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THE GHANA PHARMACEUTICAL JOURNAL

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Volume 9 No. 1 June, 1986

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THE GHANA PHARMACEUTICAL JOURNAL

HEADQUARTERS, PHARMACEUTICAL SOCIETY OF GHANA
P.O. Box 2133 ACCRA

Vol. 9 No. AUGUST 1986

CONTENTS

The Ghana Pharmaceutical Journal is published quarterly by the Pharmaceutical Society of Ghana at the Social Advance Institute, Accra. Correspondence concerning editorial contents and advertisements should be addressed to: **The Editor, Ghana Pharmaceutical Journal, P. O. Box 2133, Accra, Ghana.** * All materials intended for publication should be submitted typewritten, in double line spacing on one side of the paper. Materials accepted for publication may be subjected to editorial revision and, in the case of original papers, once they are published in this journal they cannot be published elsewhere except by agreement. Authors should conform with current style in the presentation of papers, indicating where tables and figures should be inserted. * Views expressed by contributors do not necessarily reflect the opinion of the Editor. * Partial or total reproduction of the comments of this issue in any manner or form is prohibited.

Printed by Nsamankow Press, Accra-North

Editorial

ENTERING A NEW ERA

THAT the Golden Jubilee Celebrations was a big success needs no further trumpeting. To both organizers and participants alike we say: BRAVO!

Again, the fact that the past 50 years have seen remarkable improvements in Pharmacy Practice as well as in the image of the Pharmacist in this country cannot be over emphasized —that is why Prof. Beckett proudly associated himself with these achievements when he said he has personally "been involved in 25 of these 50 golden years".

However, to merely look back on these achievements and rejoice would, in our opinion, be sheer complacency, to say the least.

We say this because our past success should only serve to inspire us to draw up and implement strategies needed to see the profession march confidently into the future.

To this end, we suggest that the Pharmaceutical Society proceed immediately to address itself to the following issues:

1) stepping up and maintaining its efforts towards educating the public on the right use of drugs combined with a comprehensive public relations programmes to further lift up the Pharmacist's image;
2) seeing not only to an increase in the number of Pharmacists turned out each year by the Faculty of Pharmacy, equipped with the appropriate knowledge and skill to successfully meet the demands of the governments policy of decentralizing Pharmacy Service, but also bringing pressure to bear on the government to restore the manpower and equipment needs of government pharmacies;
3) supervising a harmonious and effective merger of orthodox and traditional medicines;
4) getting the government to promulgate the new Pharmacy Council, Drugs and Cosmetic Law as early as practicable to replace the obsolete Drugs and Pharmacy Act of 1963.

We profoundly believe that if these measures are efficiently dealt with, the beautiful picture we secretly hold in our minds, regards the future of the profession, will surely become a reality and what is more, the immense health and economic advantages to be derived therefrom should put broader smiles on our faces—pharmacists and non-pharmacists alike.

The rural folks form the bulk of our population. Their toil ensured your training as a health professional. Yet they enjoy your services least. This anomaly should be reversed fast. Pharmaceutical services is going rural in support of the PHC programme. Join the wagon now.

THE GOLDEN JUBILEE

P.N.D.C. Chairman congratulates the Society

HIS Excellency, The Head of State and Chairman of the PNDC Flt-Lt J. J. RAWLINGS expressed his congratulations to the Society on its fiftieth anniversary. In a speech read on his behalf by the Secretary for Health, Mr E. G. Tandoh during the inauguration of the Golden Jubilee Celebrations at the Kwame Nkrumah Conference Center, Accra on the 23rd November, 1985, he said fifty years had been a long journey but it is not the length of the journey that matters, rather how the Society had arrived at the point in time and most of all, how it had reacted to the various situations and how these changing situations had influenced its present status and performance.

He said that at the age of 50 the Society needed to take stock of the past and reflect soberly on its failures and achievements and make an honest assessment of its overall performance, and then look into the future with confidence through its past experience. He said the Society would be assessed by the people on its performance over the years and how far it had lived up to its objective of service to mankind.

COMMITMENT

Primary Health Care Programme

I notice with satisfaction that the Pharmaceutical Society of Ghana, like your other health colleagues have accepted your full role in the Primary Health Care Programme to which the PNDC Government is faithfully committed, he continued.

He reminded pharmacists that drugs and other Pharmaceuticals for which they are responsible accounted for more than 70% of material resources of the nations health care delivery system apart from capital equipment. He said this demanded good management techniques and high sense of responsibility in the handling of drugs.

ESSENTIAL DRUG LIST

The Chairman said that, it is now widely accepted that for the optimal use of limited financial resources the available drugs must be restricted to only those drugs of proven therapuntic efficiency and reliability and must be safe and capable of satisfying the health needs of the majority of the population. 'In fulfilment of this vital need the Ministry of Health has adopted a list of essential drugs for use in the public hospitals' he declared...

CHALLENGE

The Chairman expressed the great concern that private hospitals and clinics are operating with unlimited number of drugs most of which are very expensive and not essential to our health needs. He said in view of the serious constraints on the national economy, the adoption of a national formulary of selected essential drugs is imperative. He highlighted some benefits from a limited drugs lists:

a. reduction in the number of pharmaceuticals to be procured, stored and distributed;
b. improved drug utilisation, management, information and monitering;
c. improvement in the performance of local pharmaceutical industries;
d. assurance of adequate and regular supply of essential drugs;
e. judicious utilisation of limited financial resources;
f. reduction in overall cost of running the health services;

He charged that the profession is expected to take initiative and give leadership in this area of developing a national formulary of essential drugs for this country. 'This is a challenge of your fifty years anniversary', he added.

PHARMACY VRS. PHC

Chairman Rawlings said the adoption of the Primary Health Care concept by the PNDC government is an eloquent testimony of the governments determination to improve the level of health of the people of this country, particularly the neglected rural majority who produce most of the wealth of this nation to enable them enjoy a socially and economically productive life.

(*Continued on page 2*)

Enact new laws

In his welcome address the president of the Society gave the history of the Society. He traced the progress of Pharmaceutical Education, Service and Pharmacy Practice and spoke on the Society's International co-operation.

The president said that a solid foundation has been laid for pharmaceutical education at the University of Science and Technology, Kumasi and great strives in pharmacy practice is forecast for the years ahead. He said hospital pharmacy practice would be expected to have its scope widened.

The future should see the full compliment of Pharmaceutical Specialist, analysts, dispensing Pharmacists, pharmacologist and production pharmacists in the hospital set-up, he said.

The President hoped that current efforts to up-date the Pharmaceutical legislation would be crowned by the publication of the Pharmacy

(*Continued on page 3*)

PNDC Chairman

He re-echoed the important role pharmacy has in the PHC System saying the provision of essential drugs and vaccines forms one of the basic components of primary health care and the regular supply of limited number of essential drugs is one of the indicators to assess the progress of the goal of health for all by the year 2000.

DISAPPOINTMENT

Continuing, Flt-Lt. Rawlings said "it is rather disappointing to note that the uneven distribution of Pharmacies throughout the country does not favour the regular supply of the most needed essential drugs to the larger segments of the population. He referred to the capitals. Accra only has more than 60% of all registered pharmacies while Upper east, Upper west, Northern, Brong Ahafo and Volta Regions, together have less than 5%.

REVERSE YAWNING IMBALANCE

You will need to address yourselves seriously to this anomalous situation to find a suitable solution to reverse this yawning imbalance in the drug distribution network.

'Come to Macedonia & Help us'

A Far Cry

Most of you owe your education and training to the wealth generated through the efforts and sacrifices of the neglected rural population who need your services. This is a far cry from the wilderness to 'come to Macedonia and help us'!

'Quack Doctors'

The conspicuous absence of any authorised pharmaceutical services in the rural communities have created fertile grounds for the operations of 'quack doctors' and drug pedlars who go about cheating the unsuspecting helpless victims and causing hazards to the health of the public, lamented the Head of State.

PLANT MEDICINE

The Chairman said the country has very rich potentials in this area and some useful data has been collected. The Center for Research into Plant Medicine, the Faculty of Pharmacy, U.S.T. and the Department of Pharmacology of the University of Ghana, Medical School are engaged in research into some identified plants. The Society is not only aware of the high cost involved in drug research but also of the immense benefits and financial gains that can be derived from a successful development of a new drug.

SUPPORT

He said that in view of the expected benefits the pharmaceutical industry should identify itself with the activities of the center and the Faculty of Pharmacy by providing financial support for their research programmes or financing specific research into local substitutes as raw materials inputs for drug manufactures.

MERGER

Concluding, he said that the WHO had accepted plant and herbal medicine as useful supplement to orthodox medical practice. A harmonisation of the two systems on the basis of a mutual respect will facilitate the achievement of the goal of primary health care and help to reduce the overall cost of the health budget.

VITAL ROLE TO PLAY

'Pharmacy has a vital role to play for the success of the PHC and members of the Pharmaceutical Society of Ghana have an obligation to accept their responsibilities to play their roles to ensure the realisation of the goal of 'Health for all by the Year 2000', he added.

PUBLIC LECTURE

C.P.A. President commends the Society

Dr J. N. Benejee, President of the Commonwealth Pharmaceutical Association (CPA) has commended the society for being a founding member of the CPA.

Delivering one of three lectures which formed part of the Golden Jubilee Celebrations, Dr Benejee also noted with pleasure that the pharmaceutical system in Ghana is more developed than in most third world countries.

PHARMACY HAS ROLE IN PHC

Dr Benejee spoke on Pharmacy and Primary Health Care and said the WHO accepts the 'provision of essential drugs as an essential element of the concept of the PHC programme and stipulates the drawing up of an essential drugs list for the programme. 'Who should take care of these drugs, he asked'. The selection, counselling, procurement, storage and distribution of drugs should be done by Pharmacists. A great deal of drugs obtained for the PHC Programme go to waste when left in the care of unskilled personnel.

Pharmacists, he continued, must take over the management of drugs to ensure efficient drug distribution system.

Dr Benejee observed that pharmacists are more accessible than doctors and are consulted more. Pharmacists, he said, should provide the needed drugs counselling for effective use of drugs to their patients and communities.

Pharmacists can contribute immensely to health education and Family Planning, he said. Using the disease patterns of their communities, pharmacists, he said, should draw up an essential drug list for the country. He encouraged pharmacists to enter the corridors of power and acquire full control of drug matters and come out with effective drug policies.

DON'T SACRIFICE EFFECTIVENESS AND QUALITY

Dr Benejee said, pharmacists must estimate the annual drug requirements for the PHC programme and advised that in procuring drugs pharmacists should ensure that the lowest possible costs are obtained

but without sacrificing effectiveness and quality. Generics should not be opted for merely because they are cheap.

NOT FOR MONETARY REWARDS ONLY

On delivery of rural pharmaceuticals services, Dr Benejee exhorted pharmacists to go to the rural areas on sacrifice, saying pharmaceutical services should not be provided for monetary rewards only.

Dr Benedicta Ababio, a Deputy Director of Medical Services who was the Chairperson for this lecture remarked, that a National Formulary is a must for the country and said drugs on such an essential drug list should not attract any tax. She said the rural banks should be approached to finance rural pharmacies.

THE ROLE OF PHARMACY IN NATIONAL DEVELOPMENT

Prof. A. H. Beckett, Head, School of Pharmacy, Chesea College, University of London, spoke on 'The Role of Pharmacy in National Development', Prof. Beckett observed that the aim of Pharmacy is to preserve and promote health which is the desire of all nations.

He mentioned the development and procurement of drugs and medical products as the foremost responsibility of pharmacists. He identified drugs misuse and abuse as costly to nations and an escalating problem in this sub-region. He said that it is pharmacists who should fight off this problem. He added that pharmacists must play their role in the PHC Programme, ensure quality control of pharmaceuticals, provide appropriate drug information to other medical personnel and the public, and avoid indecent commercial exploits.

Prof. Beckett who had been involved in research on the development of native products in the country observed that such projects are very expensive. He doubted the ability of developing countries to successfully finance such projects alone and was pessimistic about the potentials. He felt that it would benefit interested developing countries to accept joint efforts in this field.

Enact new laws

(*Continued from page* 1)

Council and Drugs, Cosmetics and Poison laws.

He said the Society shall encourage its members to make their professional services available to a greater majority of the people by ensuring that some pharmacies are sited away from urban centres. He said this can only be successful in close collaboration with the government and interested organisations. The necessary infrastructure and incentives should be provided to those who put up pharmacies in the suburban and rural areas.

The Society will make more effective contributions to the PHC Programme by ensuring that Pharmacists provide health education to the public and training to the rural health education workers on the proper storage distribution and use of medicines, he added.

The President said pharmaceutical manufacturing units in the country are producing less than 25% capacity because of inadequate inputs. He hoped that the pharmaceutical industry will receive more attention in the allocation of resources in the Government's E.R.P. He also called for establishment of an integrated chemical industry which will produce chemicals not only for pharmaceutical use but also for other industrial activities including agriculture.

ANNIVERSARY DINNER

Chief Justice hails Society

THE Chief Justice, Mr Justice F. K. Apaloo, has praised the impact of pharmacy in health care delivery in the country.

Justice Apaloo made this commendation when he was proposing a toast to the Society at the dinner held at the Banquet Hall of the Kwame Nkrumah Conference Center on Saturday, November 30 to round off the 50th anniversary celebrations.

He said it was perhaps because of this outstanding impact that "you are now widely referred to as 'pharmacists' and not 'dispensers' as was the case in the past.

The Chief Justice urged the present generation of pharmacists to continue to build on the gains and experiences of the past.

During the course of the dinner, which was possible thanks to Messrs, GIHOC Pharmaceuticals Ltd. J. L. Morison Son & Jones (Ghana) Ltd, and Netherlands African Manufacturing Company, fresh graduates who had successfully completed their housemanship, were inducted into the Society. It is many years now since this ceremony was last conducted.

In all, forty graduates had the honour of being received into the fold of pharmacists in this way.

* Thirteen more distinguished pharmacists have been made fellows of the Pharmaceutical Society of Ghana;

They are: Sister Angelina Alfafara, Dr Kwabena Boakye-Yiadom, Mr Paul Edward Affum Okyabi, Mr James Pearce-Biney, Jnr., Mr William Ayiah Hanson, Mr J. E. Brown, Mr Johnny Amarteifio, Mr G. O. Jones Quartey, Mr J. K. A. Quarshie, Mr E. A. Halm, Mr E. K. Mensah, Mr Joseph Badu Schandorf, Mr Ando Benoni Koomson.

Their citations were read by the Registrar of the Pharmacy Board, Mr T. C. Corquaye and presented to them by the president of the society during the Golden Jubilee dinner.

This brings to thirty-two the total number of persons conferred with this award, two of them being members of the Pharmaceutical Society of Great Britain.

* Also at the dinner a wooden-plaque indicating the presidential chain of office of the Society was donated to the Society by the Brong-Ahafo Branch of the Society. The presentation was done by Sister Angelina Alfafara.

* On behalf of the Society, the President also launched an Endowment Fund for the Faculty of Pharmacy, U.S.T. This was before the dinner ended. The Fund is to

(*Continued on page* 9)

Help for the pharmaceutical industry

THE government is to pump more funds into the Pharmaceutical Industry with a view to helping existing firms rehabilitate their machinery.

This was announced by the Secretary for Industries, Science and Technology, Dr Francis Acquah, at the opening of the Pharmaceutical Exhibition which formed part of the Golden Jubilee anniversary activities.

According to the Secretary, this measure would raise considerably the production capacities of these firms from their present low levels of around 24 per cent.

The exhibition which was held in the exhibition hall of the Kwame Nkrumah Conference Centre and lasted three days, attracted a large crowd from all walks of life, notably, doctors and nurses.

Products on show included those from GIHOC Pharmaceuticals, Danafco, J. L. Morrison Son and Jones, the Centre for Scientific Research into Plant Medicine and Dr G. K. Noamesi's Establishment, to mention a few.

Look out for

LETTERS

to the

EDITOR and INFORMATION

on some EXISTING as well as newly approved proprietary PRODUCTS in the Next Issue

ANNIVERSARY LECTURERS

For each state a unique System

IF Professor Albert Wertheimer, Head of the Department of Graduate Studies in Social and Administrative Pharmacy, College of Pharmacy, University of Minnesota, U.S.A. greeted his audience of the Anniversary Lecture with a "*ene nen nnu ahri*" in a funny way, then it was because he was not well versed in speaking Twi. But he did not bother to tell us that; it was obvious.

He however admitted he was not well versed in the subject he had to treat since he was from a developed country.

In any case, owing to the extensive travelling he had done, he managed to treat the topic, "PHARMACY PRACTICE IN THE THIRD WORLD", very beautifully.

Professor Wertheimer, who is also chairman of the academic section of the International Pharmaceutical Federation (IPF), started by cautioning his audience that one cannot transfer *en masse* health care delivery system from one country to another since the type prevailing in any one state was purely "a reaction to the political, economic and historical factors" to be found in that state.

He went on to illustrate various systems as they existed in various countries adding that Ghana must "look around and choose" the type that would serve its purpose most and not to adopt the "lunacy" that had to live within his country.

Prof. Wertheimer advised that in rendering Pharmaceutical Services, Pharmacists should not pre-occupy themselves with what they wanted as professionals but rather what society needed.

Concerning drugs imput, he recommended the World Health Organisations list of some 200 essential items, adding, however that it should be amended through a study of local needs.

Ohene Manu re-elected President

MEMBERS present at the 38th Conference of the Society held in the conference hall of the Kwame Nkrumah Conference Center on Saturday, November 30, re-elected unopposed, Mr K. A. Ohene-Manu as president to serve another two-year term.

Other members of the Standing Executive Committee (S.E.C.) also returned unopposed were Mr E. O. Gyamfi, Vice-President; Mr Moses Appiah, Hon. General Secretary; Mrs Agnes Brookman-Amissah, Hon. Treasurer; Mr Joshua Addo, Editor and Mr T. C. CorQuaye, Council member.

Mr Abu-Boateng and Mrs Joyce Addo-Atua were elected to replace Mr Charles Dontoh and Mrs E. R. Gavu as Assistant General Secretary and Council Member respectively, the last two stepping down voluntarily.

The following regional representatives have been chosen to join with members of the standing Executive Committee to form the National Council of the Pharmaceutical Society of Ghana for the period 1986—1987: Mr J. Pearce-Biney, Immediate Past President; Mr F. K. Bruce, Acting Director of Pharmaceutical Services; Prof. D. Dwuma-Badu, Dean of the Faculty of Pharmacy, UST; Mr Eric Aheto, (Greater Accra); Mr M. A. Akiwumi (Greater Accra); Mr Maxwell Aboagye Eastern); Mr Mike Addo (Ashanti) Mr Thomas Boamah (Brong Ahafo); Mr M. Amoah-Ampah (Central); Mr D. A. Obuobie (Volta) and Mr S. A. Bentum (Western).

RETENTION FEE

At the 38th Conference of the Pharmaceutical Society of Ghana it was decided that the annual retention fee be raised to C1,500.00.

This increase was necessary in order to help the secretariat cope with current inflationary trends and to regularly publish and circulate the Pharmaceutical Journal.

SYMPOSIUM

Marriage between orthodox and traditional Medicine recommended

ALL four panelists at the symposium held on Friday, November 29 at the Kwame Nkrumah Conference Hall as part of the activities marking the Golden Jubilee Celebrations expressed their desire for a successful marriage between orthodox and traditional medicines in the future.

Dr J. A. Nartey, Director of the Institute of Herbal and Tropical Medicine at Nsawam, said "traditional medicine is God-given" and that its integration with orthodox medicine, which is long overdue, would go a long way in treating patients more effectively.

He noted that "despite their differences in principle and in practice, they both have the same aim—alleviation of suffering to bring about peace and happiness".

Dr Nartey regretted that some people were doing everything they could to prevent the merger of the two practices. "Those fighting against their integration are doing so out of ignorance and should therefore be pitied rather than condemned", he added.

Dr Kwame Sarpong, Head of the Pharmacognosy Department in the Faculty of Pharmacy at the University of Science and Technology observed that over 70% of our people living in the rural areas virtually have no access to modern medical care, and even where this was accessible the cost involved was considered prohibitive. These people therefore relied largely on the services of traditional healers whom, he said were playing an important role in our rural set-ups.

Dr Sarpong recommended, among other things, that physicians open up and evaluate critically and without prejudice the potentials of herbal medicine, and also, that renowned and effective traditional healers be encouraged to set up traditional hospitals. "We have said a lot about this problem. What we need now is action", he declared.

Professor C. C. Adomakoh, Chairman of the Medical and Dental Council, suggested a kind of co-operation, scientific in approach between the two practices in which orthodox medicine would play a leadership role. According to Prof. Adomakoh, such co-operation was already taking place in the area of midwifery and psychiatry and hoped that other departments would follow soon.

Rev. Quarcoo, who appealed to the orthodox practitioners to take the lead and "propose" to the traditional healers, also advised that respect and trust, to mention a few, were vital qualities needed for a successful marriage and that the same virtues would equally do for this other form of marriage.

Felicitations!

MR Nicholas Palmer, President of the West African Pharmaceutical Federation (WAPF) was guest of the Society during the 50th anniversary celebrations.

Saluting the Society on behalf of the WAPF & the Society in Liberia, he said the lessons of the past are needful to guide our future actions.

'Let the example of your predecessors and the spirit of the past, as well as the ever present future, animate you to the most complete abounding service, to the building of a great and glorious society, and what you receive into a bright and beautiful possession, may you transmit it pure and unsoiled to those who come after you, called Mr Palmer.

'May your society flourish and increase, until time shall be no more' prayed the President. Other fraternal greetings were delivered by Prof. A. Wetheirmer, American Pharmaceutical Association. Prof. A. H. Beckett, Pharmaceutical Society of Great Britain, Chief Bayo Ogunyemi, Pharmaceutical Society of Nigeria.

SCIENTIFIC SESSION

Some future pharmacons

The active principles of the plants **Cryptolepis Sanguinolenta, Rhigiocarya recemifera** and **Griffonia Simplicifolia** have been identified as having great potentials for use as pharmacons in future product formulations.

This was disclosed by Professor D. Dwuma-Badu, Dean of the Faculty of Pharmacy, U.S.T in a talk he gave at the scientific session of the Golden Jubilee Programme.

He said the first plant, containing Crytolepine, an anti-inflammatory as well as antibacterial agent, could serve as "lead substance" in the search for new antibiotics, anti-inflammatory and possibly anti-hypertensive drugs just as morphine did in the search for narcotic analgesics.

The principal constituent of the second plant, o-methyl flavinantine and liriodenine showed analgesic and anti tumour properties respectively and the tincture prepared from this plant, it is believed, would improve the conditions of cancer patients.

The third plant is known to contain griffonin a substance capable, *in vitro*, of "effectively" changing sickle-shaped cells to normal. It is hoped that preliminary observations made on griffonin could be re-examined so as to evaluate critically its therapeutic value as anti-sickling agent for the Black Race, 25% of which is affected by this dreaded disease.

Prof. Dwuma-Badu concluded his talks by urging pharmacists, doctors, biochemists and pharmacologists to put their heads together to formulate products containing these pharmacons so that they would be integrated into the nation's health care delivery systems. Such a measure, he said, would help conserve some foreign exchange which otherwise would have to be used for importing products in the same therapeutic classes.

Local raw material for pharmaceutical industry abound

As a contribution to a symposium at the scientific session of the Golden Jubilee Celebrations, Professor B.A. Obiorah, of the Faculty of Pharmacy, University of Benin, Nigeria, laid bare the "enormous potential" that existed in the use of local natural products in the production of pharmaceuticals in the West Africa sub-region.

According to Prof. Obiorah, common diluents like dextrose, lactose and cellulose could easily be derived from most woody plants through degradation processes while dextrose and glucose were readily available from molases.

Acacia, ethyl cellulose, gelatine and starch among others, which serve as binders and disintegrants could be obtained by simple processing of local materials including animal bones, hides and skins, while refining our local clays and shale would provide us with enough absorbents.

Fats and oils needed as ointment and suppository bases could be found in cocoa and shea butters as well as in a blend of dika fat with palm kernel oil.

The actions of these excipents, he said, compared favourably with their official counterparts and in some cases proved even better.

Touching on available active principles, Professor Obiorah demanded that the importation of official medicinal plant products such as Rauwolfia, Datura, Cassia and Strophanthus, to mention a few, which grew in our sub-region be stopped and instead their cultivation encouraged.

He also mentioned some indigeneous drugs that could be possible alternatives to recognized medicinal agents and some with new pharmacological activities. He cited, among others the antimalarial activity of **Cryptolepis Sanguinolenta** and the hepatotropic activity of Kolaviron obtained from *Garcinia Kola* seeds and which is closely related to silybin (Legalon) which is used world-wide in the management of liver affections.

In conclusion, Professor Obiorah pointed out that a radical shift from tertiary manufacturing to primary and secondary sectors of the business was the only solution to the raw material problem in the pharmaceutical industry, adding that "governments in our sub-region should recognise this fundamental error in the development of our pharmaceutical industries and use all available means to redirect the unplanned and chaotic growth of parasitic colonial outposts sometime mistaken for industries".

STABILITY STUDIES ON HYDROGEN PEROXIDE

J. K. KWAYE
Department of Pharmaceutical Chemistry
University of Science & Technology
Kumasi, Ghana.

The rate constant and shelf life for hydrogen peroxide (20 vols) have been determined for various stabilizers. Hydrogen peroxide containing nitric acid/phenacetin as stabilizer has been found to be the most stable with a decomposition rate of 10% per year at room temperature (28°C). Accelerated storage testing results are comparable with those of extended room temperature studies.

Hydrogen peroxide decomposes to water and oxygen. Pure hydrogen peroxide is very stable. It has a decomposition rate of about 0.5% per year. However, the rate of decomposition increases with dilution. At very high dilutions the decomposition is so high that it possesses a lot of problems to manufacturers, sellers (retailers) and consumers. Unfortunately it is the diluted forms which are mostly employed for the various pharmaceutical applications. Among these applications are bleaching of hair, first aid for minor cuts and abrasions, cleaning of wounds and teeth, as mouth and throat wash, removal of wax from ear and in the treatment of Trichomonas vaginitis and balanitis.

Factors which control the stability of hydrogen peroxide are pH, temperature, light, presence of catalytically active substances which may be present either dissolved or suspended in the solution or held in the walls of the container. Alkaline pH, high temperatures, light and presence of metals particularly those having more than one valence state accelerate the decomposition rate [1,2].

Many compounds have been known to stabilize hydrogen peroxide, among these are; all acids (both organic and inorganic) and complex forming substances such as acetanilid, phenacetin, quinine sulphate and 8-hydroxyquinoline which supposedly remove heavy metal ions from solution by forming a co-ordination complex. These stabilizers function well under cool atmosphere. Unfortunately most of these hydrogen peroxide (20 vol.) preparations are not stored under the right temperature conditions and therefore deteriorate very fast. It is therefore, important to know the shelf life of hydrogen peroxide (vol. 20) at the ordinary room temperature(28°C).

This paper reports the stabilizing ability of various stabilizers for hydrogen peroxide solutions and hence the prediction of shelf life for the various preparations. The 'shelf life' was predicted using accelerated storage tests at four elevated temperatures and then at room temperature (extended room temperature studies) for comparison. The method of accelerated testing is based on the principles of chemical kinetics[3]. According to this technique, the 'K' values for decomposition of a drug at various elevated temperatures are obtained by plotting some function of concentration against time. The logarithms of the specific rates of decomposition are then plotted against the reciprocals of the absolute temperature (Arrhenius plot) and the resulting line is extrapolated to the room temperature. The relevant equations employed in the studies are:

1) 10g K —log A—Ea/2.303R 1/T
   Arrhenius equation
2) t—2.303/K log Co/C
   Prediction of shelf life

Where K is the specific decomposition rate, A, Ea and R are constants, T the absolute temperature Co and C are the initial and final concentrations of the drug and t, the expiry date.

EXPERIMENTAL

Preparations of Hydrogen Peroxide solutions (20 vols.)

Eight stabilizers were employed. They were: Sulphuric acid, Nitric acid, Sulphuric acid / Phenacetin, Sulphuric acid/ Acetanilid, Phosphoric acid/Acetanilid, Phosphoric acid/Phenacetin, Nitric acid/Phenacetin and Nitric acid / Acetanilid. For each preparation 120ml. of Hydrogen peroxide (50% w/w) was dilute with distilled water to 1000ml after the appropriate stabilizer had been added.

Accelerated Storage Tests

200ml quantities (4) of the various hydrogen peroxide solutions were put in glass stopped bottles and kept in ovens set at various temperatures (35°C, 50°C, 70°C and 90°C). Aliquots (10ml) were taken at various time intervals, diluted to 100ml with distilled water and 10ml of the resulting solution titrated with $KMnO_4$ (0.1N) after adding 5ml of sulphuric acid (50% w/v). The formular given below was used to calculate the % w/v of the residual hydrogen peroxide.

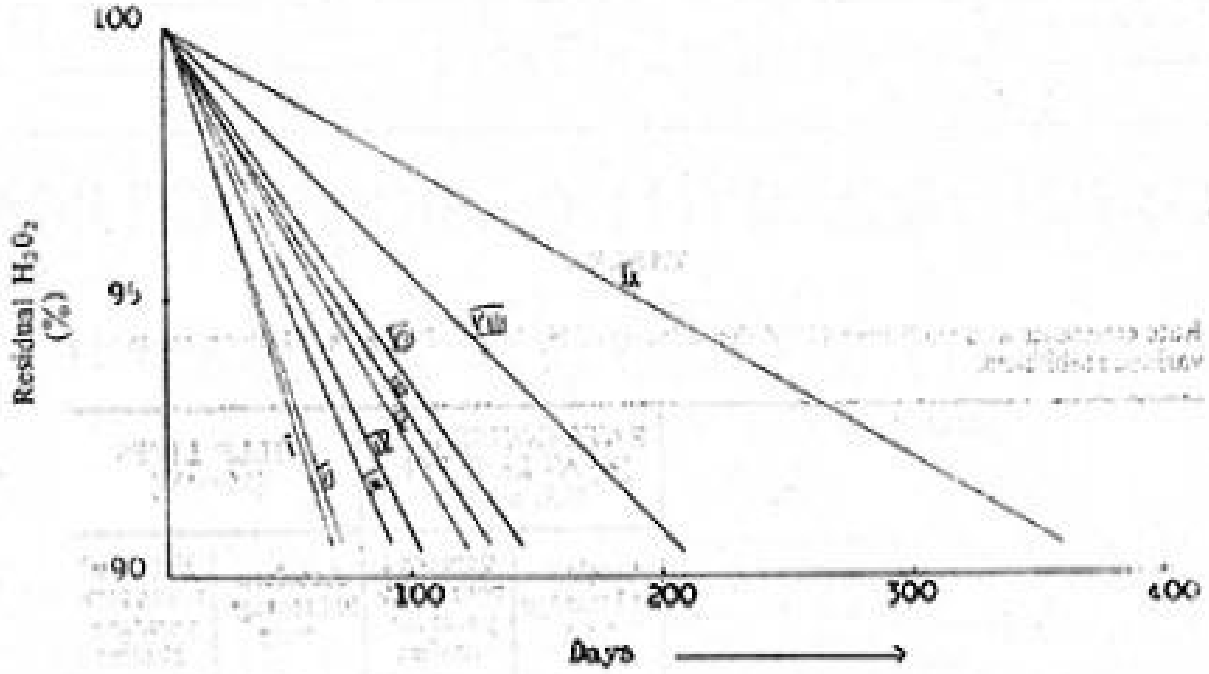
% w/v—100 (y x f x 0.001701)

Where 'y' and 'f' are the volume and factor of the $KMnO_4$ (0.1N) respectively.

TABLE I

Rate constants and shelf lives (10% degradatin) of Hydrogen Peroxide solutions containing various stabilizers.

	RATE CONSTANTS [K] AT 28°C PER HR. x 10^{-3}		SHELF LIVES [Months]	
	Accelerated storage tests	Extended room temperature studies	Accelerated storage tests	Extended room temperature studies
Sulphuric acid	5.7	5.2	2.5	2.7
Nitric acid	2.7	2.4	5.4	6.0
Sulphuric acid/Phenacetin	4.7	3.2	3.0	4.5
Sulphuric acid/Acetanilid	4.2	3.8	3.4	3.7
Phosphuric acid/Phenacetin	4.1	4.5	3.5	3.2
Phosphuric acid Acetanilid	3.5	2.9	4.1	5
Nitric acid/Phenacetin	1.0	1.2	15	12
Nitric acid/Acetanilid	2.1	1.9	6.8	7.4
Control (without stabilizer)	6.0	4.7	2.4	2.5



Stabilizers

I	Control	II	H_2SO_4
III	H_3PO_4/Phenacetin	IV	H_2SO_4/Acetanilid
V	H_2SO_4/Phenacetin	VI	H_3PO_4/acetanilid
VII	HNO_3	VIII	HNO_3/Acetanilid
IX	HNO_3/Phenacetin		

Extended Room Temperature studies

200ml quantities of the various solutions were stored at room temperature (28°C) in ambered coloured bottles for six months. Aliquots of 10ml were taken at 2 weeks intervals and analysed as for the accelerated storage studies.

RESULTS AND DISCUSSION

The summary of results are shown in Table I and Figure 1.

The results obtained from the accelerated storage tests are comparable with those of the extended room temperature studies except for sulphuric acid/phenacetin solution. Generally the rate constants from the accelerated storage tests were slightly higher than those of the extended room temperature studies. However, the difference is so small that accelerated storage tests can quickly be used to determine the shelf life of hydrogen peroxide.

Among the stabilizers studied, nitric acid/phenacetin is the best. It has a decomposition rate of 10% per year. Infact nitric acid and its combinations are the best stabilizers whereas sulphuric acid and its combinations are the least useful. The selection of stabilizers for the project was based on the stabilizers commonly found in Hydrogen peroxide solutions on the local Market.

The need for stabilizers in hydrygen peroxide solutions is clearly demonstrated by the results obtained for the control experiment. None of the solutions containing a stabilizer has a rate constant above that of the control.

The rate constants provided for the various stabilizers will be a useful guide to manufacturers of hydrogen peroxide to be able to indicate on their products their expiry dates. The expiry date and conditions of storage are very essential for both sellers and consumers.

A more comprehensive stability studies on hydrogen peroxide is still in progress and will be communicated as soon as it is completed. This will include all stabilzers.

Chief Justice hails society

(*Continued from page 3*)

enable the Faculty renovate its old building and to re-equip its laboratories. The Society donated C250.00 to the Faculty. This followed an appeal from the Faculty to the Society to help set up such a fund. The appeal was delivered by the former Dean of the Faculty, Prof. K. Boakye-Yiadom now the Pro-vice Chancellor of the University.

GOOD MANUFACTURING PRACTICE IN STERILE PREPARATION

By — F. M. DICKSON, General Manager, Intravenous Infusions Ltd., Koforidua — Ghana.

PRODUCTION of a sterile product intended for animal use cannot be solated from the premises and conditions under which it will be manufactured. The premises and conditions under which a sterile product is manufactured varies, to my mind, directly with the quality of the product. Thus when a customer is confronted with the choice of nominally the same product from a number or varying sources, and the difference is the cost, normally such a customer would make the choice on the basis of reputation for quality.

Quality is often influenced by procedures and protocols drawn out by management of the organisation concerned. In short, management in itself, is part of the intangible features of a product which constitutes the quality of the product. A responsible manager therefore in such an organisation, who is alive to the difficulties and requirements of a product sold by his organisation needs to know not only the situation for which he is personally responsible but also the inter-relationships with other areas in the organisation. This is the reason why selection and training of personnel in a sterile product manufacturing organisation is indispensable.

What then is a sterile preparation? A sterile preparation is a product which is injected, or applied to wounds or mucous surfaces of the body. Again products whose ingredients would become decomposed if the preparation is not sterilised. Examples could be given as parenteral solutions, hypodermic solutions or tablets, ointments for the eyes, solutions for the irrigation of the bladder, etc. For this purpose therefore, a sterile preparation could be defined as a preparation from which micro-organisms cannot be recovered when subjected to a sterility testing procedure.

Sterile preparations as suggested by some authorities, could be separated into three main processing groups; These are:-

(*a*) Aseptically prepared preparations. Preparations in which aseptic techniques are required for all processing steps e.g. Preparation of vaccines.

(*b*) Bulk sterilized preparation. These preparations are sterilized in the final stages; however, clean techniques are applied during the early parts of the preparation and aseptic techniques follow later, e.g. Preparations sterilized by filtration.

(*c*) Terminally sterilized preparations: - Only clean techniques are applied in all stages of the processing but the products are sterilized in their final containers. It should be noted that the environment used in each case should have lower bacterial load because the lower the bacterial load of a preparation, the greater the probability of success for any sterilization.

In considering therefore good manufacturing practice in sterile preparation, the following codes should be taken into account since earlier on in the first paragraph, I have mentioned that a sterile preparation cannot be isolated from the premises, the conditions and the management under which it is produced.

i. PREMISES:

Assuming sterile preparations are classified into three groups as listed above, then the building employed in each case should be located, designed constructed, adapted and maintained to suit the type of preparations carried out therein e.g. In the preparation of parenteral products like large volume Intravenous Fluids, buildings with laminal flow, air flow systems etc. are suggested. The location and design of the building should be made in such a way that the bacterial load of the environment is very low. To ensure that the preparation conforms to standards required and again to achieve greater probability of success for any sterilization process employed, the conditions in the environment should, as much as possible, be maintained at the standard set from the beginning. This may call for cleaning and fumigation of the rooms of the building, daily and periodically respectively.

The building design should be made in such a way that the preparation and processing methods can flow easily and faster to avoid mistakes, confusions and delay.

The temperature of the room is no exception hence it is necessary to ensure that the temperature of the designed room should not exceed 25°C and should not fluctuate. Air conditioners with air filters are therefore strongly recommended.

ii. EQUIPMENT:

In choosing equipment to use for a particular sterile product a manufacturer wants to prepare, the manufacturer has to take into consideration the most suitable equipment designed as such, constructed and adapted for such a purpose. The equipment in most cases, is designed according to the type of sterile product required, i.e. either aseptically prepared, bulk sterilized or terminally sterilized product.

It will be to no avail if the equipment so designed is not properly maintained. Hence

such equipment must be well located to ensure easy maintenance.

iii. CLEANLINESS AND HYGIENE (MAINTENANCE)

A sterile product as described in the early part of this essay, is said to contain no recoverable micro-organism when subjected to sterility tests. Thus appropriate precautions are required to avoid product contamination risks of all kinds.

Cleaning routines should be available for all kinds of equipments employed in the manufacturing process. The sort of cleaning method used should suit the equipments' designed.

There should be available cleaning routine of all the manufacturing areas and constant control of bacterial load in the manufacturing rooms should also be made.

The provision of toilet and washing facilities should be well considered and appropriately situated. The design of these facilities should suit the manufacturing area.

Protective clothi g changing rooms and canteens should be provided to help control the bacterial influx to the environment. Underground water tanks should not be sited near septic tanks.

Where the workers that come in contact with the preparation do not wear any gloves, finger nails of those workers should not be allowed to overgrow. Protective clothing and shoes should, as much as possible, be provided for these workers to ensure that the bacteria content of the room is controlled. Face masks and caps should also be made available to help minimise particles released from the mouth and hair respectively.

iv. PRODUCTION PROCEDURES AND DOCUMENTATION:

A document that gives information of preparations and properties of all products prepared by the organisation should be kept for reference. This document, termed the Master Document, gives a general information on all preparations carried out in the organisation.

Each batch prepared should be covered by a batch record sheet. All information related to the preparation procedures, temperature, weighings, personnel, tests, cleaning, mistakes, corrections and comments from the various sections through which the product passes, should be recorded in this batch record sheet. Such a sheet gives the exact work performed or the detailed history of the product from its raw material stage to its final stage.

Quite apart from the above information, the batch record sheet should also give the batch number, the formula and composition of the product and other properties of the product. All these documents should be filed and kept in the organisation's library for future reference. On no account should such documents be disposed of. Future improvements on the products could be based on facts and figures together with comments to be obtained from such records.

The person designated as having the overall responsibility for production, i.e. the production pharmacist, should not be responsible for quality control also. The work of such a person should not be controlled directly by the Control Personnel.

Weighing of materials should be controlled by the Pharmacist and the weighing should be done one material after the other. The Pharmacist should sign against each material weighed to avoid mistakes.

Containers for weighing should be well cleaned, dried and so labelled. The materials to be weighed are inspected prior to weighing from their respective containers and re-examined together with the weighed materials after weighing.

v. PERSONNEL AND TRAINING:-

The personnel employed to do such preparations should be selected and trained to man both the equipments and the premises according to laid down plans. The persons should be introduced to all products from the organisation and their preparations together with their handling.

Since listening and communication are very important, or more so, indispensable in such organisations, it is absolutely necessary that each worker is trained to know the act of listening and communication.

Wrong information passed on from a worker to another worker will result in an unwanted product being obtained finally.

The health of the personnel is also to be treated as a priority. Periodic medical check-ups should be instituted so as to ensure that healthy persons are involved in the preparations.

For example, a worker with a broken skin or a skin disease should not be allowed to come in contact with the product in its intermediate or preparation stages. The person in charge of the production should be a pharmacist, trained and employed as such.

vi. QUALITY CONTROL-:

In my opinion, this sector is the most sensitive area of any production or manufacturing unit. The duty of the Quality Control Unit is to monitor and control the activities of almost all sections of the factory.

In-coming goods must be monitored for examination before being released for production.

The finished product should also be controlled to ensure that the final product conforms to the set standards. The final product is tested physically, chemically (if any) and biologically by the unit to confirm the quality of the product.

Since these listed jobs are very

THE FIGHTER

I've got fighting in my veins. I admit it would be better if I had blood. I've done quite a lot of boxing in my time. I used to work in a Kipper-Packing store. I remember my last fight very well. I was fighting a man named Basher Beauchamp. The punishment that guy's hands took from my nose! When I stepped into the ring and took off my dressing-gown the crowd went wild with excitement. I'd forgotten to put my shorts on. The second nudged me and whispered, "The bell's gone". I said: "Well don't look at me. . . I never touched it". In round two, I had the Basher worried. He thought he had killed me. The Basher was smothered in blood. Mine. In round four we spent most of the time playing Puss-In-Corner. He'd hit me in the nose and I'd lie in the corner.

sensitive and indispensable, it is a good practice for the Control Department to have a defined system of materials, supervision of process and examination of samples.

The systems applied in the control unit normally indicate the way in which the building and various rooms should be designed. The rooms should be adapted and equipped to suit the types of controls performed there.

A person so designated should have the overall responsibility for quality control only. Such a person must be reliable and trustworthy. Records of all tests performed on both raw materials, intermediary and finished products should be properly kept.

Samples of each batch of products should also be kept by this unit for at least three years on the premises for future reference.

Last, but not the least, there should not be any interference with the work of this unit whatsoever.

vii. **REVIEW OF PROCEDURE:**

Procedures for manufacturing and control should be reviewed periodically to ensure that methods used are effective. By so doing, improvements upon the performance of the manufacturer is assured.

This calls for constant research in the laboratory of the manufacturer.

viii **DISCIPLINE:**

Finally, if all the foregoing requirements have been fulfilled, it is necessary that discipline is ensured. Without discipline, routine and procedures would not be strictly followed and products from the manufacturer will definitely not conform to standards.

CONCLUSION:

In summing up therefore, it could be deduced from the essay written that to exhibit any good manufacturing practice in sterile preparations the ideas incorporated in the essay, though not exhaustive, should at least be adhered to.

It is worthy to note here that a decision taken by management or a group of workers to improve upon a production process or to save money by increasing or reducing, respectively, on the number of control formalities will definitely affect the product in one way or another.

EXHIBITION OF SKELETAL MUSCLE RELAXANT ACTION

By An Active Constituent of ELAEOPHORBIA DRUPIFERA

by E. Ayitey-Smith, B. Pharm., Ph. D., MPSG and C. A. Heman-Ackah, MB, CHB.

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SUMMARY

Pharmacological studies of extract of *Elaeophorbia drupifera* in mice and on rat nerve-diaphragm preparation have shown that an active principle in the herbal extract possesses skeletal muscle relaxant action.

INTRODUCTION

Elaeophorbia drupifera (Euphorbiaceal) is a plant which is commonly found on the coastal plains in Ghana. The latex is poisonous and dangerous to the eyes and may cause incurable blindness. If rubbed on the skin, it causes considerable swelling. The latex has been reported to have been taken internally with eggs or cereal or with palm-nut soup as a purgative, and the leaves pounded with salt and onions have been applied externally to guinea-worm sores to assist extraction (1, 2).

In the Ivory Coast and in Ghana the latex or the pounded leaves and fruits are either added directly to water or placed in shells or calabashes in water to stupify fish. Pharmacological studies were, therefore, undertaken to investigate the possible activity in the leaves. During preliminary screening the herbal extract was found to produce paralysis in mice.

MATERIALS AND METHODS

Leaves of Elaeophorbia drupifera, collected during the dry season, were dried and pulverised. The material was extracted with hot water and the filtrate evaporated at 60° to dryness. Part of the dried extract was reconstituted with water, on addition of acetone a precipitate was produced and this was separated by filtration. Concentration of the filtrate resulted in the formation of water soluble crystals. The crystals were washed several times with acetone and then dried. Both the dried extract and crystals were used for the study.

Mice of either sex weighing between 20-30g were used for the investigation. Doses of 0.1 ml/10g of 5%, 10% 20%, and 50% solution of the extract were given orally by stomach tube or injected intraperitoneally into mice. Doses for the crystals given intraperitoneally were 1mg, 2mg, 5mg and 10mg/10g.

Investigation on the effect of the drug at the neuromuscular junction was performed by using Hoppe's method(3). Mice were placed on a mesh wire screen inclined at a 90° angle from the horizontal. Administration of a neuromuscular blocking agent would result in the development of paralysis and mice would abruptly slide off the screen within half an hour. About 36 mice were used for the experiment.

In a second experiment, the drug was tested on the phrenic nerve diaphragm preparation of rat. The nerve-diaphragm was prepared and set up in an organ bath containing

Krebs solution at 37°C and aerated with 95% O_2 and 5% Co_2 according to the method of Perry (4). Contractions of the diaphragm muscle were recorded on a kymograph. Nerve and muscle were stimulated at a rate of 12 shocks per minute by rectangular wave pulses of 0.5 sec. Cumulative graded doses of solutions of the extract and crystals were respectively added to the tissues in the bath while the nerve and muscle were alternately stimulated.

RESULTS

Mice

When doses of 0.1 ml/10g of 10% of 50% of extract were given orally or intraperitoneally or 5mg-10mg/10g of crystals were given intraperitoneally, paralytic effect of the druging mice was observed within 5-10 minutes (using Hoppe's method): **Table I.** Normally, the drug paralysed the hindlimbs before the forelimbs and the mice could move with difficulty until 45-60 minutes when they were completely immobilized and were lying on their bellies, occasionally kicking the hindlimbs for a minute or two. At this stage, they showed marked difficulty in breathing, especially when higher doses were administered. Respiration was irregular, sharp and shallow. Most mice died within 2 hours when doses of 0.1 ml/10g of 20% of extract and 10 mg/10g of crystals were administered. All mice treated with 0.1 ml/10g of 50% of extract and above 10 mg/10g crystals died within 15 minutes. All deaths were due to respiratory failure.

NERVE-DIAPHRAGM PREPARATION

In six preparations, solutions of both the extract and crystals of E. drupifera caused a significant decrease of 50-80% in contractions of the muscle due to nerve stimulatiion while direct muscle stimulat,on remained unchanged (Figs 1 and 2). When the drug was washed from the bath there was gradunl recovery of contractions due to nerve stimulations.

(Continued on page 15)

TABLE I

SKELETAL MUSCLE RELAXANT EFFECT OF AN ACTIVE CONSTITUENT OF ELAEOPHORBIA DRUPIFERA IN MICE — USING HOPPE'S METHOD

DOSES	ONSET OF PARALYSIS IN MINUTES	
	ORAL	INTRAPERITONEAL
1. EXTRACT		
0.1 ml/10 g of 10%	10.57 - 1.11	9.67 - 1.50
0.1 ml/10 g of 20%	7.81 - 0.65	5.67 - 0.92
2. CRYSTALS		
5 mg/10 g	8.67 - 1.02	7.50 - 1.35
10 mg/10 g	6.71 - 0.51	5.17 - 0.79

Control mice remained on the mesh wire screen for more than an hour until they were removed.

Figures are mean - Standard Error.

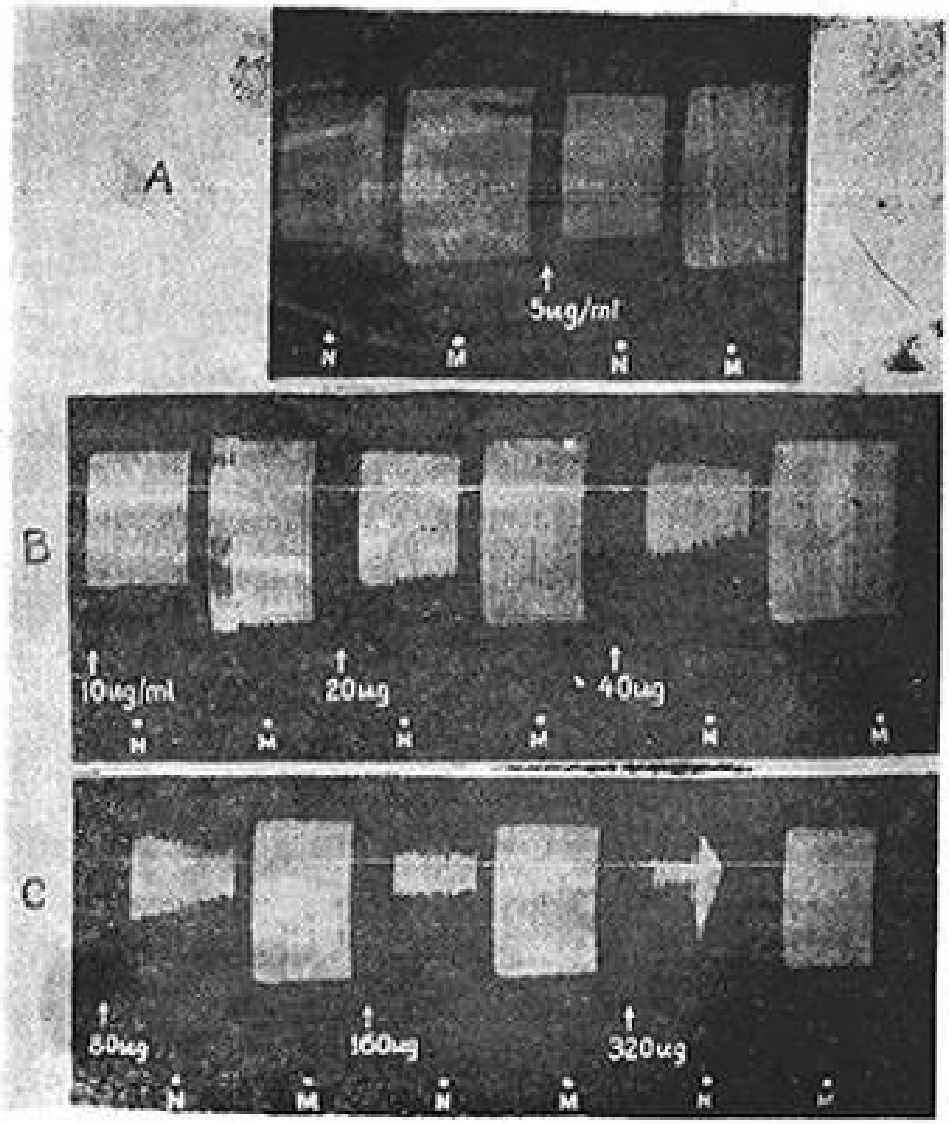

Fig. 1
Effect of active constituent (Crystals) from Elaeophorbia drupifera on contractions of diaphragm muscle (of phrenic nerve diaphragm preparations) stimulated electrically either directly or indirectly through the nerve. N shows contractions due to nerve stimulation and M, contractions due to muscle stimulation. The arrows indicate where various concentrations of the drug were added to the tissue in the bath. The drug decreased contractions due to nerve stimulation dose-dependently.

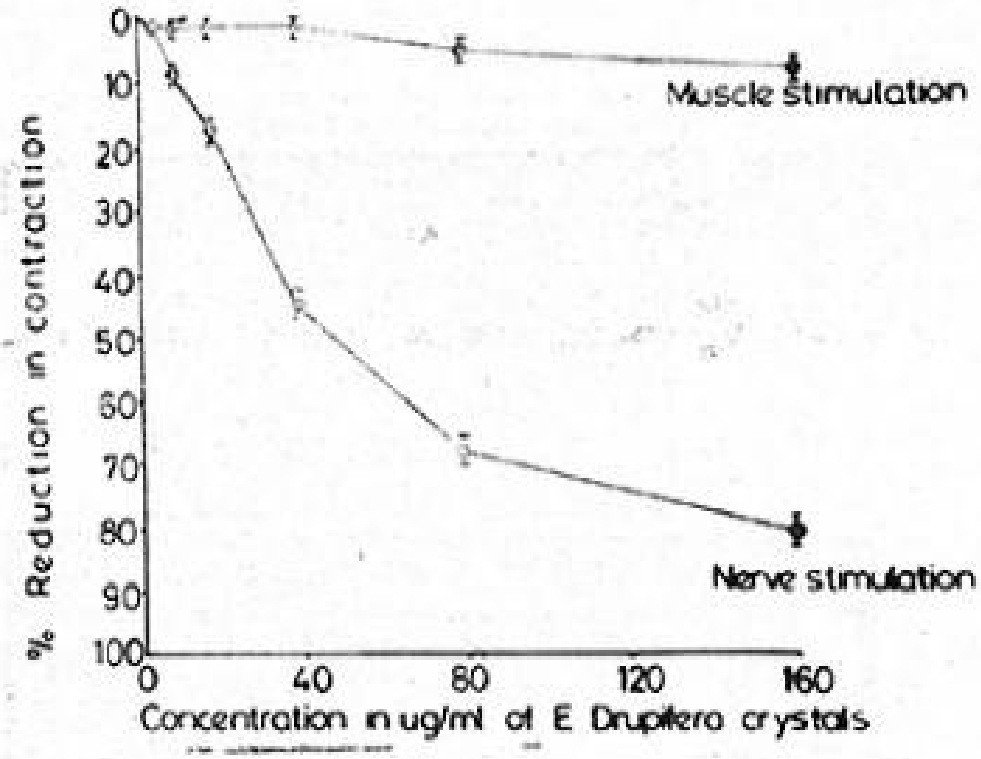

Fig. 2

Dose-response curves of phrenic nerve diaphragm preparations to active constituent from Elaeophorbia drupifera.

Contractions of diaphragm muscle was produced by either direct electrical stimulation of muscle or indirect electrical stimulation through the nerve.

The vertical bars represent the standard of error the mean.

DISCUSSIONS

The results obtained showed that the extract and crystals of Elaeophorbia drupifera produced paralysis in mice. The effect was observed first on the hindlimbs followed by the forelimbs. The intercostal muscle might have been depressed since the drug caused difficulty in breathing. That the mechanism of skeletal muscle paralysis might not be postsynaptic was shown by the finding that muscle contractions due to nerve stimulation and not direct muscle stimulation was blocked by the drug in phrenic diaphragm preparations. However, further work is needed to show the exact mechanism of action.

Leaf preparations were reported to be applied to guinea-worm sores to assist extraction (2), or used internally to treat the infestation. It appears possibly that the active agent in E. drupifera might cause paralysis of the worms and this might have made extraction of the worms easier.

It can be concluded from the available evidence that E. drupifera contained a water soluble active constituent which possesses skeletal muscle relaxant action.

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1986 Annual General Meeting of the Pharmaceutical

The Eastern Region Branch of the Society will host this years AGM at Koforidua from Sept. 4 — 6, 1986 Below is the Programme of Activities.

Theme: "Extending Pharmaceutical Services to the Rural Areas"

Venue: The Hotel EREDEC, Koforidua.

Thursday, 4th September, 1986
7.00 p.m. — Arrival of participants
— Council Meeting

Friday, 5th September, 1986
7.00 a.m. — Breakfast
8.00 a.m. — Registration of participants
9.00 a.m. — Invited Guests and Members of the Society to be seated
— Welcome Address by the President of the Pharmaceutical Society of Ghana
— Official Opening of the Annual General Meeting
By: The PNDC Secretary for the Eastern Region
10.00 a.m. — Group photograph
10.30 a.m. — Coffee Break
11.00 a.m. — Presentation of Working Paper on Theme
By: Mr J. Pearce-Biney, Chairman, Ad-Hoc Committee on Extending Qualified Pharmaceutical Services to the Rural Areas
12.30 p.m. — Lunch
2.00 p.m. — Symposium on Theme
Chairman: President of Pharmaceutical Society of Ghana
Panel Members
a) General Practice Pharmacist
b) Hospital Pharmacist
c) Industrial Pharmacist
d) Academic
6.00 p.m. — Cocktails

Saturday, 6th September, 1986
7.00 a.m. — Breakfast
First Business Session
— Hon. General Secretary's Report
(including Reports from Regional Branches and wings of the Society)
— Hon. Treasurer's Report
10.00 a.m. — Coffee Break
10.30 a.m. — Discussion of Reports
12.00 p.m. — Lunch
Second Business Session
2.00 p.m. — Open Forum
3.30 p.m. — Group Meetings
4.30 p.m. — Matters for Consideration of Annual General Meeting
5.30 p.m. — Election of Fellows
7.30 p.m. — Dinner

Sunday, 7th September, 1986
7.00 a.m. — Breakfast
8.00 a.m. — Departure.

Achieving Self-Sufficiency in Drug Production in West African Sub-Region Using Natural Products.

A synopsis of a contribution to Symposium at the Golden Jubilee of the Pharmaceutical Society of Ghana on November 29, 1985.

By Bona A. Obiorah

Bona Obiorah is Professor of Pharmaceutical Technology and Dean, Faculty of Pharmacy, University of Benin, Nigeria. He has served as a member of the Science Association of Nigeria Task Force on African Medicinal Plants. He has also served as Adviser to WHO on small to medium size pharmaceutical plants in developing countries. For over a decade now, he has been actively involved in formulation research using raw materials of Nigerian origin.

I AM delighted to be here in Accra to participate in the activities marking the celebration of the Golden Jubilee of the Pharmaceutical Society of Ghana. I also wish to thank you for your invitation to make an input at this symposium.

You have chosen for your theme: "Pharmacy Practice in Ghana—Problems, Progress and Potentials". I believe this is an apt theme for a society just turned fifty. While we must admit that there are very many problems with the practice of our profession in the West African sub-region, it will also be fair to accept that some progress has been made and that the practice has a lot of potentials.

I have chosen for my talk the issue of utilizing natural products in our sub-region in the production of pharmaceuticals. I will try to illustrate that our natural products have p lot of potential for pharmaceutical aroduction. With austerity sweeping through our sub-region it is only logical that pharmaceutical companies operating here must turn their attention now, more than ever before, to the local production of drugs rather than the importation and distribution of drugs. The present trend of compounding wholly imported raw materials into dosage forms must be discouraged as this appears to be fraudulent avenues for siphoning our hard-earned foreign exchange out of our sub-region. These "assembly line" pharmaceutical manufacturers are unwittingly contributing to the perpetual underdevelopment of the industry by engaging in the last stages of the manufacturing process. This can aptly be described as doing the last things first and the first things last. If the trend continues we are sure to witness the demise of many industries whose production lines are dependent on imported raw materials. It is also not difficult to imagine that no other sector of the economy will be as hard hit as the pharmaceutical industries by the import restrictions that are sequel to the sub-regions reduced foreign exchange earnings.

Potentials

The pharmaceutical and other consumer products based on chemical feedstocks are usually imported into our sub-region either as finished products or processed secondary materials for conversion into finished goods in our industries. There is very little local input in the raw materials used in our pharmaceutical and allied industries. It is well known that less than 20 to 25 per cent of the materials used in our drug industries are obtained from local resources. It is doubtful if this situation can endure the realities of our present economic predicament.

It is very difficult to figure out unequivocally the rationale for establishing these industries in the first place if they were only supposed to serve the interests of foreign business concerns. This is rather intriguing since in at least Ghana and Nigeria we have both the basic raw materials and the personnel needed to convert the crude substances to processed industrial foodstock. It is because of the unlikely possibility that some of us may be unaware of the enormous potential that exists in the use of natural products in the drug industry that I have chosen my topic of this talk.

Pharmaceutical dosage forms consist essentially of two parts: the non-biologically active, apparently inert moiety generally referred to as the excipients, and the active ingredient responsible for the pharmacological activity which could be referred to as the Pharmacon.

It therefore means that any serious effort at the local production of pharmaceuticals must identify local sources of both the excipient and the active substance. The substances incorporated in pharmaceutical dosage forms as excipients vary according to the nature of the preparation. In some cases, for example, preparations for parenteral administration the excipient component is very negligible and for most part consists of water or similar common solvent. For the other dosage formulations such as tablets, capsules,

syrups, mixtures, powders, aerosols creams, lotions and suppositories the excipients constitute the bulk of the drug. They may be considered the most appropriate vehicle for the transportation of the pharmacon to the site of action within a reasonable time. I will like to use the tablet to illustrate the possible local alternatives available as excipients for the pharmaceutial industry. The reason for my choice is not because I am a pharmaceutical technologist with bias towards tabletting but rather because the tablet form is the simplest drug package to manufacture, transport, handle and swallow and in most circumstances the most suitable dosage form for long term storage.

The pharmacon or active principle is only a small proportion of the whole tablet, whose bulk is composed of diluents and binders designed to hold the tablet together and other agents which are added to ensure the efficient disintegration of the tablet in the gastrointestinal tract. In making a tablet, it is essential to produce a compressible mixture with high flow properties, hard enough to withstand shock, rubbing together, etc. and which will nevertheless rapidly disintegrate after being swallowed. It is therefore obvious from this explanation that pharmaceutical excipients while possessing no pharmacological activity as such, are of immense pharmaceutical importance in pharmaceutical manufacturing processes. I will now like to consider the principal excipients such as diluents, binders, lubricants, disintegrants and perhaps colouring and flavouring agents which sometimes incorporated in tablets to achieve the desirable properties.

The common diluents include dextrose, lactose and cellulose. These three compounds are easily derived from the degradation of most woody plants either by controlled acid treatment of pulp or by microbial degradation. A more readily available source of dextrose and glucose is molasses obtained as by-product of cane sugar (saccharum officinaliss) refining. The chemistry involved is quite simple and uncomplicated and the reaction sequence only yields ethanol and yeast broth as the two major by-products. For direct compression formulation further treatment of crude cellulose (hypermol) to microcystalline cellulose may be necessary and this can be achieved by a modification of the "mercerization transformation" technique. Binders usually added to the granulating fluid in tabletting include acacia, ethyl cellulose, gelatin, glucose, symps, starch mucilage, sodium alginate and sucrose syrups. All these can be obtained by simple processing of local materials. Animal bones, hides and skins are ready sources of gelatin for capsules, while refining our clays and chalk will provide us with enough pharmaceutical absorbents.

Starch remains an important ingredient in tablet manufacturing, and the availability of suitable local sources of starch is of immense pharmaceutical importance. The traditional diet in our sub-region is mainly composed of starches and carbohydrates. The importance of starch as excipient in the formulation of compressed tablets cannot be called to question. The substance is widely used in tablet formulation as a binder disintegrant as well as diluent in some cases. Two factors are considered in the selection of starch for tabletting: the first factor is the suitability of the starch to well-defined pharmaceutical standards, and secondly, the relative cost of the starch. While starch is widely distributed in the plant kingdom, there are relatively few plants from which it is obtained commercially.

Starch sources

In most countries, the pharmaceutical companies usually restrict their choice to the most available source. In the Americas, maize or corn starch is the obvious choice and sometimes supplemented with other cereal starches from wheat and barley. The Europeans use both potato and maize starches while Asian pharmaceutical industries use rice starch. Research investigations have shown that starches from cassava (Manihot utilissima) and from banana or plantain belonging to plant genus Musa can also be used as disintegrant and binder. The only processing problem encountered with banana and plantain starches is the inconvenience of the darkening effects of the polyphenols. Cocoyam tubers (Zanthosoma sagitiforlium) contain about 20 per cent of starch in loosely packed granules within the cells.

Starch is separated from the other water—insoluble materials which accompany it in the tuber by utilising its high specific gravity. Geographically, cocoyam is widely distributed in tropical regions where they grow widely in the rain forest. Cocoyam thrives well in clay soil and is a common root crop in the whole of West Africa. Otiwevwe[1] studied the suitability with acacia starch as a binder and disintegrant and also its compatibility with acacia and potato starch as binders. In the study sulphadiazine was the drug investigated. The results obtained seem to indicate that cocoyam starch might be a better disintegrant/binder than potato starch. The tablets produced passed other pharmacopoeia tests like uniformity of weight, and unofficial tests such as hardness and friability.

In most storage conditions tablets prepared with cassava give somewhat lower disintegration time than those prepared with potato starch. Cassava plants grow abundantly in our sub-region. Again, their tubers contain a lot of starch and are also used as food. Unfortunately, cassava starch has received little attention as regards its usefulness as a tabletting excipient. One of the earliest investigations into the use of cassava starch in tabletting was carried out by Mital and Ocran[2] here in Ghana.

These workers confirmed that cassava starch gave lower disintegration times than those of potato starch under almost all conditions of storage when used in the formulation of lactose, sodium hydrogen carbonate and calcium carbonate tablets. In Nigeria, Nasipuri[3] as well as Jaiyeoba and Opakunle[4] investigated the use of cassava starch as a binder in the formulation of compressed tablets. The latter workers reported among other things that modified cassava starch produced tablets possessing excellent hardness, friability and weight uniformity cassava starch has been successfully employed in the preparation of chloroquine, aspirin and aluminium hydroxide tablets. Similar investigations into the use of starches derived from other of our staple

foods such as yam, maize and rice support the view that all these locally available starches are promising candidates as disintegrants binders in tabletting. This lends greater weight to the statement that we should use what we have to produce what we want. The tempo of researching yam, maize and rice starches is much slower than for cocoyam and cassava types. The reason for this probably lies in the fact that the starches from the latter two are much cheaper than those from the first group of three.

Gums Facts and Oils

Gums are employed in pharmaceutical formulations as stabilizers, suspending and emulsifying agents; or specifically in tabletting as binders, disintegrants. They are also used as thickeners, coating agents, film forming materials and to impart smooth and spreading properties to products. For all these purposes gums from the stem and branches of *Acacia senegal* or other related African species of Acacia (family leguminosae), or Albyzia species should satisfy all our requirements for pharmaceutical gums. Acacia which produces the commercial 'gum arabic' grows abundantly in the northern parts of West Africa and in some southern parts as well. It is sad to note that processed gum arabic for industrial use in Nigeria are purchased from North African producers through European middlemen at very exhorbitant prices. Obiorah[5] studied the influence of Albyzia ferruginia gum on dissolution of sulphathiazole tablets in three different dissolution media (water, artificial gastric fluid, artificial intestinal fluid). Tablets containing from 1 to 5 per cent w/w each of acacia, A. ferruginia gum and PVP intragranularly were prepared under standardized conditions. In each case, crushing strength friability disintegration and, dissolution rates were determined. Whereas increasing amounts of acacia decreased *in vitro* release rate, the converse was the case with PVP and A. ferruginia gum. It has been shown that there is nothing like universal *in vitro* test fluid for dissolution studies, even for identical active substances. Dissolution rates may be found to vary much in water, artificial gastric fluid and artificial intestinal fluid depending on the type of binder used. Other suitable sources of pharmaceutical gums include the palms and velvet tamarind. Another commercial source of high quality gum is pure culture fermentation of carbohydrates with *Xanthomonas capestris* which yields a high molecular weight polysaccharide with the desirable properties.

Fats and oils are also very useful pharmaceutical excipients. They are generally used as ointment and suppository bases. Closely related to the fats and oils are the waxes used in Pharmacy as stiffening substances and polishing agents in tablet coating. Cocoa butter (or theobroma oil;, the fat obtained from the seeds of Theobroma cacao, family sterculiaceae) is the standard suppository base in Pharmacy and potential suppository bases are usually evaluated and defined based on their performance relative to cocoa butter. The cocoa plant is a popular economic plant in Nigeria and is largely exported as the beans. It is only recently that serious attempts have been made to process cocoa beans on a large scale in that country. The poor producer price has lowered the incentive to cultivate this crop. This is not peculiar to cocoa since the total Nigerian production of oils and fats has dropped from 1.02 million tons in 1973 to an estimated volume of 842,000 tons in 1983. This deficiency is worsened by a nearly two-fold increase in the consumption of oils and fats during the same period. The pharmaceutical and cosmestic industries have been forced to rely on foreign supplies for their needs. It is for this reason that research has been embarked upon by our Pharmacy Schools to identify new sources of pharmaceutical oils and fats.

Shea butter, a natural fat obtained from the seeds of shea tree Butyrospermum parkii (Family Sapotaceae) has been shown to possess properties expected of a good ointment base[6]. It compared favourably with official ointment and cream bases in experiments designed to determine rheological properties such as spreadability, extrudability and solidification capacity. The results indicate that shea butter ointments released the medicaments at a faster rate than the official ointment bases. The stability of shea butter against autoxidation was found to be enhanced by the addition of butylated hydroxytoluene (BHT), propyl-gallate (PG), nordihydroguaiaretic acid (NDGA) and butylated hydroxyanisole (BHA)[7].

The fat from "Ogboro" known in commerce as Dika fat has been evaluated as a tablet lubricant[8]. The fat is obtained from the kernels of Irvingia gabonensis var. excelsia by soxhlet extraction of the decorticized and pulverized seeds with a non-polar solvent such as hexane, petroleum spirit or benzene. The fatty acid composition has been found to be: myristic 441, palmitic 5.2, lauric 46.6, decoic 2.0, oleic 1.9, linoleic 0.2 mol %[9].

It produced better disintegration and dissolution profiles than magnesium stearate at all the concentrations tested. A 4:3 blend of dika fat with palm kernel oil gave better drug release than cocoa butter or butter or witepsol H15/10.

The physical properties of dika fat have been well studied and the logical next step would be its commercial production. It is unfortunate that "Ogboro" and its close relative "ugiri" are not cultivated as cash crops in our sub-region and users still rely on wild plants for supplies.

The wax has been found useful in the manufacture of candles and this has increased the demand for both varieties of Irvingia. I have up till now been talking about the non-active excipients used in tableting. Of course, a drug without an active substance would not be useful in medicine as a therapeutic agent. At best, such formulations could serve as placebos. Most of the pharmaceutical manufacturers in our sub-region depend entirely on imported pharmacon for their production. This situation they blame on the lack of appropriate local sources of such compounds. In Nigeria now, we are told that the only hitch in the availability of pharmaceutical active ingredients is the proposed petrochemical industry. While, one would not deny the importance of petrochemical feedstock in the pharmaceutical industry, it must be emphasized that active medicinal compounds are not derived only from petrochemicals, and some of the

drug exporting countries are not even endowed with petroleum resources.

It would have been more tolerable to import chemicals for the synthesis of drugs rather than import the finished products. Synthesizing the drugs here will also help in stimulating the growth of the local pharmaceutical manufacture of drugs. With such abundant reserves of chemical raw materials and highly rated chemists, our sub-region should be able to establish bulk synthesis plants at various stratetic locations. It is difficult to comprehend how the proposed petrochemical industry complex will miraculously transform the chemical industry overnight. The very crucial point is that there is presently no demand for the primary products of the proposed petrochemical complex since the products would require further processing before they can be used as feedstock for pharmaceutical and allied industries.

From a purely theoretical view point, nearly all the products associated with petroleum can be obtained from coal. One wonders why there has not been any attempt to exploit our coal resources for chemical feedstock. Coal and plant products constitute very viable sources of raw materials for the pharmaceutical industry, especially for the preparation of medicinally active substances.

I would now like to summarize some of the results of the investigations by our scientists on indigenous medicinal plants. This will be approached from two parameters: the official plant products available in our sub-region but are presently imported, and the indigenous drugs that are possible alternatives to recognized medicinal agents or with new pharmacological activity.

On the first group of medicinal plants we have such drugs like Rauwolfia, Datura, Cassia, Cymbopogon, Catharanthus and Strophanthus which are official in most compendia. A detailed investigation of the African Rauwolfia species/11, has established that Rauwolfia vomitoria is a better source of reserpine (the active antihypertensive agent in Brinerdin and other proprietary products) than the Asiatic species.

The United Nations Industrial Development Organization (UNIDO) has produced a list of over sixty important plant drugs suitable for production by developing countries/12. Although, nearly all the plants in the UNIDO list grow widely in West Africa, I am not aware that a proper attempt has been made to cultivate these plants for pharmaceutical raw materials.

From the UNIDO list certain plants qualify for special mention because of the apparent ease of cultivation or collection from the wild and the availability of detailed research data on them. These include physostigma venenosum, Costus afer, Theobroma cacao, Solanum species, Cassia alata, Voacanga, Strophanthus, Datura gloriosa, Prunus africa. The International Trade Centre UNCTAD/GATT in a series of publications has documented the profiles of some of these plants, including the export market, for them and the probable market trends for the future 13/. It is unlikely that any producer of these phytochemicals will lack market for them.

Local pharmacons

Investigations of our medicinal plants seem to indicate strongly that formulation of these traditional remedies into dosage forms would drastically reduce our dependence on imported drugs for our health care delivery. We do have local drugs for the treatment of malaria sickle cell anaemia, and also for the management of hepatitis. We now have plant products with proven antimicrobial, anticonvulsive, antimalarial, antihypertensive, antidiabetic properties etc. It is noteworthy that two of the few potent drugs used for the treatment of cancer, Vinblastine and Maytensine are obtained from tropical African plants. Sofowora's team at Ife University have successfully evaluated the antisickling properties of Fagara zanthoxyloides, the popular Yoruba chewing stick/14. Dwuma-Badu working in Kumasi and later in Lagos studied the antimalarial activity of Cryptolepis sanquinolenta, a plant used in various parks of West Africa for the treatment of malaria/15. A cussory search of the chemical, biological and pharmaceutical abstracts will furnish the details of other outstanding contributions by several workers in our sub-region.

A team led by Dr Iwu at the University of Nigeria has in the last few years been investigating some medicinal plants for pharmacologically active compounds. Their study is bifocal in nature: the initial objective is to identify and catalogue the phytotherapeutic means of indigenous health care of the Igbo people in Nigeria and subsequently to examine the collection for new therapeutic agents that could have a place in modern medicine/16.

Several compounds were isolated from selected medicinal plants and subjected to a variety of biological tests, which include antihepatotoxic, cytotoxic, antimicrobial, antimalarial bioassays designed to select only those compounds which exhibit remarkable biological activity. A compound kolaviron was obtained from Garcinia kola seeds. The active constituents of kolaviron would be easily accepted as a pharmaceutical agent because of its close relationship with two commercial products used for the management of liver toxicity, namely silybin (Legalon) and cyanidanol (Catergen). The three compounds are believed to exert specific protective action on liver membrane and thereby prevent liver damage.

The drugs used for the treatment of malaria in Western orthodox medicine are limited usually to those substances which act within the narrow western understanding of the disease. Chloroquine and other synthetic antimalarials are capable of eliminating serum parasitemia but they have little effect on the other characteristics of this disease. A four-point antimalarial evaluation of various herbal remedies revealed that some of our traditional medicine may prove useful as modern antimalaria agents.

The first method of evaluation was to examine the ability of the plant extract to interrupt the pre-infection incubation of Plasmodium berghei drawn from heavily infected laboratory animals. The drugs were also tested for their ability to generate methemoglobin and stabilize glutathione (GSH) in vitro. The differences in the time between clinical malaria attacks or relapses were also determined both for the test plant products and the allopathic reference drugs.

From the results it was clear that some herbal remedies are comparable to chloroquine and its analogs. The large number of plants available in this review suggests that a great deal of information of local pharmaceutical agents will be available over time, as many of these plants have never been previously investigated, unexplored or grossly under-exploited. Some of the plant products are available in forms ready for clinical application, others are in various stages of development, and the rest are only of phytochemical interest.

The use of medicinal plants in the preparation of pharmaceutical dosage forms should not be confused with a subscription to the practice of folk medicine. There is hardly any difference between a plant based drug and a synthetic equivalent if both of them are presented in an acceptable manner. It is interesting to observe that our pharmacists import huge quantities of cough syrups and laxatives when nearly all the ingredients for their manufacture could be obtained from local sources.

Conclusion

In conclusion, I wish to state that it is not my intention to present an over optimistic and rather simplistic picture of the raw material situation for the pharmaceutical industry. I am aware of the crippling and often frustrating condition of the industrial scene caused by near absence of basic technological support, public utilities and a most confused and primitive bureaucracy. Even in the scientific processing of these plants, it is obvious that numerous untested difficulties have to be overcome before these compounds are accepted as pharmaceutical agents. Of more fundamental importance is the absence of any data on the commercial viability of the scale up processing of these plants on a magnitude that would be attractive to the industries.

The only solution to the raw material problem in the pharmaceutical industry is a radical shift from tertiary manufacturing to primary and secondary sectors of the business. The governments in our sub-region should recognise this fundamental error in the development of our pharmaceutical industries and use all available means to redirect the unplanned and chaotic growth of parasitic colonial outposts sometimes mistaken for industries.

Perhaps, the mistake is so fundamental and far-reaching that we may have to re-examine our whole concept of education, science and technological development. It seems to me that somewhere along the line we got confused by a system we pretend to understand—so many concepts that were merely symbolic have been made representative and a vulgar distortion of the original conception.

The whole industrial outfit has been based, as it were, on a very poor foundation and would sink deeper in this quicksand by its own weight. The issue is not that we do not have the needed raw materials but rather that we were tricked into building the wrong factories first, and I bet some people somewhere are having a most hilarious time at our expense.

Finally, Indies and gentlemen, I want to thank you for your attention.

Acknowledgement

I wish to acknowledge the use of some research publications of Dr M. Iwu of University of Nigeria, Nsukka, in the preparation of this lecture.

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PLANT MEDICINE:
A CHALLENGE TO THE PHARMACIST AND THE PHYSICIAN

by L. L. CRABBE, B. Pharm., MPSG., M.I. Pharm. M.

SUMMARY:

A hint on the historical relationship between the Pharmacist and the Physician. The contribution of Ghanaian Pharmacists and Physicians in the development of drugs from plant material for the colonial masters is a pointer that the African expert can also produce at least plant medicine from local medicinal herbs. Instances have been cited as consolation for the long silence in this area to wipe out any doubt of the capability of the local expert. The challenge cannot be addressed to effectively if the curriculae of the Faculties of Pharmacy and medicine

are not modified to expose the students to plant medicine.

PLANT MEDICINE:

THIS challenge will first be addressed by reference to historical facts. Before 1450, the professional activities of the Physician and the Pharmacist were embodied in the same person called the 'Medicine-man' for short. "The necessity of an expert agency not only for filling medical prescriptions but also, from a pharmaceutical point of view, for checking them, found a classical expression in the Apothecary (or the Pharmacist of today) as early as about 1450. The Pharmacist is supposed not only to supplement the knowledge of the Physician but also to detect mistakes in the prescription which might be dangerous. It was this idea which, in his successful fight against the dispensing of drugs by Physicians within the frame of the English Sickness Insurance Act 1911, Sir William Glyn-Jones expressed by stating that it does not seem opportune to have the dispensing of possibly harmful drugs and signing of the death Certificate done by the same person".

(a) An example which gives credence to this division of labour can be found in the notorious involvement of the Israeli Physician-anaesthetic in the recent attempted kidnapping of Dr Dikko from Britain. Dr Dikko was an ex-Minister in the ousted Shagari Government in Nigeria. The Separation of Pharmacy from Medicine has given the physician ample time to devote to the diagnosis of diseases and treatment of patients while the pharmacist can now concentrate his effort and time on drug production, storage and distribution. Research into drugs have however continued to occupy the attention of the pharmacist, the physician, the biochemist, the medical laboratory technologist etc.

The Apothecary era added education, some form of organisation and ethics to what used to be the un-organised medicine-man or the herbal period. Since the separation, a lot of progress and advancement have been made in these professions as could be seen in the modern medical and pharmaceutical services. The developing countries have had the benefits of this separation thrust to them during the era of colonization and the time of their educational interaction with the Colonial masters. In their socio-economic situation, the Colonial masters have been able to improve upon some medical herbs and plant materials and crystallised their findings into tablets and injections some of which we are priviledged to be using in the developing countries. It must be conceded that in the pursuit of education a lot of our professors and scientists have contributed in no small measure towards the development of these drugs for the Colonial masters but most of these drugs, unfortunately, are sent back to us at prices which take much of our scarce foreign exchange resources. Examples of some of these drugs are Ephedrine, Adrenaline, Digoxin, Belladona, Ergot Alkaloids and Reserpine. What should be remembered is that varieties of the same medicinal herbs in the Colonial Countries could be found growing in Ghana.

Consolation

This is the domain of the plant taxonomist or the Forestry Officer who is of value in the identification and classification of the plants.

No doubt many of the local herbs and their medical claims have been listed and few have even been investigated in the Faculty of Pharmacy, U. S. T., Centre of for Scientific Research into plant medicine, Akropong-Akwapim, and other Research Institutions in the country. As yet no serious efforts have been put into this list with the view to making some available for use in our hospitals. Here the Pharmacist and the Physician must share the blame for this important economic neglect.

A consolation should however be taken from the current work being undertaken on the drug cryptolepine by the Faculty of Pharmacy, U.S.T., Kumasi, in collaboration with the College of Medicine, University of Lagos and the West African Pharmaceutical Federation. Cryptolepine is obtained from the local plant called Cryptolepis Sanguinolenta.

This drug is being investigated on all fronts and so it is likely to take some time before a marketable product becomes available for use in our hospitals. The Morphology and alkaloid distribution in the plant have been studied by Dr K. Sarpong, Head of the Department of Pharmacognosy, Faculty of Pharmacy, U.S.T., Kumasi. Isolation and characterisation of the alkaloids have been carried out by Professor D. Dluma-Badu, Head of the Department of Pharmaceutical Chemistry, U.S.T., Kumasi. Some synthetic aspects of the Chemistry of the drug have been studied by Mr S. Y. Ablordeppey, a Ghanaian lecturer in the Department of Pharmaceutical Chemistry and Pharmacognosy, College of Medicine University of Lagos. Clinical use of the drug is being carried out by Dr G. L. Boye, Senior Lecturer, Department of Pharmacology, Ghana Medical School and Acting Director of the Centre for Scientific Research into Plant Medicine. Important pharmacological findings have been made by Professor S. O. A. Bamgbose and Dr B. K. Noamesi, a Ghanaian Senior Lecturer of the Department of Pharmacology, College of Medicine, University of Lagos. Toxicity studies have been done by Dr R. Ansa-Asamoah, Head of the Department of Pharmacology, Faculty of Pharmacy, U.S.T. These personalities and their works have been enumerated to show that we have the expert manpower. What then has been holding us back all these years?

If the practising pharmacist and physician can initiate or create a plant medicine they could be assured of the assistance of many more of these specialists.

It will be of interest to note that the drugs derived directly from herbs or plants constitute about fifty per cent of all the drugs and diagnostic materials used in conventional medicine. Drugs can also be produced (1) by chemical synthesis, (2) from fishes and animals, (3) from fungi and bacteria (4) from gases and by irradiation and heat treatment and (5) from mineral products.

If for one reason or the other the medicinal herb cannot be propagated on a large scale the active principle is synthesised by other means to produce the needed drug.

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It implies therefore that if the medicinal herb resources of our land can be exploited to the full, within our technological limits, some foreign exchange spent on the importation of drugs could be saved and this gain could be re-directed to import the drugs whose production involves advanced technology.

Now there is the need to get the pharmacist and the physician involved and encouraged in the development, manufacture and application of plant medicine. This is more so in so far as there is no substitute for the pharmacist and the physician.

History

History has shown that their functions were embodied in the same person who evolved from the medicineman and the herbalist. For this involvement to take root firmly, the educational structure of the Faculty of Pharmacy and the Medical School must be reviewed to reflect a practical emphasis on plant medicine and the economic reasons for teaching such a subject.

The Faculty of Pharmacy could for instance intensify and diversify the present practical Biochemistry Subject being taught in the first year to have direct relevance to what really happens in the hospital laboratory.

The graduate pharmacist needs the hospital laboratory technology base in order to be able to initiate some research programme into plant medicine on his own while working in the hospital. If the plant medicine is introduced as suggested the young graduate pharmacist and the physician could have been exposed at an earlier stage and would have accepted its application in modern medical and pharmaceutical practice. They will then use it and contribute willingly to research into plant medicine.

The new subject should also cover guidelines in Research into plant medicine so that the young pharmacist and the young physician would feel confident in going into plant medicine alongside their normal or official Health Care delivery service. There could be set up a National Plant Medicine Research Fund to which all Pharmacies, Drug Manufacturing Houses, Clinics, Hospitals and Maternity Homes, both private and government owned, will be required to contribute at least a fixed minimum amount annually. Those who already have their own viable plant medicine Research Outfits could be exempted from this obligation.

A Board for the Development and application of plant medicine could also be set up to administer the proposed Fund, to collate developmental material in plant medicine, set up minimum specifications and standards register such plant medicines that fall within the set standards and authorise the use of the accepted ones in our hospitals. Some Pharmaceutical Research Laboratories, Clinics and Biochemical Laboratories could be singled out to handle specific requests for analysis and other studies into plant medicine. Where the one who makes the laboratory request does not have the finance to pay for the analysis of the potential plant medicine the proposed Fund could go to his aid. GI.H.-O.C. Pharmaceuticals should necessarily establish a research and Development Unit into plant medicine.

Where drugs are concerned, there is no doubt that locally manufactured plant medicine will be cheap but in order to guarantee a sustained good health for the people, the pharmacist and the physician must get involved in the Research, development manufacture and the application of good quality plant medicine. No headway in development and progress will be made if this responsibility is left in the hands of the herbalist.

The aim of the herbalist is to do the same old and un-organised thing in the small corner as was handed down to him by his grand parents. So long as the progressive development of plant medicine is retarded in various ways, the herbalist is happy because he stands to gain thereby. In any event modern plant medicine will prevail in view of technological development.

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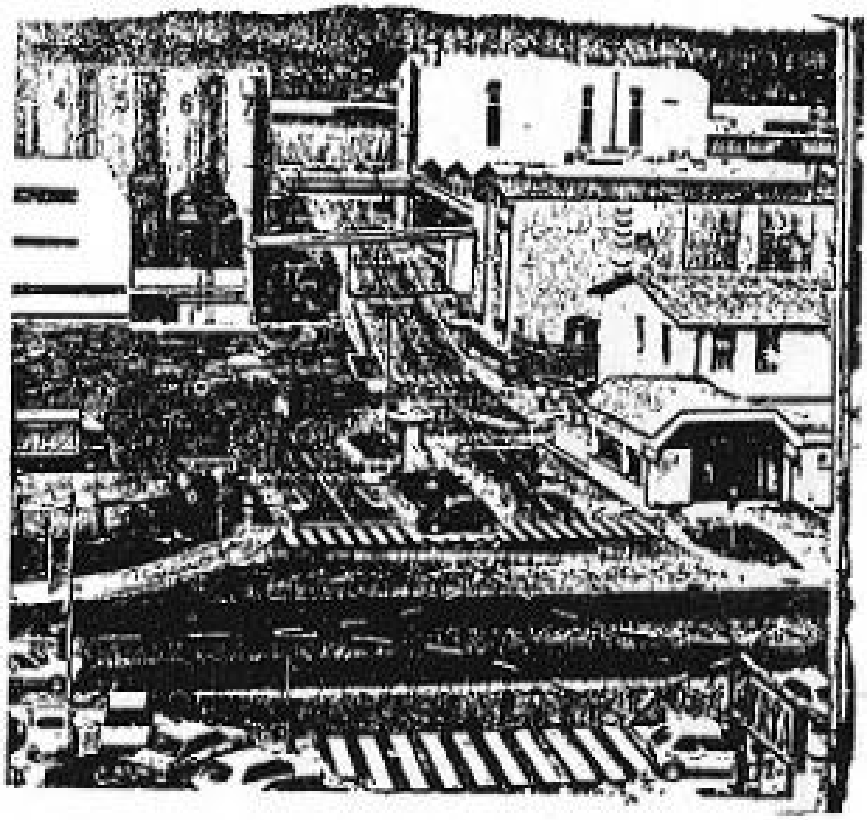


Krka is one of the leading Yugoslav pharmaceutical companies employing 3850 workers. Its range of activities includes pharmaceutical and chemical raw materials, pharmaceuticals, veterinary and cosmetic products, medical herbs, health resorts and tourism, as well as glass fibres for heat and sound insulation.

Krka produces about 146 different products for human and over 30 for veterinary use. The production is partly based on Krka's technology and partly on technological co-operation with different foreign companies.

Krka produces drugs for the following indications: infectious diseases, cardiovascular and lung diseases, gastrointestinal disorders, urinary tract diseases, disorders of the locomotor apparatus, psychiatric diseases and cancer. Krka is the only producer for radiological diagnostics.

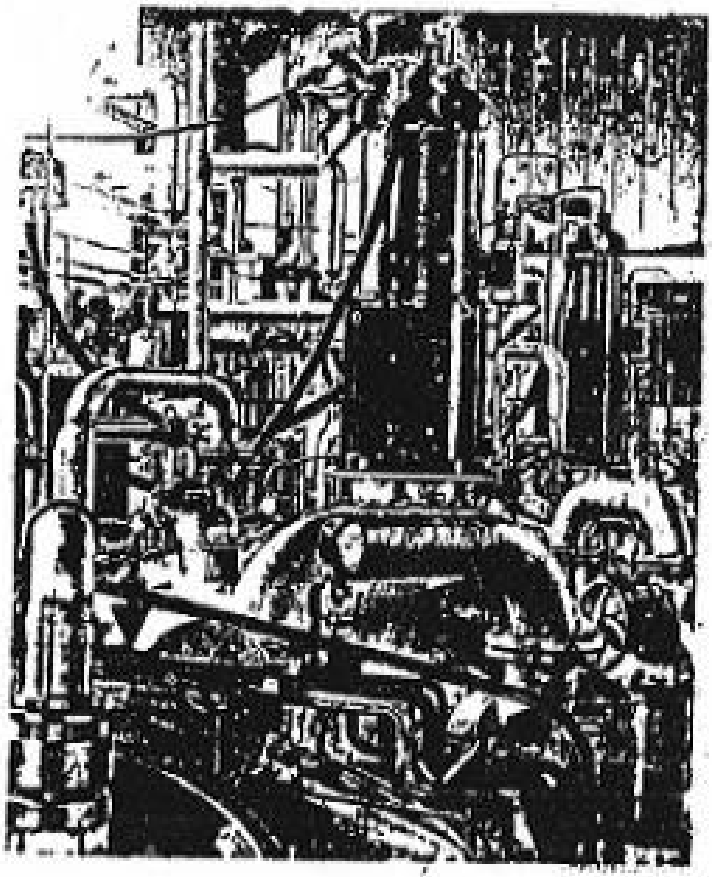
The production range includes also dietetic products, natural stimulants, vitamin beverages, products for diabetics, fruit and vitamin sweets and a series of other products like insecticides, thermometers for different purposes, solutions for cleansing and storage of contact lenses, etc.

Krka's research is focused on development and improvement of production technologies for extraction of antibiotics, enzymes and vitamins as well as new biosynthetic technologies and procedures.

Krka was granted FDA registration for bacitracin-Zn and oxytetracycline.

Krka exports to all continents, mainly antibiotics, various pharmaceuticals and medicinal herb products. The value of exports in 1983 amounted to $55 million.

Krka has a joint venture, DAWA Pharmaceuticals, in Nairobi, Kenya.



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