits, principles and practices which tend either to preserve good health or to cure illness—has always been handed down by word of mouth from generation to generation. Only a very small part of this information was ever written down.

VESELIN PETKOV, of Bulgaria, is a member of the Bulgarian Academy of Sciences, director of its Institute of Physiology and professor of experimental and clinical medicine at the University of Sofia. The author of some three hundred scientific publications, including several monographs on medicinal plants, he serves as a consultant to the World Health Organization.

Folklore is a rich source of information about the realm of popular medicine. Since folklore is an art of the people, it often embodies subjects relating to popular medicine, subjects which are widespread in customs, legends, folktales, folksongs, sayings and proverbs.

Certain elements of phytotherapy, or plant therapy, reflected in Bulgarian folklore seem at first sight to be the expression of a certain superstition, or an attempt to conceal man's inability, because of his ignorance, to explain natural phenomena. Folktales and folksongs tell us that the miraculous power of such and such a simple can be relied upon only if it is plucked "at dead of night", at dawn, as the first

cock crows, or else in a place that is "secret, shady and damp". Other simples must be picked at a specified time of year, for instance at the Feast of Enio, the anniversary of Krastu or the birthday of the Holy Virgin, or they must be gathered in certain clearly defined areas.

Nowadays, we are in possession of an abundance of scientific data which prove that the sun, the temperature, the quality of the soil, the time of day, and the stage of development of the plant all have an important effect upon the plant's metabolism and, more specifically, on the biosynthesis (or natural formation) of active biological components and on the changes in the plant's cycle which take place as these components are distributed to different parts of the plant—the roots, leaves, flowers, or fruit.

In the early morning, the leaves of stramony or thorn-apple are much richer in alkaloids than in the evening. Certain other active substances react in the opposite way. For instance foxglove or *digitalis* leaves lack glycosides at night, because glycosides decompose at night. Thus leaves gathered in the afternoon have a far higher glucose content than those gathered in the morning. In general, plants growing in shady areas contain far more alkaloids.

Biochemical studies of the various stages of a plant's development demand that the exact timing of gathering any plant be specified, so that the greatest quantity of the active substances can be extracted. These timings coincide in most cases with the requirements specified in folklore.

In some areas of Bulgaria, the snowdrop is completely lacking in its active therapeutic alkaloid, known as galantine; in some areas, camomile plants do not contain the substances which are the source of camomile's healing properties. In some places, wild rose-hips are very rich in Vitamin C, while in other places this vitamin is almost totally absent. In general, the directions given in popular medicine, though they may appear to spring from superstitious mysticism, are in fact founded on wide popular experience, which has been accumulated and passed on from generation to generation.

The use of herbs as preventive and healing agents in the treatment of a variety of ailments in Bulgaria has its roots far back in the history of Bulgarian popular medicine. In his nine-volume "History of Plants", the Greek philosopher Theophrastus tells us that Thrace was a region extremely rich in healing herbs. And Dioscorides, a Roman military doctor although Greek by birth, describes in his work "On Medical Matters", written in Greek, a great many plants which were used by the Thracians in medicine. Dioscorides' indications were widely used by Avicenna and by Galen as well as by almost all doctors in medieval times. Thus early Thracian experience in medicinal plants became part of the body of European medicine.

The Slavs too were happy to combine magic with the use of healing methods originating from plants. They used fewer herbal plants than other peoples and far more leaves and fruits of forest trees—elm,

pine, fir, juniper, willow, ash, sycamore lime, hawthorn, cornel, and so on. The Slavs also used poppy and hemp as anaesthetics.

Information about the use of medicinal plants in the first Bulgarian State, which was founded in the 7th century, has also come down to us. The glossary, given as an annex to John the Exarch's "Hexameron" (now preserved in the British Museum), describes pleurisy and a treatment for it consisting of the leaves and fruits of willow, poplar and hellebore, the first two of which both contain salicylates.

John of Rila (early 11th century to mid-12th century), later canonized by the Bulgarian church, was a famous healer known for his ability to treat all sorts of illnesses with medicinal plants.

'In poison there is physic'

Because of their often deadly effects, poisonous plants and animals played an important role in the life of early man. Surrounded with an aura of mystery and superstition, poisons were used in rituals and ordeals, arrows were tipped with poison extracts and venomous snakes often figured in religious beliefs and ceremonies. As medicine gradually became dissociated from magic and religion, poisons and their antidotes were studied more intensively and recorded in medical manuals. Among ancient records that have survived are two works in verse by the 2nd-century BC Greek poet and physician Nicander of Colophon: the *Theriaca*, on the nature of venomous animals and the wounds they inflict, and the *Alexipharmaca*, on poisons and their antidotes. Right, 12th-century Byzantine illustrations of the *Theriaca* which retain the flavour of the ancient Greek originals. But poisons can heal as well as harm. Today curare arrow poisons are used as muscle relaxants and anaesthetics and the poison of the cobra has pain-killing properties.



Vassily the Healer, a leader of the Bogomil movement, who was burned as a heretic in Constantinople in 1114, was also a healer of great renown. The Bogomil talent for healing is well portrayed by the fact that the chroniclers describe them as preachers travelling from village to village, with two bags slung across their shoulders, one containing bread, the other medicinal herbs.

A more recent example is that of the Bulgarian method of treatment for Parkinson's Disease. The inventor of this therapeutic method, which was based on an infusion in wine of the roots of belladonna (Deadly Nightshade), was the healer Ivan Raev. From 1928 to 1933, his method was tested in a number of clinics, mainly in Italy, but also in Germany and other Western European countries, and became known as the best method at the time for the treatment of Parkinson's Disease.

It is interesting to note that this method,

recognized throughout the world as a Bulgarian contribution to European medicine, was also apparently practised by the ancient Bulgarian healers. Long before Ivan Raev, they had been using extracts of belladonna for chronic sufferers from locomotive troubles (quite probably various types of Parkinson's Disease) in quantities which provoked a temporary dementia in the patients followed by a complete cure.

Today, after a long period during which it was fashionable to attribute absolute power to the efficacy of synthetic medicine, to the point of excluding all the possibilities of natural products, enthusiasm for medicines of herbal origin is increasing. Scientific institutes and pharmaceutical companies from all countries are studying plants as potential sources of new therapeutic products.

medicinal plants. A new era has begun, an era of revolutionary discoveries in the plant world which have greatly benefited medicine, a new blossoming of "green medicine".

This revived interest in the healing powers of medicinal plants has given birth to the question of which directions should be taken to obtain the greatest success in the experimental work now being undertaken. For it is unlikely that we shall ever succeed in studying in depth every one of the 500,000 different vegetable species growing on our planet, even if the entire human race were to join forces on the project. It therefore seemed logical to adopt the policy of concentrating research on plants traditionally used in popular medicine, and therefore tried and tested by many centuries of common experience.

other plants or simples which were used in Bulgarian popular medicine, has proved that forty of them have the effect of decreasing blood pressure, ten can arrest intestinal spasms, and approximately fifty have a germicidal action more powerful than that of the strongest chemical medicines. The studies have also confirmed the healing properties of certain plants described by popular medicine, which are used against worms and disorders of the bile system, and as tranquilizers.

But at the same time, certain medicinal plants have not produced the effects which popular medicine attributes to them, and others have even proved dangerous. This is why it is the doctor's duty to oppose the indiscriminate use of remedies and methods advocated by popular medicine. Each remedy must be subjected to a detailed ex-

alien to it. This explains the fact that plant therapy is less harmful and causes fewer side-effects than modern chemical drugs.

The use of medicinal plants in treatment works on the organism by means of a compound of active or apparently inactive biological substances. A great many of these "apparently inactive" substances, known in the past as "ballast substances", retard or accelerate the reabsorption by the tissues of the active substances, and also their evacuation in the urine or the bile.

Their action also causes useful changes in the effects of the main active biological components in the medicinal plants. In recent years it has been discovered that a great many medicinal plants contain, alongside their primary active substance, a series of other biological components,



Photos © Bibliothèque Nationale, Paris

A few examples will serve to illustrate the wide horizons which this approach makes possible.

Garlic is widely used by the Bulgarian people as a remedy for a great many diseases. Judging from popular descriptions of these diseases, one can infer that they consist of infectious disorders of the digestive and respiratory tracts, worms, hypertension and arteriosclerosis. Modern studies by Bulgarian specialists have proved that garlic contains substances with a very strong antimicrobial action and is indeed an effective remedy against worms and that it retards the development of arteriosclerosis. Garlic is also an excellent preventive against chronic lead poisoning, and can also be a cure when the condition has already developed. Another interesting fact, and one which could have economic importance, is the stimulating effect which garlic can have on the growth of animals.

The study of a few hundred herbs and

amination, and no treatment should be applied without a medical prescription.

It is not a question of choosing between medicinal plants and chemical substances isolated from natural products. Any direct opposition of these two groups would be misplaced, as they are not mutually exclusive but, on the contrary, if cleverly used by the doctor, can be complementary.

At the present stage of development of pharmacotherapy, it is quite out of the question to try to substitute herbal remedies for the efficient medicines we have in our possession to fight against most diseases. But we must recognize that in a not inconsiderable number of cases, plant therapy provides undeniable advantages as against modern drugs. Taking into account the fact that the active biological substances found in plants are the product of the metabolism of a living organism, the human body is able to assimilate a great many of them more naturally than it can assimilate synthetic medicines which are

some of which react on the biosynthesis of proteins, stimulating the synthesis of antibodies and reinforcing the system's immunities.

This also explains why the effects of numerous medicinal plants like belladonna, garlic, tea, coffee, St. John's wort and others are very different from the therapeutic effects of chemical products extracted from the plants such as atropine, hypericin, polysulphides and caffeine.

There is every reason to suppose that medicinal plants and the active biological substances which are extracted from them, will gain in importance every year. A very powerful factor in this area would be a multidisciplinary approach to the scientific study of medicinal plants, and the number of scientists using this approach is increasing every day. The successes already achieved by plant chemistry have a decisive part to play in widening the use of medicinal plants in modern medicine.

■ Vesselin Petkov

African medicinal plants... *continued from page 19*

large and very important class of drugs and have a wide range of therapeutic and other uses (as oral contraceptives for example), are generally manufactured by processes that originate from the saponin diosgenin, a substance available in large quantities from a Mexican yam species. Unfortunately African yam species contain very low quantities of this saponin. But many African plants are rich in steroidal saponins and continued search might reveal new sources of this or other steroids that might serve as starting materials for the synthesis of steroidal or other drugs.

Many interesting new compounds have been discovered in the last decade or two from African medicinal plants as a result of the application of modern methods of isolation and structural elucidation. While hardly any of these compounds has found clinical application in modern medicine, some of them have shown activities which give credibility to the use of the plants in traditional medicine.

An example from our own work in Ibadan is our investigation of the fruit of *Xylopia aethiopica*. The dried fruits of this plant are used in many parts of Africa as a spice and in many folk medicinal preparations. We investigated the dried fruits and found, besides large quantities of an essential oil, an acid component obtainable in good yields of up to 1.5%. The new compound was named xylopic acid and its structure determined by spectroscopic analysis and chemical degradation.

Publication of our work eventually prompted other researchers in Ghana to study the antimicrobial properties of extracts of the dried fruits and they found xylopic acid very active against two bacteria, *Staphylococcus aureus* and *Bacillus subtilis*, and the yeast *Candida albicans*. The demonstration of antimicrobial activity by xylopic acid against this yeast, a common agent of vaginal infections, is of interest because of the use of the dried fruits in traditional obstetrics and preparations of vaginal douches.

There has also been considerable interest in alkaloids leading to the isolation of a large number of either known or derivatives of otherwise well-known classes of alkaloids, such as the alkaloid funiferine from the roots of *Tiliacora funifera* which exhibits significant anti-leukaemia and antibacterial activity.

Most of the work described above was prompted either by a reputed use in folk medicine or an interest in a particular class of compounds or groups of plants. But the studies were not directed at isolating compounds of any specific activity and were therefore not monitored by bioassays.

They consisted usually of extraction with solvent, separation of the fractions by a chromatographic process and isolation of the compounds that happened to be accessible usually through crystallization. The chances of this method of investigation leading to any further results of interest are now very small, one might almost say negligible.

This is not because the vast resources of the plant kingdom have been fully tapped—this is very far from being the case. About the middle of this century there was a fall in interest in plants as a source of new drugs because of advances in the ability of the chemist to synthesize new compounds. However the success rate in finding new drugs from such purely synthetic compounds has been very low and since the 1960s there has been a growing revival of interest in plants as a source of new biologically active substances.

The approach is however different from the classical one. Extraction is carried out with well defined objectives, as part of a search for substances possessing specifically selected activities. The extraction and fractionation procedures are therefore monitored and guided by continual bioassays of the various fractions, until the active substance is isolated.

By this method active compounds have been discovered which would otherwise have been overlooked because of their occurrence in minute quantities. A well-known example in the field of anti-cancer drugs is the alkaloid vincristine which was isolated from *Catharanthus roseus*.

Vincristine is now one of the drugs in clinical use for treating certain forms of leukaemia. Since the discovery of vincristine there has been an intensive search for anti-cancer drugs from plants, guided by bioassays at every stage of the fractionation procedures. Many tens of thousands of plants have been investigated by this method including several thousands of African plants. Most of the investigations even of the African plants are taking place in the U.S.A. and Europe and a large number of active anti-cancer compounds have already been discovered, which are undergoing further studies to determine

their suitability as potential therapeutic agents.

At the same time these compounds have provided incentives for the synthesis of modified derivatives which might have superior properties to the original natural products. One of the most promising of these new anti-cancer compounds is the macrolide maytansine isolated from a Kenyan medicinal plant *Maytenus ovatus*. Maytansine occurs in such small quantities that it might never have been found if the investigation of the plant had not been directed towards the isolation of an anti-cancer agent and the fractionation of the extract guided by bioassay.

At present intensive work is going on to develop an efficient synthesis to avoid the tedious extraction procedure. This is to say, if it does prove successful as a therapeutic agent, there is not likely to be a booming trade in the export of the plant or its extracts, let alone the compound, from Africa to the rest of the world. In other words, if maytansine turns out to be effective in therapy, a synthetic procedure would probably have been developed in the meantime for preparing the compound, which would make it available more cheaply and in larger quantities than would otherwise be possible by extraction from the plant.

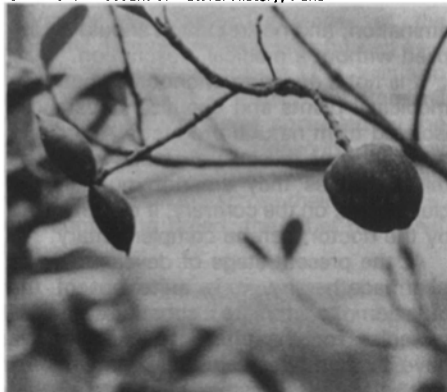
The lesson for African scientists is clear. They do not have a monopoly of the study of African medicinal plants. The old screening techniques as well as the blind fractionation of extractives without bioassay are of little interest. The traditional use of a plant in folk medicine serves only as an indication of the possible occurrence of active substances whose significance for modern medicine may not necessarily be related to the traditional use of the plant in folk medicine.

Extraction and fractionation must be directed towards a clearly defined objective of isolating compounds possessing a specific activity of interest. Consequently the fractionation procedure must be monitored by bioassays of each of the fractions. This implies close collaboration between chemists and scientists trained in the life sciences. If close day-to-day collaboration between chemists and life scientists is not practicable, an alternative is to develop simple bioassay techniques that can be carried out in a chemical laboratory by a chemist during fractionation of extracts.

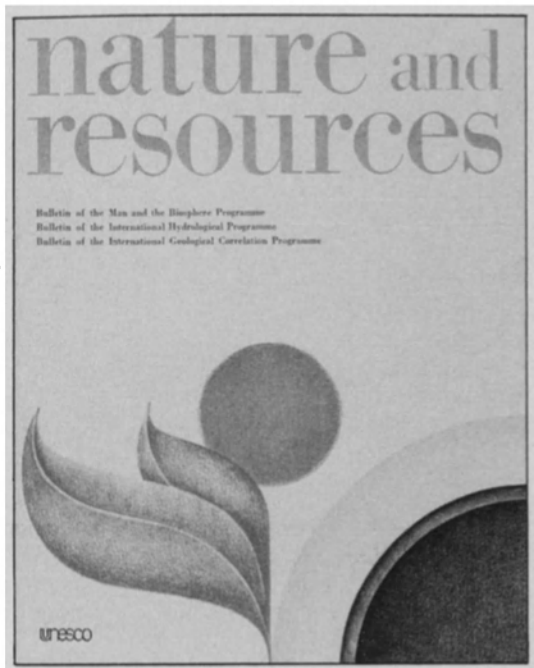
Such simple bioassay techniques need not meet all the requirements for full investigation of the biological activity in which the chemist is interested, but need only be adequate to give an indication of activity in a fraction, leaving detailed investigation of the activity to be carried out later by the appropriate life scientist after isolation of the pure compound. It is only by such an approach that African scientists can expect to contribute to the worldwide search for new substances of medicinal and other economic value which African medicinal plants have and without doubt will continue to afford.

■ Donald E.U. Ekong

Photo L. Allorge,
© National Museum of Natural History, Paris



When a German botanist landed on one of the Molucca islands in the Malay Archipelago, in 1742, the inhabitants told him of the virtues of a small tree with red fruit and yellowish wood — Ochrosia, the plant that cures. More than two centuries later, extracts derived from Ochrosia appear to offer hope of beneficial results in the treatment of certain types of cancers. (See back cover for details of the action of a compound derived from a plant of the Ochrosia genera.)



*For those who care about the environment...
Unesco's quarterly NATURE AND RESOURCES
offers :*

- articles by leading natural and social scientists which assess the impact of man on the biosphere, review the latest research projects and findings on conservation and environmental problems, and survey new developments in resource management ;
- a unique and comprehensive book-review section covering environmental publications ;
- news items and information about forthcoming international symposia, conferences and training courses.

NATURE AND RESOURCES also incorporates the bulletins of Unesco's three major intergovernmental scientific co-operation programmes : the Man and the Biosphere Programme, the International Hydrological Programme and the International Geological Correlation Programme.

Published quarterly in English, French and Spanish

Price, single issue : 6.50 French francs

Yearly subscription : 20 French francs

Where to renew your subscription and place your order for other Unesco publications

Order from any bookseller or write direct to the National Distributor in your country. (See list below; names of distributors in countries not listed, along with subscription rates in local currency, will be supplied on request.)

AUSTRALIA. Publications: Educational Supplies Pty. Ltd. P.O. Box 33, Brookvale, 2100, NSW. Periodicals: Dominie Pty. Subscriptions Dept., P.O. Box 33, Brookvale 2100, NSW. Sub-agent: United Nations Association of Australia, Victorian Division, Campbell House, 100 Flinders St., Melbourne (Victoria), 3000. — **AUSTRIA.** Dr. Franz Hain, Verlags- und Kommissionsbuchhandlung, Industriehof Stadlau, Dr. Otto Neurath-Gasse 5, 1220 Wien. — **BANGLADESH.** Bangladesh Books International Ltd., Ittefaq Building, 1, R.K. Mission Rd., Hatkhola, Dacca 3. — **BELGIUM.** "Unesco Courier" Dutch edition only: N.V. Handelsmaatschappij Keesing. Keesinglaan 2-18, 2100 Dourne-Antwerpen. French edition and general Unesco publications agent: Jean de Lannoy, 202, avenue du Roi, 1060 Brussels, CCP 000-0070823-13. — **BURMA.** Trade Corporation No. 9, 550-552 Merchant Street, Rangoon. — **CANADA.** Renouf Publishing Co. Ltd., 2182 St. Catherine St. West, Montreal, Que. H3H 1M7. — **CHINA.** China National. — **CANADA.** Renouf Publishing Co. Ltd., 2182 St. Catherine Street West, Montreal, Que. H3H 1M7. — **CHINA.** China National Publications Import Corporation, West Europe Department, P.O. Box 88, Peking. — **CYPRUS.** "MAM", Archbishop Makarios 3rd Avenue, P.O. Box 1722, Nicosia. — **CZECHOSLOVAKIA.** — S.N.T.L., Spalena 51, Prague 1 (Permanent display); Zahranicni literatura, 11 Soukenicka, Prague 1. For Slovakia only: Alfa Verlag. — Publishers, Hurbanovo nam. 6,893 31 Bratislava — **CSSR.** — **DENMARK.** Munksgaards Boghandel, 6, Nørregade, DK — 1165, Copenhagen K. — **EGYPT (ARAB REPUBLIC OF).** National Centre for Unesco Publications, No. 1 Talaat Harb Street, Cairo. — **ETHIOPIA.** National Agency for Unesco, P.O. Box 2996, Addis Ababa. — **FINLAND.** Akateeminen Kirjakauppa, Keskuskatu 1, SF-00100 Helsinki 10. — **FRANCE.** Librairie de l'Unesco, 7, place de Fontenay, 75700 Paris, C.C.P. 12598-48. — **GERMAN DEMOCRATIC REP.** Buchhaus Leipzig, Postfach 140, 710 Leipzig or from Internationalen Buchhandlungen in the G.D.R. — **FED. REP. OF GERMANY.** For the Unesco Kurier (German ed. only): 53 Bonn 1, Colmanstrasse 22. For scientific maps only: GEO CENTER D7 Stuttgart 80, Postfach 800830. Other publications: S. Karger GmbH, Karger Buchhandlung, Angehörstrasse 9, Postfach 2, 8034 Germering/München. — **GHANA.** Presbyterian Bookshop Depot Ltd., P.O. Box 195, Accra; Ghana Book Suppliers Ltd., P.O. Box 7869, Accra; The University Bookshop of Ghana, Accra; The University Bookshop of Cape Coast; The University Bookshop of Legon, P.O. Box 1,

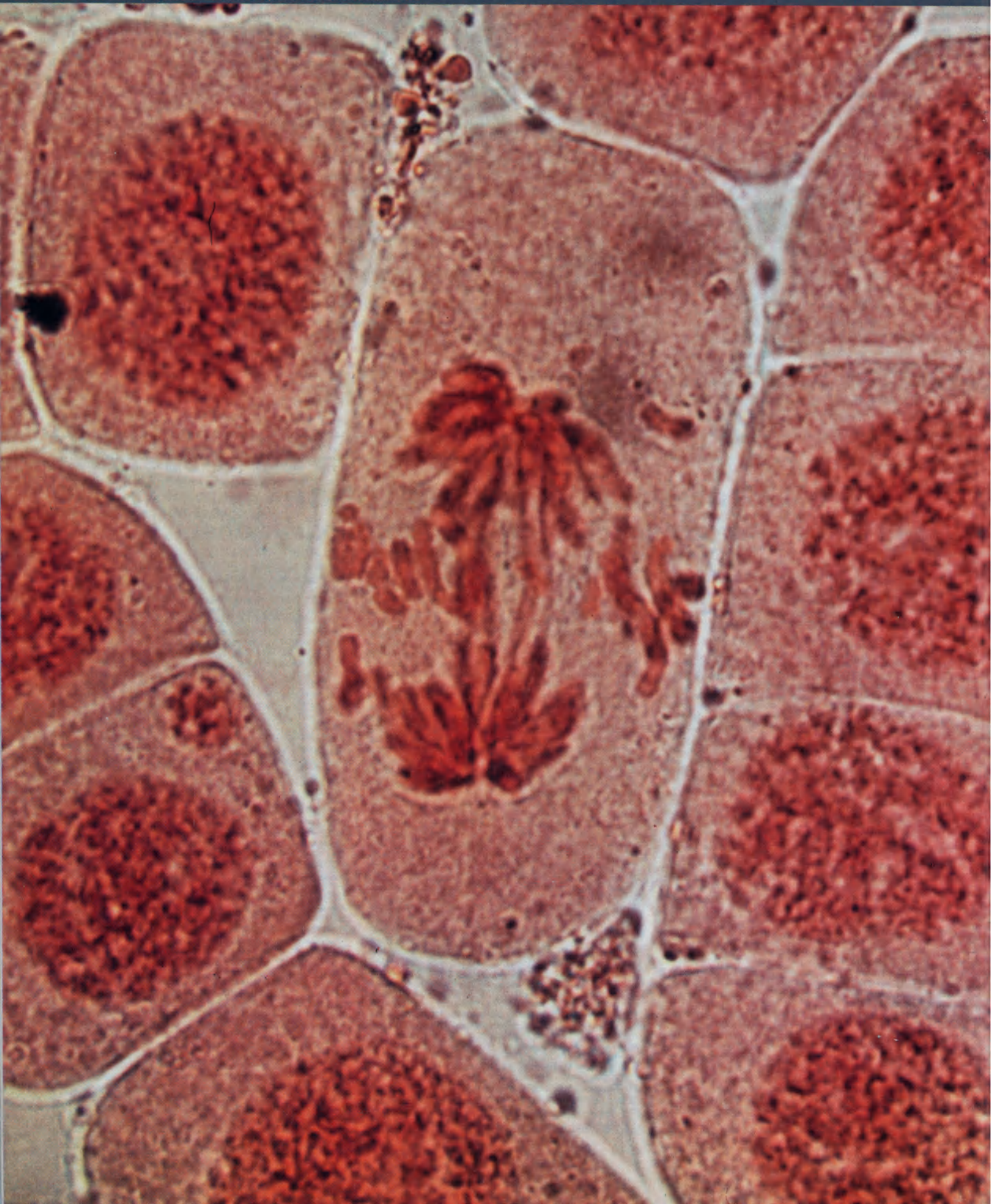
Legon. — **GREAT BRITAIN.** See United Kingdom. — **HONG KONG.** Federal Publications (HK) Ltd., 5A Evergreen Industrial Mansion, 12 Yip Fat Street, Aberdeen. Swindon Book Co., 13-15, Lock Road, Kowloon. — **HUNGARY.** Akadémiai Könyvesbolt, Váci u. 22, Budapest V; A.K.V. Könyvtirok Boltja, Népköztársaság utja 16, Budapest VI. — **ICELAND.** Snaebjörn Jonsson & Co., H.F., Hafnarstraeti 9, Reykjavik. — **INDIA.** Orient Longman Ltd., Kamani Marg, Ballard Estate, Bombay 400038; 17 Chittaranjan Avenue, Calcutta 13; 36a, Anna Salai, Mount Road, Madras 2; B-3/7 Asaf Ali Road, New Delhi 1; 80/1 Mahatma Gandhi Road, Bangalore-560001; 3-5-820 Hyderguda, Hyderabad-500001. Sub-Depots: Oxford Book & Stationery Co. 17 Park Street, Calcutta 70016; Scindia House, New Delhi; Publications Section, Ministry of Education and Social Welfare, 511 C-Wing, Shastri Bhavan, New Delhi 110001. — **INDONESIA.** Bhratara Publishers and Booksellers, 29 Jl. Oto Iskandardinata III, Jakarta; Gramedia Bookshop, Jl. Gadjah Mada 109, Jakarta; Indira P.T., Jl. Dr Sam Ratulangi 47, Jakarta Pusat. — **IRAN.** Kharazmie Publishing and Distribution Co., 28, Vessal Shirazi Street, Shahreza Avenue, P.O. Box 314/1486, Teheran; Iranian Nat. Comm. for Unesco, Ave. Iranchahr Chomalai No. 300, B.P. 1533, Teheran. — **IRAQ.** McKenzie's Bookshop, Al-Rashid Street, Baghdad. — **IRELAND.** The Educational Company of Ireland Ltd., Ballymount Road, Walkinstown, Dublin 12. — **ISRAEL.** A.B.C. Bookstore Ltd., P.O. Box 1283, 71, Allenby Road, Tel-Aviv 61000. — **JAMAICA.** Sangster's Book Stores Ltd., P.O. Box 366, 101 Water Lane, Kingston. — **JAPAN.** Eastern Book Service Inc., C.P.O. Box 1728, Tokyo 100-91. — **KENYA.** East African Publishing House, P.O. Box 30571, Nairobi. — **KOREA.** Korean National Commission for Unesco, P.O. Box Central 64, Seoul. — **KUWAIT.** The Kuwait Bookshop Co., Ltd, POB 2942, Kuwait — **LESOTHO.** Mazend Book Centre, P.O. Mazendod, Lesotho, Southern Africa. — **LIBERIA.** Cole and Yancy Bookshops Ltd., P.O. Box 286, Monrovia. — **LIBYA.** Agency for Development of Publication & Distribution, P.O. Box 34-35, Tripoli. — **LUXEMBOURG.** Librairie Paul Bruck, 22, Grande-Rue, Luxembourg. — **MALAYSIA.** Federal Publications, Lot 8323, JI.222, Petaling Jaya, Selangor. — **MALTA.** Sapienzas, 26 Republic Street, Valletta. — **MAURITIUS.** Nalanda Company Ltd., 30, Bourbon Street, Port-Louis. — **MONACO.** British Library, 30 bd. des Moulins, Monte-Carlo. — **NETHERLANDS.** For the "Unesco Koerier" Dutch edition only: Systemen Keesing, Ruysdaelstraat 71-75, Amsterdam-1007. Agent for all Unesco publications: N.V. Martinus Nijhoff, Lange Voorhout, 9, The Hague. — **NETHERLANDS ANTILLES.** Van Dorp-Eddine N.V., P.O. Box 200, Willemstad, Curaçao. N.A. — **NEW ZEALAND.** Government Printing Office, Government Bookshops at: Rutland Street, P.O. Box 5344, Auckland; 130, Oxford Terrace, P.O. Box 1721 Christchurch; Alma Street, P.O. Box 857 Hamilton; Princes Street, P.O. Box 1104, Dunedin;

Mulgrave Street, Private Bag, Wellington. — **NIGERIA.** The University Bookshop of Ife; The University Bookshop of Ibadan, P.O. 286; The University Bookshop of Nsukka; The University Bookshop of Lagos; The Ahmadu Bello University Bookshop of Zaria. — **NORWAY.** All publications: Johan Grundt Tanum (Booksellers), Karl Johansgate 41/43, Oslo 1. For Unesco Courier only: A.S. Narvesens Literaturtjeneste, Box 6125, Oslo 6. — **PAKISTAN.** Mirza Book Agency, 65 Shahrah Qaid-e-azam, P.O. Box No. 729, Lahore 3. — **PHILIPPINES.** The Modern Book Co., 926 Rizal Avenue, P.O. Box 632, Manila D-404. — **POLAND.** Orpan-Import, Palac Kultury i Nauki, Warsaw; Ars Polona-Ruch, Krakowskie Przedmiescie No. 7.00-068 WARSAW. — **PORTUGAL.** Dias & Andrade Ltda, Livraria Portugal, rua do Carmo 70, Lisbon. — **SEYCHELLES.** New Service Ltd., Kingsgate House, P.O. Box 131, Mahé. — **SIERRA LEONE.** Fourah Bay, Njala University and Sierra Leone Diocesan Bookshops, Freetown — **SINGAPORE.** Federal Publications (S) Pte Ltd., No. 1 New Industrial Road, off Upper Paya Lebar Road, Singapore 19. — **SOMALI DEMOCRATIC REPUBLIC.** Modern Book Shop and General, P.O. Box 951, Mogadiscio. — **SOUTH AFRICA.** All publications: Van Schaik's Book-store (Pty.) Ltd., Libri Building, Church Street, P.O. Box 924, Pretoria. For the Unesco Courier (single copies) only: Central News agency, P.O. Box 1033, Johannesburg. — **SOUTHERN RHODESIA.** Textbook Sales (PVT) Ltd., 67 Union Avenue, Salisbury. — **SRI LANKA.** Lake House Bookshop, 100 Sir Chittampalam Gardiner Mawata P.O.B. 244 Colombo 2. — **SUDAN.** Al Bashir Bookshop, P.O. Box 1118, Khartoum. — **SWEDEN.** All publications A/B C.E. Fritzes Kungl. Hovbokhandel, Regeringsgatan 12, Box 16356, 10327 Stockholm 16. For the Unesco Courier: Svenska FN-Förbundet, Skolgränd 2, Box 150 50 S-104 65, Stockholm. — **SWITZERLAND.** All publications: Europa Verlag, 5 Rämistrasse, Zurich. Librairie Payot, rue Grenus 6, 1211, Geneva 11, C.C.P. 12-236. — **TANZANIA.** Dar-es Salaam Bookshop, P.O.B. 9030 Dar-es-Salaam. — **THAILAND.** Nibondh and Co. Ltd., 40-42 Charoen Krung Road, Siyaeg Phaya Sri, P.O. Box 402, Bangkok; Sukspan Pamit, Mansion 9, Rajdamnern Avenue, Bangkok; Suksit Sam Company, 1715 Rama IV Road, Bangkok. **TRINIDAD AND TOBAGO.** National Commission for Unesco, 18 Alexandra Street, St. Clair, Trinidad, W.I. — **TURKEY.** Librairie Hachette, 469 Istiklal Caddesi, Beyoglu, Istanbul. — **UGANDA.** Uganda Bookshop, P.O. Box 145, Kampala. — **UNITED KINGDOM.** H.M. Stationery Office, P.O. Box 569, London, S.E.1., and Government Bookshops in London, Edinburgh, Cardiff, Belfast, Manchester, Birmingham, Bristol. — **UNITED STATES.** Unipub, 345 Park Avenue South, New York, N.Y. 10010. — **U.S.S.R.** Mezhdunarodnaya Kniga, Moscow, G-200. — **YUGOSLAVIA.** Jugoslovenska Knjiga, Trg Republike 5/8, Belgrade; Drzavna Zaloza Slovenje, Titova C 25, P.O.B. 50-1, Ljubljana.

New drugs patterned on nature

Scientific study of the chemistry of medicinal plants is opening up new horizons in chemotherapy. Natural compounds isolated from these plants, or synthetic compounds modelled on them, can offer powerful new weapons in the fight against disease. Scientists have, for example, recently isolated compounds from plants that inhibit mitosis, or cell division. Cell division is part of the normal life process, but these compounds offer hope for treatment of the abnormal division of cells in some forms of cancer, which has been described as "mitosis gone mad". Photo shows root cells of a garlic plant after short experimental treatment with a compound derived from a plant of the *Apocynaceae* family. In the oblong, palm-tree-like cell, at centre, the process of splitting has been disturbed by the application of the compound; extended treatment will further disturb and then block the cell division process.

Photo: C.P. Bournique, Laboratoire de Botanique, Faculté de Pharmacie, Paris



news from unesco

A bulletin published by
the Office
of Public Information
Unesco
7, Place de Fontenoy
75700 Paris, France

Science Takes Limelight in Unesco Conferences, Ceremonies

May could have been designated "science month" at Unesco, embracing as it did a wide variety of activities aimed at intensifying the Organization's work in this field.

The month opened with the Director-General, Mr. Amadou-Mahtar M'Bow, reporting to the Executive Board on Unesco's preparations for the U.N. Conference on Science and Technology for Development (UNCSTD). It ended with UNISIST II, the Intergovernmental Conference on Scientific and Technological Information for Development, which itself is a major Unesco contribution to the work of UNCSTD. In between there were such events as a public ceremony at Unesco Headquarters to mark the centenary of the birth of Albert Einstein, a three-day meeting of 60 of the world's leading scientists to discuss future prospects for international scientific cooperation, a session of the bureau of the International Co-ordinating Council for the Man and the Biosphere Programme, and a visit by the Director-General to the French Bureau des Recherches Géologiques et Minières (BRGM) where he presided a panel discussion on the unification and development of earth sciences at the international level.

Quite apart from the events at headquarters there were meetings



Photo Unesco / Dominique Roger

Unesco Director-General Amadou-Mahtar M'Bow presents a medal to Prof. P.A.M. Dirac, Nobel prize-winning physicist and former associate of Albert Einstein, at Einstein ceremony 9 May at Unesco Headquarters.

concerned with Unesco's work in science and technology policies, hydrology and oceanography in such cities as Dortmund (FRG), Ottawa (Canada) and Dakar (Senegal).

In its discussion of the UNCSTD conference, which is to take place in Vienna in August, the Executive Board endorsed the Director-General's view that it would be undesirable to create new structures to deal with science which would be "ineffectual and unnecessarily expensive", and declared that it should be the responsibility of the Specialized Agencies, particularly Unesco, to translate the results of the Conference into action.

At the ceremony marking the Einstein centenary, Mr. M'Bow hailed the late physicist as not only a great scientist but "a man of peace and

freedom" who strongly supported Unesco and who "defended the idea of giving to the United Nations the prerogatives of a supranational system, the only one which he considered capable of instituting and supervising a just and lasting peace."

One of Einstein's disciples and colleagues, Prof. P.A.M. Dirac, winner of the Nobel Prize for physics in 1933, recalled the controversy with Niels Bohr over the interpretation of the findings of quantum mechanics that marked the latter period of Einstein's life.

Einstein's love of beautiful mathematical equations, said Dirac, made it difficult for him to accept the probability calculations of standard quantum mechanics. "They lead to infinities and are therefore illogical",

he added. "I agree with Einstein. I think he will turn out to be right in the end if a better quantum mechanics is achieved."

Dirac, who retired from Cambridge University and now is professor of physics at Florida State University in Tallahassee, demonstrated how modern physics still follows the paths that Einstein traced. This theme was then taken up by Prof. Abdus Salam, director of the International Centre for Theoretical Physics at Trieste, who spoke of "Einstein's last dream, the space-time unification of fundamental forces."

Salam, who is also associated with Imperial College in London, ended his talk with the reminder that Einstein might have been lost if he had been born in a developing country. He recalled the genius's difficulties with his teachers and in obtaining a Ph. D. and said: "Every one of the discouragements he suffered is a norm for a scientist in a developing country. And in a developed country today, would an Einstein, with his commitment to science for its own sake, fare any better?"

The 60 leading scientists who took advantage of the Einstein observance for a three-day exchange of views on enhancing international cooperation in science, included three other Nobel Prize winners besides Prof. Dirac. They were Hannes Alfvén of Sweden, Alfred Kastler from France, and Academician A.M. Prokhorov from the USSR.

Chairman of the meeting was M.G.K. Menon from India, who is also chairman of the preparatory commission for UNCSTD, and one purpose of the meeting was to help make known to UNCSTD the views of the world scientific community.

These views, as expressed in a series of recommendations, showed how attitudes towards science and

technology as factors for development have changed since the first UN conference on this topic was held in 1963 in Geneva. At that time, the Geneva conference's chairman, Carlos Chagas of Brazil, told the Paris meeting, it was generally believed that developing nations had only to shop around the "supermarket" of science and technology for solutions to their problems.

At the end of the Seventies, this attitude is long dead. As J.F. Da Costa, secretary-general of the UNCSTD conference remarked, it now seems clear that science and technology cannot be separated from their cultural and social context. In other words, they cannot be imported, they must be grown at home.

But how? Here, Prof. Salam, a Pakistani, remarked that in a developing country like his, there is only one research physicist for every million inhabitants, as compared with one for 10,000 in the United States. Without quantity, he felt, there is little hope of getting quality in science.

The meeting recommended the strengthening of international and regional scientific centres and expansion of this form of international co-operation into other scientific fields. Suggestions were also made for ways to enable leading scientists from developed countries to spend at least part of the year in developing countries and for "Einstein fellowships" to allow young scientists from those countries to work abroad.

There was an undercurrent of criticism of indiscriminate introduction of technology which, as was said, tends further to enrich the rich and impoverish the poor in the developing countries. Instead, science should work at local levels.

An example was mentioned by S. Bhagavantam of India, president of the Committee on Science and

Technology in Developing Countries of the International Council of Scientific Unions. He related how research by Malaysian scientists has quintupled the yield of rubber trees and enabled natural rubber to hold its own against competition by synthetics. He regretted that similar research had not done the same for jute, cotton and the coconut palm.

This concern was reflected in the meeting's recommendation that scientific research in developing countries be concentrated on maximizing the return from indigenous resources. Such needs, Menon stated, explain why scientists in developing countries may apparently show less interest in pollution or overconsumption of energy, when the immediate demand is for basic food and shelter.

Decisions concerning research priorities must be made with the help of scientists in the councils of government, the meeting declared, after several participants warned that economists should not monopolize planning for science and technology.

Winners Named in Art Contest for International Year of the Child

A four-year old boy from Japan, a nine-year old Austrian girl, and a Peruvian boy, aged 11, were among the winners announced in May of a children's art contest organized by Unesco, Unicef and the United Nations High Commission for Refugees (UNHCR).

More than 600,000 pictures on the theme "My life in the year 2000" were submitted by children aged four to twelve in 84 countries, including children living in refugee camps.

The winners, selected by an international jury at Unesco headquarters, were: a group of nine-year-old handicapped children in Berlin (German Democratic Republic); Claudia Chesi (Austria, 9); Panayota Demetriou (Cyprus, 11); Nipa Sae Lim (Thailand, 11); Torben Larsen (Denmark, 8); Ito Tsuyoshi (Japan, 4); Hu Xiaozhou (China, 6); Park Jeong Je (Republic of Korea, 6); Tang Che Ye (Singapore, 7), and Marco Antonio Acuna Picon (Peru, 11). An



Photo Unesco / Dominique Roger

11th prize was awarded by the International Fund for the Promotion of Culture to Koumidou Antri, a nine-year-old in a refugee camp in Limasol, Cyprus.

This autumn, the prize-winners will fly to Paris on tickets provided by Air France, for a week's stay during which they will work together on a design to decorate Unesco headquarters and mark the International Year of the Child. Their winning entries were on display at Unesco from May 29 to June 8.

Among the members of the jury were Madame Amadou-Mahtar M' Bow, wife of the Director-General

Members of the jury study a selection from the more than 600,000 entries in a children's drawing contest sponsored by Unesco, Unicef and the U.N. High Commission for Refugees.

of Unesco, Princess Caroline of Monaco, Mr. J.J. Dubois, representing the President of Air France, H.E. F. N'Sougan Agblemagnon, Togo Permanent Delegate to Unesco and Madame Leda Mileva, former Bulgarian Permanent Delegate. Italian publisher, Mr. Gino Nebiolo, Mr. Peter David of the European Secretariat for International Year of the Child, Mr. Baron-

Rebouard, France, Vice-President of the International Association of Art, and Mr. Dunbar Marshall Malagola, its Secretary General, were also on the jury, along with eight painters: Mr. I.C. Glazounov (USSR), Mr. Oguiss (Japan), Mr. Svend Otto (Denmark), Mrs. Alicia Penalba (Argentina), Mr. Adam Saulnier (France), Mrs. M. Torres (Mexico), Mr. Hédi Turki (Tunisia) and Mr. Zao Wu Ki (China).

UNISIST to be Oriented Towards Use for Development Planning

A shift in emphasis in the UNISIST programme is slated to take place as one result of the recent intergovernmental conference on scientific and technological information for development (UNISIST II). Whereas up to now the programme has been concerned chiefly with scientific and technological information for the advancement of

science, it will now be concerned with the use of this information as an essential but increasingly complex tool in the development process.

"Scientific and technological information is a national and international resource", declared one recommendation of the conference. "The progress of science and technology depends to a large extent upon access to and effective utilization of this resource, and together with economic, social and cultural information, it constitutes a major factor for accelerating the development process. All countries have the same right to full access to the resources of scientific and technological information and need the necessary means to adapt, utilize and absorb this information to serve

their development."

Some 300 delegates and observers from 90 countries and about 40 international organizations attended the week-long conference at Unesco headquarters in Paris. They reviewed the achievements of the UNISIST programme to date and made recommendations for future strategy in this area.

They also recommended that the forthcoming U.N. conference on science and technology for development (UNCSTD) "take full advantage of the considerable experience accumulated by Unesco through UNISIST" and "avoid the creation of new programmes and structures within the United Nations system which could duplicate the work of existing agencies."

Unesco Executive Board Endorses Aid to Yugoslavia

The 107th session of Unesco's Executive Board, meeting in Paris, unanimously supported a proposal by the Director-General to launch a world appeal for the protection and conservation of cultural monuments and the reconstruction of scientific and educational institutions in earthquake-ravaged Montenegro.

This followed Mr. Amadou-Mahtar M' Bow's account to the Board of a visit to the devastated area of Yugoslavia shortly after the April 15 earthquake. The Board also invited the Director-General to examine the possibility of creating a network of seismic observation stations in the Balkans and the Mediterranean and to consult with Member States and UN agencies to see whether a relief fund for natural disasters might be established to permit speedy aid in Unesco's fields of competence.

In his appeal, launched on 28 May, the Director-General called upon governments, public and private institutions and individuals the world over to give their aid, and urged experts working with Unesco on the safeguard of humanity's cultural heritage to mobilize public opinion on behalf of Montenegro as well as offering their expert services. Museums, art galleries, and libraries

could also give appropriate assistance, he said.

Mr. M' Bow also appealed to teachers, students and, in the current International Year of the Child, to all the children of the world to organize collections to contribute to the reconstruction of educational facilities in Montenegro.

Another proposal of the Director-General also received unanimous support of the Executive Board. He was authorized to devote to the least developed countries some \$3 million earned as interest on loans granted by some Member States to the Organization.

A new prize for meritorious work in promoting literacy was established following the Board's acceptance of an offer from the International Reading Association to provide \$5,000 yearly for such a prize.

On the agenda of the Board, which met under the chairmanship of Mr. Chams Eldine El Wakil of Egypt, were questions ranging through Unesco's fields of competence in education, science, culture, communication and the social sciences to problems of human rights and peace.

One resolution, recognizing the "universal scope of Unesco's mission"

in the field of human rights, invited the Director-General to consult the UN Secretary-General to determine to what extent Chilean exiles belonging to Unesco's specific fields of competence might receive assistance from the United Nations Trust Fund.

"Speedy and continuing action" taken by the Director-General at the request of the Lebanese Government in fields of priority assistance was noted by the Board, which requested the Director-General to provide increased assistance. Another resolution noted from the report of a mission sent by the Director-General to Jerusalem, that Israel had not undertaken to refrain finally from archaeological excavations in the Old City and invited the Director-General to continue his efforts with a view to the implementation of the resolution adopted by the last General Conference on the preservation of the city's cultural heritage.

Two new members were unanimously elected to the 45-seat Executive Board during the session: Mrs. Josefa Maria Prado, replacing Mr. Horacio Bustamante of Panama, and Mr. Daoed Joesoef of Indonesia, replacing Mr. Sjarif Thajeb. The 108th session of the Executive Board will begin on 19 September 1979.

Paris Meeting Calls For Better Protection of Newsmen

Journalists exercise "the most dangerous profession in the world" and must be protected in their personal and professional integrity.

This was the principal conclusion reached by representatives of 30 international press and broadcasting organizations at a meeting in Paris, 17 and 18 May, convened by Mr. Sean MacBride, chairman of the Unesco-

sponsored International Commission for the Study of Communication Problems. The aim of the seminar was to obtain the views of professional organizations on recommendations regarding the protection of journalists which might be included in the Commission's final report. Mr. MacBride emphasized that the Commission had not yet adopted a position on the subject and was seeking advice from journalists themselves in this connexion.

He was encouraged by the fact that the meeting underlined the importance of protecting journalists on dangerous missions. Several participants had also stressed the importance of investigative journalism and the special need for

protection of investigative journalists.

While agreeing that the mass media have a moral responsibility to inform the public honestly and truthfully about world events, the participants in general did not share the view that the protection of journalists should be tied to their duties and responsibilities. In addition, given the plurality and diversity of legal, political and ideological systems in the world, they saw no possibility of an international code of ethics for the journalistic profession at the present time. National voluntary codes of ethics, established by professional organizations, could be of value, however, they said, and might possibly be worked on later in some regions.