THE GHANA PHARMACEUTICAL JOURNAL

Incorporating a report on the 32nd

GHANA PHARMACEUTICAL CONFERENCE AND EXHIBITION

held at the STATE HOUSE, ACCRA, 2–5 August, 1973

OFFICIAL ORGAN OF THE PHARMACEUTICAL SOCIETY OF GHANA

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The Ghana Pharmaceutical Journal

THE PHARMACEUTICAL SOCIETY OF GHANA

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INFLUENCE OF EMULSION FORMATION ON THE BIOLOGICAL AVAILABILITY OF INCORPORATED PRESERVATIVES

By G. H. KONNING—Ph.D (Lond.) M.P.S.G.
Faculty of Pharmacy, University of Science and Technology, Kumasi

SYNOPIS

The total amount of preservative found adequate for protecting simple aqueous preparations against microbial contaminants may not necessarilly be adequate for preserving emulsions. The efficacy of a preservative in an emulsion or cream depends on the concentration biologically available in the watery phase of the emulsion.

INTRODUCTION

Investigations over the past two decades or so have led to the discovery that many commercial pharmaceutical emulsions and creams (Cade, 1947; Atkins, 1950; Kallings, et *al*, 1966) and industrial cutting oil emulsions (Wheeler and Bennett, 1956; Bennett et *al*, 1959) are often heavily contaminated with microorganisms. Emulsions have been found containing several million organisms per gram of product (Duffett et *al*, 1943; Kallish, 1968). Among the organisms isolated are various species of moulds, fungi and bacteria (Barr and Tice, 1957; Woodward and McNamara, 1970). As a result of microbial activity, an emulsion may give off very offensive odour, appear slimy and pitted or break down into its component phases.

The presence of living organisms in a cream may present very grave health problems. The use of a pseudomonas contaminated hand cream recently led to a serious outbreak of skin infection in a dermatological ward (Noble and Savin, 1966).

Adapted from a presentation made at the 32nd Ghana Pharmaceutical Conference State House, Accra.

Numerous cases of dermatitis have also been recorded among industrial workers handling contaminated cutting oil emulsions (Ayliffe et *al*, 1965).

Manufacturers are aware of the high probability of microbial contamination of emulsions and take stringent precautions to produce products relatively free from microorganisms. Such precautions, however, offer no safeguards whatsoever against contamination during use by the consumer. Even a very small number of contaminants in the product initially may, under favourable conditions, multiply rapidly in the cream since most organisms can metabolize the oil and the emulgent. Admittedly most contaminants isolated from creams are non-pathogenic but the fact must not be overlooked that even a non-pathogenic in an abrased skin can pose a serious health problem. The need for adequate protection of oil-water formulated products cannot therefore be too strongly emphasized.

It may be argued that emulsions can be prepared sterile by the use of appropriate sterilization procedures but this will not prevent subsequent contamination during use. The most rational approach to the problem therefore appears to be the addition of a suitable amount of preservative to the formulation to destroy chance contaminants all through the period of use. The choice of a suitable amount of preservative is critical since too high a concentration causes irritation to the site of application and is economically wasteful, and too small a concentration, on the other hand, fails to protect the product against microbial infection.

The empirical approach to selecting a so-called suitable concentration of a preservative for incorporation in an emulsion or cream has been to determine the minimum inhibitory concentration of the preservative in a simple aqueous solution and then to employ this concentration in the formulation, or alternatively, to add an arbitrarilly selected concentration and then sample the product over several months to test its sterility only for the experiment to be repeated when the concentration is finally found inadequate. The time and money wastage involved in such hit and miss methods can be colossal. Indeed, the use of either method at all is an open admission of the fact that the factors controlling effective preservation are not fully appreciated.

Editorial

RESEARCH INTO LOCAL HERBS

AT the opening ceremony of the 32nd Conference of the Pharmaceutical Society of Ghana, the Head of State Col. I. K. Acheampong, announced that "the Government has decided to set up a centre for Research into Plant Medicine with Dr. Oku Ampofo as its first director. Arrangements are being made to inaugurate it soon and *it is my wish that you co-operate fully with the centre and its research programme.*"

It is clear from the Head of State's speech that pharmacists in the country, as experts on preparation and dispensing of medicines, are being called upon to contribute towards the research programme. Although the details of the programme are not known to the Society, the Journal will like to offer some suggestions in the establishment of a centre for Research into Plant medicine.

The use of plant material as source of medicine to cure various ailments has been known to man since the time he learnt to treat diseases affecting him. As pharmacists, we are aware that plant materials are still being used in hospitals today for treatment of diseases. For example, extract of belladonna herb is added to antacid preparations and reserpine from the plant Rauwolfia serpentina is a very potent antihypertensive drug, just to name a few. We are also aware that some of our Traditional Healers use herbs to cure certain diseases for which orthodox medicine has no remedy. In addition, research workers in the Faculty of Pharmacy have successfully isolated a number of pure chemical substances from reputable herbs which have been found to be pharmacologically active. It is therefore without doubt that research into local herbs could lead to discovery of some potent drugs for mankind. However, we have to remind ourselves that availability of modern equipment today has led to more detailed studies of drugs pertaining to their efficacy and safety. The Thalidomide disaster and recent microbiological contamination of drug preparations in Sweden and Britain have placed high responsibilities on those engaged in drug development. Recent studies also indicate that some drugs which were first thought to be safe are injurious to health, e. g., Phenacetin, hexachlorophene and D.D.T. It is therefore necessary that our local herbs which have been known to have useful medicinal properties, are studied in detail. Such studies fundamentally will involve — toxicological evaluation, effect one child development in the foetal stage, uniform presentation of the drug for dispensing purposes, stability of the drug, its side effects and contraindications, etc. All these studies require expensive equipment and highly skilled personnel. It is obvious that we cannot, at the present state of the national economy, afford to establish a centre with all the requisite facilities to do effective research into our local herbs.

Fortunately, we have already invested in equipment and personnel in some of the existing institutions in the country. It is suggested therefore that, in line with the current national policy of maximum utilization of all available resources, we do not spend money to build a centre with the requisite facilities but all the existing facilities are put into maximum use. We realize that the required personnel will include Taxonomists, Pharmacognosists, Chemists, Pharmacologists, Pharmaceuticists, Microbiologists, etc. Since equipment and a number of such staff are already at post in the Faculty of Pharmacy, University of Science and Technology, Kumasi, what we need are Research Fellows and Assistants to be employed by the Council for Scientific and Industrial Research to work in the Faculty.

We believe that the whole programme should be broadly divided into two:

(*a*) Investigative Unit
(*b*) Documentation Unit.

The Investigative Unit could be made up of *Pharmacognostic Section* which will be concerned with the collection and identification of plant materials from our herbs.

It could also undertake large scale cultivation of medicinal plants and investigate methods of increasing the active constituents of the useful plants.

Phytochemical Section to deal with isolation, characterisation and elucidation of the chemical structures of the active constituents.

Pharmacological Section to screen both crude drug extracts and various concoctions from herbalists as well as isolated pure compounds. It would refer crude drugs and their extracts found active to the Phytochemical Section for detailed investigation.

Formulation Section will not only be concerned with preparing dosage forms of isolated active compounds but will standardise doses of crude drug extracts and concoctions.

Clinical Section which will involve itself with

clinical trials of extracts of crude drugs and pure compounds.

Although this can be done at Hospitals and various Health Centres, it would be necessary to set up a *Herbal Treatment Centre* under qualified medical practitioners working jointly with our Traditional Healers. It is our hope that the Head of State's mention of a centre for Research into Medicinal Plants refers, in fact, to the Herbal Treatment Centre which we agree should be set up at Mampong Akwapim.

The *Documentation Unit* will be concerned with the collection and collation of all information on Herbs. This could be divided into the *Pharmacopoeia Section* and *Information Section*. The Herbal Pharmacopoeia Section will keep records of herbs containing their description, standards, preparations, uses, etc. The *Information Section* will, among other things, include a Herbarium so that the authenticity of herbs collected could be checked.

It is our view therefore, that two distinct Centres need be set up to make the programme a success, viz. a Herbal Research Centre at the University of Science and Technology, Kumasi and a Herbal Treatment Centre at Mampong Akwapim with the two Centres working in collaboration.

PHARMACEUTICAL REVOLUTION

THE word revolution is heard nowadays almost in every sphere of our life. This might be an indication of man being more critical in his present state than before. Pharmacists in Ghana have of late been very conscious of the need to improve and develop Pharmaceutical service in the country. This state of mind does serve as basis for revolution. However there will be no revolution if we are not able to identify clear strategies or goals.

The 32nd Annual Conference this year ended up with various goals spelt out. Lest we forget, some of these are:—

the Pharmaceutical Society absolutely controlling the profession of pharmacy in Ghana; this means revising the 1961 Pharmacy and Drugs Act to be in line with the Professional Bodies Registration Decree, (NRC decree No. 143) — out-patient prescriptions to be dispensed by private pharmacies — and very fundamental, reasonable conditions of service for Pharmacists employed in the Government and the private sector.

To turn these ideals into reality would require conscious effort from every Pharmacist in the country. Perhaps we can start by making sure that those of us in retail and hospital practice wear their white overcoats with their names tagged on their breast-pocket and all of us, always ready to offer professional advice on the use of drugs to the public.

Speech delivered by his Excellency Colonel I. K. Acheampong, Head of State and Chairman of the National Redemption Council, at the opening of the 32nd Conference of the Pharmaceutical Society of Ghana at the State House, Accra, Thursday, 2nd August, 1973.

Mr. Chairman, Nananom, Your Excellencies, Distinguished Guests, Members of the Pharmaceutical Society, Ladies and Gentlemen,

1. I will first of all wish to express my gratitude to the National Council of the Pharmaceutical Society of Ghana for inviting me to open this their 32nd Biennial Conference. I am happy to accept this invitation which gives me the opportunity to meet the members of the profession of Pharmacy. Since I assumed office as Head of state I have endeavoured to meet members of professional bodies and certain sections of the community. I have not been able to meet you, Pharmacists, yet. I can assure you that this is not to be taken as a sign of disinterestedness in your Society and its activities, because I have followed your activities with keen interest. One demonstration of our interest is the promulgation of the Professional Bodies Decree which will give deserving Professional Societies in the country proper recognition and status. It is needless to say that your Society should be one of such Bodies.

2. It is my understanding that the progress made in the practice of pharmacy in this country has been faster than in most countries. This has been made possible by the advances made in pharmaceutical education in this country which, in turn, has been influenced by the international progress in technology and the changing pattern in the practice of medicine. The former system of training pharmacists on the job through apprenticeship which most of your older members went through, has gradually but steadily given way to training in the Universities. Today the only means by which one can become a member of your Society is by obtaining a University degree of B.Pharm. from the University of Science and Technology or from any other recognized institution. This very high educational standard in your profession is very necessary in Ghana today if you wish to make a mark in the international pharmaceutical field. Very potent medicaments have been discovered whose action can be followed with exactitude. These medicines are very selective and specific in their actions in the human body. Therefore, those who are privileged to store and distribute them should have a thorough knowledge of the contents and actions of these drugs.

3. The members of your profession formulate and produce these potent drugs in dosage forms to be dispensed on the physicians' prescriptions. Thus you should have knowledge in pharmaceutics, pharmacology and pharmaceutical chemistry among others, so that you may also advise the physicians on the action of these drugs for the achievement of effective treatment thereby restoring the health of the patient which is the aim of both the pharmacist and the physician.

4. Your very high scientific knowledge and expertise should go with very high ethical standards. Your Society will have to organise its members in such a way that they will give the highest pharmaceutical service to the community in which they live. By this I mean, the Pharmacists should confine themselves to the best performance of their practice and not to stray into the practice of medicine.

5. Your profession places grave responsibility on you in relation to the health and welfare of your fellow men. Our economic survival, our advancement as a nation, depend largely on the good health and vitality of the people. We cannot achieve the level of productivity essential for the revival of the economy if our people are plagued by poor health, malnutrition and other wasting diseases resulting from insanitary conditions. In recognition of this fact, the National Redemption Council has placed the provision of adequate medical facilities in all parts of the country on its scale of priorities.

6. But you will recognise that the provision of medical services is very expensive undertaking — an undertaking which not only Ghana, but all developing nations cannot meet in the desired manner. Thus it is necessary that all who are in the medical field (and this includes Pharmacists) should endeavour to stretch existing resources to the fullest possible extent.

7. It is true that generally pharmacists are the group in the health team who are first approached by people in the community with their ailments. With your training and high ethical background you should be able to discern an ailment which may require what is popularly known as "counter prescribing" and refer all other ailments to the medical practitioner to avoid delay in the patient having the right treatment. Pharmacy and medicine are complementary but there should be a definite line of demarcation in the practice of each by its members.

8. I understand that just a few weeks ago you launched the Ghana Pharmaceutical Journal. I congratulate you on this achievement which should be a feather in your cap. Through the medium of this organ you should be in a position to give your members continuing education by keeping them abreast with developments in the pharmaceutical field and stimulate professional responsibility and awareness.

9. After speaking generally let me address myself to certain distinct sections of your profession. Those of you who are in the academic field, and I mean the lecturers, I exhort you to plan your courses to meet local requirements so that the young pharmacists you turn out may effectively and immediately contribute their quota in the reconstruction of this nation. I am informed that you have on your teaching staff 21 lecturers all of whom, except two, are Ghanaians holding degrees not below the Masters degree. Your Dean is a Ghanaian and the departments in the faculty are headed by Ghanaian Professors or Associate Professors.

With such a formidable team you should engage in research work in addition to your normal teaching with particular emphasis on research into our local medicinal herbs. In this connection, Government has decided to set up a Centre for Research into plant Medicine with Dr. Oku Ampofo as its first Director. Arrangements are being made to inaugurate it soon and it is my wish that you co-operate fully with the Centre in its research programmes.

10. After long negotiations, pharmacists in the civil service have been placed on the professional ranges of salary. Your Commissioner is personally seeing to the correct and early implementation of this decision. At this juncture, I would like to implore all of you to uphold the ideals of your profession. Rather unfortunately, it appears that some members of your profession regard material reward as more important than professional satisfaction. I think that in a revolution such as ours, the spirit of sacrifice should permeate all your actions. A little fellow-feeling is called for, and I believe that pharmacists too have the capacity for sacrifice.

11. The Pharmacy Department in the hospital is the last check point before the patient leaves hospital. You should, therefore, exercise great care and patience in handling the patients who come to you for their medicines. In the present situation where there is sporadic supply of drugs I expect you, with your specialised knowledge, to suggest suitable alternatives of drugs to the physicians whenever the prescribed ones are not available.

12. The drug situation as you all know, is another matter of concern to Government. We have made funds available for the local purchase of drugs, while action on overseas orders has been expedited. We are also encouraging local drug manufacturers to step up their production, both in quantity and range, to meet increased demand. In this regard, pharmacists are also expected to play their part by the careful dispensing of drugs to discourage waste. We are sustaining heavy losses through what appears to be uncontrolled stealing of drugs and other medical supplies in our hospitals. If some pharmacists, in both private and public practice, do not provide a clandestine outlet for the disposal of such stolen drugs, this disgraceful practice would be considerably reduced and eventually checked. This is a form of sabotage which the National Redemption Council will not tolerate and will spare no efforts to combat with all the resources at its command.

13. For those of you who are in the drug manufacturing field, I would like to see that most of the drugs needed in this country are produced locally at reasonable prices without sacrificing quality. In this regard, the government will be prepared to look into the possibility of giving you protection against the importation of such pharmaceutical products which are produced locally provided they are at reasonable prices, in sufficient quantity and, of course, of the highest quality. I advise you, the manufacturers, to organise yourselves into a Consultative Association not only to see to your own welfare, but also to protect the consumer. You can also explore the expert potential in order to get into the export business and thereby earn this country some foreign exchange.

14. Those of you in retail pharmaceutical business will have to appreciate the essential role you are playing in giving service to the general public by supplying them with their pharmaceutical requirements. Where a pharmacist wishes to propose an alternative medicine to the one prescribed by the doctor he should do so only after consultation with the doctor concerned. I am afraid this is an area where there is not much communication between the two professional colleagues. The retail pharmacist portrays the image of your profession and he is therefore expected to display the highest professional conduct.

15. Pharmacists should take advantage of the tremendous opportunities that are now available and play an active part in delivering effective health service, bearing in mind the welfare of the patient which depends on the safety of the drugs you dispense. This involves correct formulation, proper storage and dispensing based on correct interpretation of prescriptions. It is only by this means that you will command the respect of other professionals especially your colleagues, the medical practitioners.

16. Finally, Mr. Chairman, Nananom, Your Excellencies, Distinguished Guests, Members of the Pharmaceutical Society of Ghana, Ladies and Gentlemen, it gives me great pleasure to declare this thirty-second biennial conference of the Pharmaceutical Society formally opened.

Thank you and May God Be With You.

Speech By

MR VICTOR K. AIDOO,

The President of the Pharmaceutical Society of Ghana at the Opening Ceremony of the 32nd Ghana Pharmaceutical Conference, State House, Accra., August 2—5, 1973

Your Excellency the Head of State, Distinguished Guests, fellow Pharmacists, Ladies and Gentlemen,

The Pharmaceutical Society of Ghana, born in 1935 (with its motto "Amicus Humani Generis") is a full adult, and I feel very proud and honoured to be its president at this time of the country's development.

All of us here are indeed greatly honoured by the presence of our august guest in the person of his Excellency the Head of State.

We thank you that despite your many engagements, you have found time to be with us and to open our 32nd Conference. This is the first time that a person in such high office has honoured our Society to perform the opening ceremony of our conference and we are indeed very grateful to you.

We have followed with keen interest what your Government has done for our Society.

For the first time, the Pharmaceutical Society of Ghana has had a place on committees appointed by Government to look into matters affecting the Health needs of the country. I would refer to the Korle-Bu Teaching Hospital Committee of Enquiry and the Committee on Drug Requirements on both of which committees representatives of the Pharmaceutical Society of Ghana served at the invitation of the Government.

I would also like to express our appreciation to the Government for N.R.C. Decree 143 — Professional Bodies Registration Decree, 1973, which seeks to give greater responsibility and authority to Professional Bodies such as ours. Under the provisions of this decree, the Pharmaceutical Society is required to register with the Registrar General's Department as a Professional Body. I am glad to inform you all that the Pharmaceutical Society of Ghana is one of the first Professional Bodies to have complied with the provisions of this decree and thus to date only three Professional Bodies including the Pharmaceutical Society of Ghana are fully registered in accordance with the provisions of the Decree.

That the role of the pharmacist in the society is an important one cannot be over-emphasized.

In a country where professional numbers are small and costs of running these associations high, it is necessary for every member of the profession to be on its roll and to contribute financially, morally and technically to achieving its goal. Therefore, compulsory membership of the Pharmaceutical Society of Ghana by all pharmacists confirmed by this decree is most welcome.

I am of the opinion that in Ghana each profession should have a well organised professional association to maintain high ethical standards among its members and to help foster technical and scientific discussion and advancement. It is my hope that the Society should be able to speak for the profession and at the same time act as a forum for its members. Many people are therefore in favour of membership of the Pharmaceutical Society of Ghana remaining mandatory to the practice of pharmacy in this country. If things are not what they should be, active participation in the Society's affairs by both well-wishers and dissidents will help towards raising standards.

The Pharmaceutical Society of Ghana is again grateful to the present government for agreeing to discontinue the diploma course in pharmacy mounted in 1968 against the wishes of the Society.

The mounting of this course was a great danger both to the profession and to Ghana. It was indeed a retrograde step for a sub-standard diploma course to be mounted some six years after the Faculty of Pharmacy at the University of Science and Technology had been turning out Graduate Pharmacists. This was considered a raw deal by all Ghanaian Pharmacists.

At a time when a degree in pharmacy is becoming the only registrable qualification in all countries a move was being made which clearly pointed to the discouragement of attaining high standards in pharmaceutical education. This would no doubt have reflected on the practice of pharmacy in this country.

Ghana has already taken the lead in the field of pharmaceutical education in black Africa and is being looked upon by other African states having produced more than 200 graduate pharmacists since 1964.

Pharmaceutical education has considerably changed in recent years to reflect changes in pharmaceutical practice. It is important today that the pharmacist should control distribution of the new potent and complex medicines. To do this effectively, he must have a thorough knowledge of the structure, action, uses, and potency of the drugs he handles.

It was therefore, sad that the diploma course which could not prepare students to meet the new challenges of pharmaceutical practice was foisted on the nation. Sir, we believe the great danger both to the profession and to Ghana has been eliminated by the discontinuation of the course.

The future role of the pharmacist will depend on his knowledge of the pharmaceutical sciences rather than

his skill in traditional dispensing—the days of "secundum artem" are gone for ever! The fundamental purpose of pharmaceutical education should be to enable the pharmacist to cope with changes that will occur in the forty years of his active professional life.

Today the academic course which gives a thorough grounding in all the basic principles of pharmaceutical sciences takes four years and this is being actively pursued at the University of Science and Technology, Kumasi.

Your Excellency the Head of State, at this juncture, I will like to bring to your attention my Society's concern over the inadequate number of Pharmacists in the country especially in the Government sector.

One contributing factor to this shortage of Pharmacists is that the University of Science and Technology cannot train sufficient number of Pharmacists for lack of space and adequate laboratory facilities. The building housing the Faculty of Pharmacy at the University is about twenty years old, and was indeed designed for only about 30 students in total. So it was that when the University authorities started a new building for the Faculty last year, every Pharmacist felt that with increased space and laboratory facilities, the Faculty would produce more Pharmacists to help improve the situation. But for some time now, work on the building which is about half completed, has ceased. It is our sincere hope and prayer that the appropriate authority will ensure that work on the building is resumed to enable the Faculty train more Pharmacists in the interest of the community.

I would now like to speak on some of the problems facing Ghanaian Pharmacists.

Firstly, we would like to have a revision of the Pharmacy and Drugs Act of 1961. This is Act 64 which seeks to regulate the Pharmacy Profession and to control the supply, manufacture, storage and transportation of drugs. It has been recommended by the Committee appointed by Government in 1966 to investigate the Health needs of Ghana that, although many sections of this Act are reasonable, a number of the sections also require revision.

Now that the Pharmaceutical Society of Ghana has registered under the Professional Bodies Registration Decree, we propose to submit to the appropriate Government body our suggestions on how best the Act could be revised to bring its provisions in line with the provisions and spirit of the N.R.C. Decree 143.

Next, I would like to speak about remuneration of pharmacists in government service. Strong representations have been made since 1968 on the disparity between the initial salaries of graduate pharmacists and graduate engineers, architects, town planners etc. Already, a Government Committee has recommended that the job content, responsibilities and long working hours of pharmacists justify an improvement in their present initial salary and conditions of service. We would, with all due respect, ask the N.R.C. Government to look into this question of remuneration.

In matters of status and salaries, pharmacists have not been fairly treated. Salaries of pharmacists are far below those of other professional Civil Servants and unless these conditions are speedily and significantly improved, hospital pharmacy will not attract many young pharmacists.

It is pertinent to note that, whereas the Government's Health Service takes care of about 70 per cent of the population, and for that matter in the case of all other trained Health personnel in the country, the vast majority are in the Government service, we find that only 25 per cent of Pharmacists in the country work in Government hospitals. We believe that this situation' has arisen because the Pharmacist in the Civil Service has not been fairly treated for decades, and so Pharmacists find it frustrating and unexciting to remain in the Civil Service.

A re-appraisal of the profession of pharmacy needs examination again to encourage the developmnt of thise profession and to accord it its world-wide status, for there is no greater satisfaction than being able through doctor — pharmacist relationship to bring relief and recovery from disease.

The Pharmaceutical Society of Ghana has as one of its objects "the placing" at the disposal of the government and the general public the benefits of pharmaceutical expertise in keeping with the Society's motto "Amicus Humani Generis" — (A friend to the human race) and to co-operate with the Government and all or any other agencies or bodies in Ghana to ensure that a pharmaceutical service comparable to the best in the world is available to the people of this country.

In this respect, we have noted the Government's concern over the current drug shortages in the country culminating in the appointment last May of the Prof. Tackie Committee on Drugs. During our deliberations at this Conference, a special working party will be set up to look into the causes of these shortages and we shall pass our comments and recommendations on to the appropriate quarters.

Your Excellency, distinguished guests, fellow pharmacists, ladies and gentlemen, the contribution of Pharmacy to the health services is the preparation and distribution of drugs used in the diagnosis, treatment, and prevention of disease. With the modern trend in the development and preparation of new medicaments, the role of most pharmacists as compounders and chemical formulators has changed to one of dispensing of complex and potent drugs. I am of the opinion that each and every member of our noble profession will be alive to his responsibility and so help to meet the health needs of our generation and succeeding generations.

Again, I say many thanks to our guest of honour, His Excellency the Head of State, the Honourable Commissioner for Health and to all our guests present here this afternoon.

Finally, to the delegates and members of the Pharmaceutical Society of Ghana, I seize this opportunity to welcome you to this our 32rd Conference. I look forward to active and useful participation by all.

I wish those who have come from abroad a pleasant stay in Ghana.

We feel happy to be in conference with you especially at this time of our national history.

This is the beginning of a gigantic national reconstruction and nation-building and for that matter the theme for this year's Conference—"Pharmacy and National Development."

I trust that the climate and contents of deliberations will be such that will produce practical and useful results for the benefit of our country.

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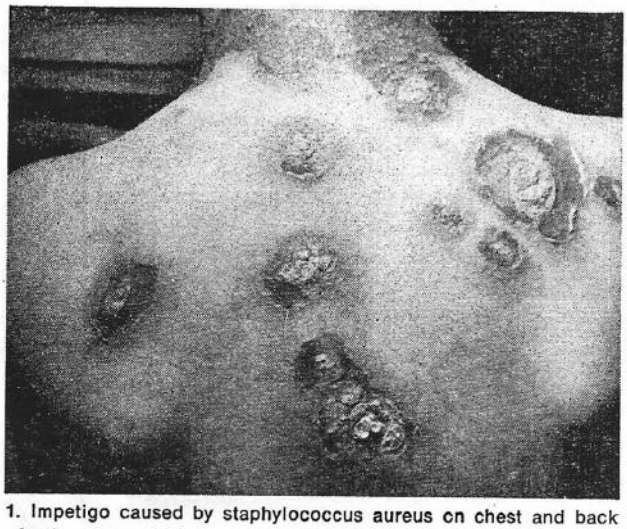

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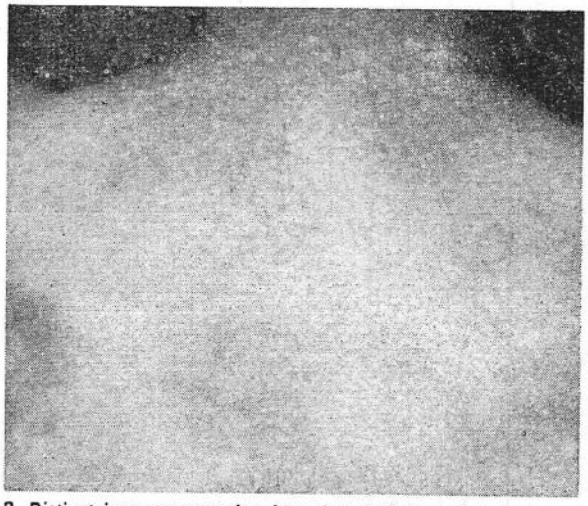

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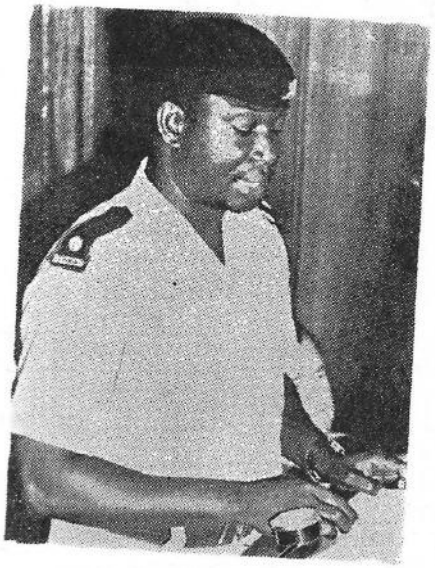
OPENING OF PHARMACEUTICAL EXHIBITION ON THE OCCASION OF THE 32nd CONFERENCE OF THE PHARMACEUTICAL SOCIETY OF GHANA— 2nd AUGUST, 1973



Address by the Commissioner of Health at the opening of the Pharmaceutical exhibition on the occasion of the 32nd Conference of the Pharmaceutical Society of Ghana—2nd August, 1973.

The Head of State, Distinguished guests, Ladies and Gentlemen.

1. It is my pleasure to be here with you this afternoon for the Opening of the 32nd Conference and Exhibition of the Pharmaceutical Society of Ghana which is one of the oldest professional societies in Ghana. May all members of the Society accept my congratulations and best wishes for a successful Conference.

2. As has always been the case, we have on display, various pharmaceutical products from overseas firms and local manufacturers. These products have been made available as cures for our diseases, and as products that provide us with good health through the efforts of international Research Institutions. In our effort to be Self-Reliant, the research institutions in the country are called upon to intensify their research into our local raw materials for their use in the pharmaceutical industry. Chairman, I am informed of some of the discoveries at the Faculty of Pharmacy, Kumasi University, in the use of local gums and shea-butter in pharmaceutical formulations. We will like to see some of these discoveries made use of in industries.

3. Occasional drug shortages here and there have been with our country for sometime now. The special committee on Drugs appointed by the National Redemption Council is to look into this problem and advise the government on the drug requirements of the country. While the Committee is at its work Chairman, it has come to my notice that some drug importers are not able to utilise their import licence quota. This is bound to create some drug shortages. My Ministry is therefore evaluating the facilities of the various drug importers and those importers with the necessary facilities will be encouraged to import drugs to meet our national drug requirements. In addition to this, we will like to see the foreign firms establish local drug manufacturing industries in this country.

4. With our limited resources, we can only afford to spend on drugs which are considered essential for the treatment of patients. The Pharmacy Board is therefore called upon to ensure that only essential drugs are imported into the country. The co-operation of Pharmacists with my Ministry in this respect will be very valuable. My Ministry also has instituted an exercise on Quality Control of both imported and locally produced drugs.

5. As Pharmacists, you are charged with the control, sale and manufacture of drugs. We will like to see proper control of drugs in your premises, especially those of you in hospitals. I am aware that pharmacists in the hospital service have not been fairly treated in the past. I have issued instructions for the full implementation of the professional scale already approved for pharmacists. For a return, I hope you will carry out your duties with honour and integrity as your contribution to our effort in the rebuilding of the Nation.

6. May the Drug Exhibition of the 32nd Conference of the pharmaceutical Society of Ghana, which I have the honour to declare open, serve as an inspiration to all of you.

Thank you:

THE CHALLENGE OF PHARMACY IN DEVELOPING COUNTRIES

BEING THE TEXT OF AN ADDRESS AS GUEST SPEAKER TO THE 32ND ANNUAL CONFERENCE AND EXHIBITION OF PHARMACEUTICAL SOCIETY OF GHANA.

2ND—6TH AUGUST, 1973

By PROFESSOR G. OSUIDE,
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Ahmadu Bello University,
ZARIA—NIGERIA

Chairman, Mr. President, Ladies, Gentlemen, and colleagues. I am highly honoured to be invited to be the guest speaker at this 32nd annual conference and exhibition of the pharmaceutical society of Ghana. I have met and worked with colleagues from Ghana, so this conference also affords me the opportunity to renew the associations and learn some aspects of pharmacy in Ghana. I am therefore grateful to the Council and members of the Pharmaceutical Society of Ghana, for giving me the opportunity of participating in this conference.

The topic of my talk is "the challenge of pharmacy in developing countries." In discussing this topic it is my intention to deal briefly with the educational history of pharmacy in these countries, the problems and achievements, before making proposals for the future.

Historical Background

Pharmacy in most developing countries started in colonial days and the earliest pharmacists were trained on the job as dispensers in government hospitals. Later diploma courses were started and at present degree courses are run in most countries. The Commonwealth Pharmaceutical Association has suggested that pharmacists in commonwealth countries should wherever possible qualify through degree courses.

THE PROBLEMS OF PHARMACY IN DEVELOPING COUNTRIES

1. Professional activity

One of the most important and at times difficult questions is concerned with professional activity. With the decrease in the amount of traditional dispensing done in hospitals and retail practice, there has been a jolt in the public image of the pharmacist even in the developed countries. Many people think the pharmacists are always asking for too much and some wonder what pharmacists do. This has been more obvious especially in developing countries where pharmaceutical industries are few and the work pharmacists do, in development, production and quality control is not known to many. You will be surprised to learn that many people do not know that tablets, injections, etc; given out in the hospital, or retail pharmacy are made by pharmacists. Also many forget the professional advice given by pharmacists to other health personnel and to patients.

2. Shortage of Pharmacists

There is a shortage of pharmacists, and other medical personnel in most developing countries. The shortage of pharmacists is further amplified by the uneven distribution of work load between them in many places. In some places I have visited, some pharmacists have been unable to take a holiday for the past 7 years, because they could not find a locum tenens. The crowded scene at many hospital pharmacies is familiar to most of us. Due to shortage of pharmacists, there are not enough personnel to check contraventions of pharmaceutical regulations. Apart from inadequate professional service to the public which arises from shortage of

pharmacists, working under pressure and strain can increase the number and frequency of human errors.

3. Industries

The infant pharmaceutical industries in developing countries have many problems. There is the shortage of qualified personnel already mentioned. With pharmaceutical industry, this shortage is more acute because the practical problems met in the industry are not dealt with in the usual pharmacy curriculum. Also there are few, or in some cases no pharmacy technicians so the pharmacist does or closely supervises everything. Another problem in the industry is the relatively high production costs. This is due to high cost of imported raw materials and, sometimes, unfavourable customs tariffs, for example, in some places empty bottles and empty gelatin capsules are dutiable while the imported medicines are exempted. This does not encourage local production. The cost of production, however, varies with the particular product, the source of raw materials, volume of production etc. Other problems encountered in industry are the delays in obtaining spare parts, import licences and raw materials.

4. Retail pharmacy

With regard to retail pharmacy, we find in some countries, retail pharmacists do not have enough prescriptions. This leads to some pharmacists combining wholesale and retail practice. This is not liked by most pharmacy boards and some have legislated against combining retail with wholesale practice. Another problem in retail practice is the fact that either out of necessity or just following the tradition of the developed British commonwealth countries, some retail pharmacies sell cameras, cosmetics, provisions, etc. in the same shop as drugs. This practice makes some people regard pharmacists just like any other shop manager. Such people do not know or have forgotten that the pharmacist has years of chemistry, pharmacology, etc. behind him which he uses everyday to render professional service to medical colleagues and his clients.

5. Hospital pharmacy

Turning our attention to hospital pharmacy practice we find many hospital pharmacies are inadequate in, common and indispensable drugs, space, equipment, and supply of professional literature. The inadequate space and equipment arise from the fact that many hospital pharmacies were planned without consultation with pharmacists. Also, the numerous patients seen so often make the existing facilities inadequate even where they were properly planned initially. I believe the difficult conditions of work has aided the exit of many pharmacists from hospital practice.

6. Education

In the educational field, we find that there are vast areas without schools of pharmacy in developing countries, for example, the whole of former British East Africa. So of necessity, many pharmacists are trained overseas, in different countries where the pharmaceutical problems and traditions are different, among themselves, and different from those of the developing countries to which the graduates return. This makes it necessary to develop local schools of pharmacy where the size and resources of the country or region permit.

ACHIEVEMENTS OF PHARMACY IN DEVELOPING COUNTRIES

In spite of the humble beginnings of pharmacy in most developing countries, and the seemingly unsurmountable problems, pharmacy has achieved a lot in these countries.

1. Legislation

Without the support of the law no profession can advance, however hard it tries. It is just like a bird trying to fly when you have cut its wings. It is therefore a great delight to see the great advances in pharmaceutical legislation in many developing countries particularly Ghana. In the last 15 years, pharmacy legislation in most developing countries has seen several revisions and the supervision of pharmaceutical activities has steadily come under the control of pharmacists. In many of these countries all members of the pharmacy board or body controlling pharmaceutical activities are pharmacists. In some countries, attempts are being made to obtain charters for the pharmaceutical societies to give them direct legal powers over all pharmaceutical activities as it is in the United Kingdom. I believe these developments are in the right direction as pharmacists are more concerned to preserve the honour of their profession, so they are likely to be better motivated to control their members and others infringing drug regulations. Other achievements in drug legislation in some developing countries include the provision for drug registration. This provides for the registration of all drugs approved for importation, manufacture and use in the country after a panel of experts have studied the merits of all aspects of the drug. The implementation of this legislation has been hampered in some places by lack of qualified personnel and adequate facilities.

2. Drug Manufacturing

In the manufacturing field during the last ten years pharmaceutical industries have sprung up in many developing countries. This is due to concern for the great drainage on the foreign exchange of these countries caused by the drug bill. In some of these countries, the pharmaceutical industries have attained a very respectable status that for example, in India and Egypt, antibiotics, basic drugs, chemicals and many drugs are manufactured to the extent of 80 per cent of the country's needs and they also export drugs.

3. Research

The developing countries have not lagged behind in pharmaceutical research. Some meaningful drug research has started in developing countries. In Ghana, at the Faculty of Pharmacy in Kumasi, work has been done on effects of diets on drugs and studies on analgesics and prostaglandins etc. Also at some centres for example Kumasi in Ghana, Kampala in Uganda, Ife in Nigeria, and some centres in India, work is being done on traditional medicinal plants. At

Ahmadu Bello University, in Zaria, Nigeria at the department of pharmacy and pharmacology, we started some work on anticonvulsant drugs and drugs used in mental illnesses, and promising results have started to emerge. In fact, the scientific merits of pharmacy and the significant contribution of some eminent pharmacists to scientific research has been recognised. One of the most outstanding examples in developing countries is the appointment of a pharmacist as Executive Chairman of the Council for Science and Industrial Research in Ghana.

THE FUTURE

Having surveyed the history, problems and achievements of pharmacy in developing countries, I propose to make suggestions for the solution of the most pressing problems as I see them.

1. Professional Societies

In order to continue to forge ahead and improve the image of pharmacy, it is important that all pharmacists support their professional associations, with members paying their dues regularly, and attending meetings when summoned. Some countries like Uganda and Ghana have already evolved legislation which make sure that every pharmacist always pays his dues to the society. Meetings of the society in the main towns, possibly monthly, could discuss various aspects of the profession; make arrangements for keeping some pharmacies open on public holidays and Sundays or probably to listen to lectures on some topic of interest to pharmacists. The Society could also arrange public enlightenment lectures on drugs, using the radio, television, etc. Such lectures arranged in co-operation with the school of pharmacy, would increase public knowledge on pharmacy and pharmacists. A virile pharmaceutical society also enables fresh pharmacy graduates to settle down professionally, and they would take better interest in the profession than when they have worked for three or more years before getting aware of the existence of the Society. A good way of achieving this is for some members of the society's executive or council to hold discussions with final year students annually. This, as usual, could be done over a meal or some light refreshments. The harnessing of the energies of the young pharmacy graduates is invaluable to the continued progress of pharmacy.

2. Hospital pharmacy

With regard to hospital pharmacy practice I would like to make three important suggestions. The first is the sharing of the out patient functions with retail pharmacies. We have previously observed that the overcrowding of hospital pharmacies is undesirable. Also many retail pharmacies only get a few prescriptions daily. The congestion in hospital pharmacies can be greatly relieved if pharmacies in hospitals with consultant facilities only attend to inpatients, emergency patients, and consultant clinic patients; while the patients from the general clinics take their prescriptions to retail pharmacies. Implementation of such a suggestion is bound to raise certain problems, for example, fees. In places where all prescriptions are normally dispensed free, the pharmacists could claim an agreed fee from the health authorities. In other places where hospital out patients normally pay for the dispensing of their prescriptions the patients can now pay the same agreed amount to the retail pharmacist. Such a proposal obviously needs to be tried in a few selected hospitals in large cities to find out what other problems are involved before full implementation. The involvement of retail pharmacies in the dispensing of hospital prescriptions will help to distribute the work and enable hospital pharmacies to carry out other vital roles. I believe such a suggestion is well worth trying as the present congestion at most hospital pharmacies is bound to increase human errors which are common, even in developed countries.

Secondly, I would like to propose the establishment of drug information centres in hospitals. Due to the greatly increased numbers, complexity, and potency of modern drugs, many developed countries have found it necessary to establish drug information and poison centres in major hospitals. In developing countries, such centres are even more urgently needed.

Due to lack of training facilities for pharmascists, doctors and other medical personnel in developing countries, these personnel are often trained in various countries with different drug traditions, so that they may prefer different drugs for one condition, use different names for the same drugs, and use different dose forms for the same drug, etc. This makes communication within the health team slow or difficult. A centre where information on drugs can be readily available would be useful to have in at least one hospital in each country. Such a centre would be available to pharmacists, medical practitioners, dentists, nurses and other interested personnel. The facilities could later develop to provide a 24 hour service on drug information. Information on drugs which could be obtained from such a centre would include:

Absorption
Chemistry and stability
Therapeutic use
Dosage
Adverse reactions and side effects
Excretion
Interactions
Therapeutic and pharmaceutical incompatibilities
Toxicity
Metabolism
Bioavailability
Trade names
Manufacturers
Product identification.

To establish such a centre in at least one hospital would be done with the co-operation between the school of pharmacy, the Society and the drug manufacturers. The service of some drug abstracting firms would also be needed to obtain continued up-to-date information on every drug.

The third role I would like to suggest for the hospital pharmacist at least in the main hospitals in each country is work on drug bioavailability. We are all aware that the same dose of a drug in different individuals of approximately the same weight and age can sometimes produce different effects varying from being ineffective, to being quite toxic. This depends on the bioavailability of the particular product and the way the different individuals absorb, metabolise, or excrete the drug. There is

therefore a great need in hospitals for facilities for the monitoring of bioavailability of drugs by analysis of the blood and urine. From the results obtained, the treatment of the patients can be made more individual in difficult cases, for example in the treatment of some cases of epilepsy with diphenyl hydantoin.

As the pharmacists are more trained in the chemistry of drugs (which are chemicals with several therapeutic potentials), and are specialists on medicines (which are some chemicals in which the therapeutic potentials have become realities after being worked on and formulated by pharmacists). Such analysis of drugs in body fluids would be most adequately done in the hospital pharmacy. Professor Beckett of the University of London has repeatedly warned that if pharmacists do not take hold of this role urgently others would. I am of the opinion that pharmacists in developing countries should press urgently for adequate facilities to enable them fulfil this essential role in at least the main hospitals in large cities.

With all the above roles being suggested for the hospital pharmacist, in addition to his small scale manufacturing duties, it is clear that his out-patient dispensing would need to be shared with the retail pharmacies as previously suggested.

RESEARCH

Traditional medicinal plants

When considering pharmaceutical research in developing countries research into traditional medicinal plants comes to mind first.

There is great public interest in research into traditional African medicines obtained from plants. Up till now this research has been carried out in an isolated fashion by small groups so that progress in this field has been slow. Research into medicinal plants is very expensive and yields rewarding results infrequently. This has led some drug industries to abandon work in this field. The progress in some of these studies has been slow because some workers have selected certain plant families and worked on the plants one after another. I am of the opinion that the best attitude would be to do selective work on plants which have been shown to have definite therapeutic or toxic effects on man or animals to the conviction of medical or veterinary practitioners. It would be useful in this connection for pharmacists to help the traditional medicine men to formulate their medicines into standard forms, to make the efficacy of the plant products more easily assessed and quantified. Workers in developing countries are in the best position to conduct scientific research in this field as they can obtain the confidence of the traditional practitioners necessary to know the best plants to select for scientific study. In order to ensure steady progress in this field it would be essential for governments in African countries to combine and establish a viable research institute where medical practitioners, botanists, pharmacognocists, biochemists, organic chemists, pharmacologists and pharmacists work together probably under the auspices of the O.A.U. or a similar body. This will reduce the financial burden on individual countries, and produce more directed effect. The present piecemeal approach is unlikely to get us very far.

Other fields of research

Other fields where research needs to be directed and intensified are as follows:—

(*i*) stability of certain medicinal preparations in the locality;

(*ii*) development of additives and excipients for medicines from locally available material. This would reduce the cost of local drug production and create new raw material industries which will in no small measure boost the economy of every developing country. For example, a lot of the maize planted could be used to produce maize starch for the local pharmaceutical industries.

(*iii*) as we all are aware, no animal species resembles man in its response to every drug. Various animals resemble man in their response to particular drugs. For example, the cat resembles man in its response to skeletal muscle relaxants, the guinea pig resembles man in its response to histamine, the rabbit resembles man in its teratogenic response to the drug thalidomide. It therefore stands to reason that some animal species found in Africa ought to be tried in pharmacological investigations. There are some responses of man to drugs which are not easily tested in the usual laboratory animals. Some of our wild rodents and other species may be found to have a major use in the pharmacology laboratory. Their breeding and exportation would start a new industry which would move any country's economy forwards. For this reason, we at the department of pharmacy and pharmacology, Ahmadu Bello University, Zaria, Nigeria have started pharmacological investigations using the African giant rat, lizards and other local species.

Pharmaceutical Industries

Most African developing countries import a large proportion of the drugs they use. This is a heavy drain on the foreign exchange of these countries, which most of them can ill-afford. Drugs being essential, their importation cannot be stopped in the same way as luxury goods like cars or some imported foods or textiles.

It therefore stands to reason that urgent steps need to be taken to start large scale drug manufacturing in these countries to halt this heavy drain in the foreign exchange and to cater for the eventuality of national emergencies when importation of some drugs may prove difficult or impossible.

Associated with the problem of pharmaceutical industries is the quality of drugs used in developing countries. There have been allegations in the local press of some of these countries about the dumping of poor quality drugs. Such allegations have made the World Health Organisation to recommend a system of certification whereby the exporting country can declare the suitability of a drug consignment for its own internal consumption. The cardinal rule in obtaining good quality drugs

Is the observation of the principles of good manufacturing practice. This means in order for a developing country to absolutely guarantee the high quality of its drugs, it must be in a position to ensure by inspection and other legislative measures that the drugs it uses have been produced under the best conditions. This is best attained by the drugs being produced in the country.

While the most reputable manufacturers undoubtedly produce and export good quality drugs, the bad quality drugs imported cause a lot of public concern to the pharmacists, medical practitioners and the public in general. This has led to an outcry for the establishment of quality control laboratories to test all imported drugs for compliance with official standards. I would like to say with great emphasis that the testing of all imported drugs for compliance with official standards is a formidable and expensive task which in the long run will not be worth the effort. In place of such an exercise, I would suggest the establishment of a drug quality control committee in each country with experts from each of the medical specialties, pharmacologists, organic chemists pharmaceutists, and pharmaceutical chemists. The Committee would be responsible for registering drugs approved for importation into the country, manufacture, or use within the country for limited periods. If the committee considers a drug to be of no therapeutic use or of no advantage over a previously registered drug, it rejects the application for the drug's registration. Consequently no effort will be wasted on analysing a drug not registered. The quality control laboratory will then only analyse random samples of registered drugs to ensure their compliance with official specifications.

Some developing countries have also used the system of drug registration to protect their local pharmaceutical industries thus refusing to register any drugs which are the same or have no advantages over locally manufactured drugs.

Other aspects of drug quality control often forgotten are the proper storage and handling of drugs to ensure maintenance of good quality. This makes it most desirable that only qualified personnel handle and retail drugs.

Education

I would not like to conclude this talk without sharing some thoughts with you on pharmaceutical education in developing countries. Being the head of a school of pharmacy, pharmaceutical education is close to my heart.

Due to the special circumstances of pharmacy in the developing countries, the education of pharmacists should take cognisance of these special circumstances and address itself to equiping its students to solving these problems. I will go straight to deal with the problems a pharmacy school could help to solve.

Industrial problems

The need to develop local pharmaceutical industries is so urgent that the school of pharmacy should help train personnel for industries. At the department of Pharmacy and Pharmacology, Ahmadu Bello University, Zaria, we have a drug manufacturing unit with all machinery for basic manufacturing of tablets, injections and mixtures. These facilities we use to train pharmacy students in the basic drug manufacturing techniques and also to supply the university hospitals with basic essential drugs at low cost. The unit also has a quality control section which ensures the quality of products produced in the unit, tests other samples purchased for use in the university hospitals, and trains students in the practical problems met in quality control of drugs. Later, we hope to provide consultant services to pharmaceutical industries in Nigeria.

(*b*) Research and post-graduate training

I believe there is a need to accelerate post-graduate research programmes in the few schools of pharmacy in Africa in order to produce academic staff and high level staff for industry and national quality control laboratories. Also training of post graduate students often stimulates academic activity within an institution.

Pharmacy Technicians

I have previously mentioned the shortage of technical assistants in most of our pharmaceutical establishments.

It is very important to have intermediate group of technical power for the smooth runnin research and practical classes schools of pharmacy, research production in industry, drug qu control laboratories, and also assist pharmacists in retail and h tals. This will prevent the pro frequently encountered in deve ing countries where the professi does everything. This makes unable to keep up with professi journals and decreases his outpu professional service and resea

There are two possibilities for training of pharmacy technicians. is to have a diploma school pharmacy technicians attached to school of pharmacy. The other have an in-service training where techniques can be learnt in the l ratories of the pharmacy school. theoretical lectures can be give the evenings. The latter would far less expensive and in some more appropriate.

The course could be a four in-service training in a pharm school with one year's experienc industry, hospital and analytical mistry laboratory. At the end such a course, the candidates sh be full fledged pharmacy technic with status equivalent to the med laboratory technologists and o similar cadres.

Pre-registration training

I would like to make some sug tions for the improvement of registration training.

Due to shortage of pharmacist many developing countries, the p macy graduate does not have opp tunity of learning from experien colleagues. In fact during their registration periods, many hold p tions of full responsibility with pharmacist to supervise them. the average newly qualified phar cist in most developing count assumes much higher responsibi than his counter-part in the deve ed countries. Under such circu stances, it is essential that the sch of pharmacy provide something lieu of the pre-registration trai in places where adequate pre-re tration training is not available. S

training could be done by having an extra year where practical aspects of the profession are taught with more exercises in modern dispensing and periods of supervised attachment to the available hospitals, industries and retail establishments. Group discussions can also be arranged so that the students can discuss their experience with their lecturers. This could be recognised by the pharmacy boards as satisfying the requirement for pre-registration training. Some time in the fourth year could also be used to reduce the great strain in the usual, very concentrated 3 - year programmes which most students find strenous.

Refresher courses

As professionals, we all need a process of continuous education. That is why it is also important that a school of pharmacy should make provision for organising refresher courses for hospital pharmacists, pharmaceutical inspectors, and other pharmacists in the field. Such courses would not only serve to bring the pharmacists' knowledge up to date, but will provide the school with some feed back information of practical situations. Such feedback will be essential for developing and improving the school's curriculum. The courses could also incorporate speakers from outside the pharmacy profession to broaden the knowledge of the pharmacists. These courses could include topics like:

(1) Poisoning;

(2) Family planning;

(3) Use and misuse of drugs;

(4) Recent developments in pharmacology;

(5) Cancer and early signs of cancer discovery;

(6) Addiction, etc.

In some parts of the U.S.A., there is statutory requirement for pharmacists to attend a certain number of refresher courses to retain their names on the registrar. While in the U.K. the government encourages pharmacists to attend such courses.

SUMMARY

In spite of the humble beginnings of pharmacy and the seemingly unsurmountable difficulties, pharmacy in most developing countries has achieved immense successes. By learning from the experience of one another and those of the developed countries, it is possible to fashion pharmacy in the developing countries, taking into consideration each country's circumstances. Suggestions have been made for the improvement of pharmaceutical services and professional activities.

It has been suggested that there is need to reduce the over crowding of hospital pharmacies in order to prevent or drastically reduce medication errors which are common even in developed countries. One way of reducing the overcrowding of hospital pharmacies is for retail pharmacies to dispense the prescriptions of general out patient clinics of hospitals.

It is suggested also that hospital pharmacists should take up the role of providing analytical data of bioavailability in cases of difficult medication and the establishment and operation of drug information centres at least in one main hospital of each country.

The necessity to expand pharmaceutical industries has been emphasised. This would make the countries take greater responsibility for the quality of drugs they use, and reduce the heavy foreign exchange drain on drug purchases. The schools of pharmacy could help develop indigenous industries by laying greater emphasis on practical industrial pharmacy and quality control in the pharmacy curriculum. They should also help in the training of pharmacy technicians to provide an intermediate technical group to help all fields of pharmacy. There is also urgent need to establish drug quality control committees in all developing countries to have responsibility for drug registration. It is suggested that random samples of imported drugs and locally manufactured registration drugs be taken frequently for analysis. Proposals for analysis of all imported drugs is expensive, tedious and unnecessary.

It has also been emphasised that the present piecemeal approach to research into traditional medicinal plants is unlikely to yield great success. Due to the complexity and tedious nature and expense involved, it is necessary to have a research institute which draws funds from several countries and which has personnel from several fields. The research should be only on selected plants of proven therapeutic or toxic activity.

I would like to conclude by reiterating sincerely how highly honoured and delighted I am to participate in this conference. I look forward to taking back with me to Nigeria new knowledge and understanding of some aspects of pharmacy and happy memories of this conference and Ghana. Thank you.

INFLUENCE OF EMULSION FORMATION ON THE BIOLOGICAL AVAILABILITY OF INCORPORATED PRESERVATIVES

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SYNOPIS

The total amount of preservative found adequate for protecting simple aqueous preparations against microbial contaminants may not necessarilly be adequate for preserving emulsions. The efficacy of a preservative in an emulsion or cream depends on the concentration biologically available in the watery phase of the emulsion.

INTRODUCTION

Investigations over the past two decades or so have led to the discovery that many commercial pharmaceutical emulsions and creams (Cade, 1947; Atkins, 1950; Kallings, et *al*, 1966) and industrial cutting oil emulsions (Wheeler and Bennett, 1956; Bennett et *al*, 1959) are often heavily contaminated with microorganisms. Emulsions have been found containing several million organisms per gram of product (Duffett et *al*, 1943; Kallish, 1968). Among the organisms isolated are various species of moulds, fungi and bacteria (Barr and Tice, 1957; Woodward and McNamara, 1970). As a result of microbial activity, an emulsion may give off very offensive odour, appear slimy and pitted or break down into its component phases.

The presence of living organisms in a cream may present very grave health problems. The use of a pseudomonas contaminated hand cream recently led to a serious outbreak of skin infection in a dermatological ward (Noble and Savin, 1966).

Adapted from a presentation made at the 32nd Ghana Pharmaceutical Conference State House, Accra.

Numerous cases of dermatitis have also been recorded among industrial workers handling contaminated cutting oil emulsions (Ayliffe et *al*, 1965).

Manufacturers are aware of the high probability of microbial contamination of emulsions and take stringent precautions to produce products relatively free from microorganisms. Such precautions, however, offer no safeguards whatsoever against contamination during use by the consumer. Even a very small number of contaminants in the product initially may, under favourable conditions, multiply rapidly in the cream since most organisms can metabolize the oil and the emulgent. Admittedly most contaminants isolated from creams are non-pathogenic but the fact must not be overlooked that even a non-pathogenic in an abrased skin can pose a serious health problem. The need for adequate protection of oil-water formulated products cannot therefore be too strongly emphasized.

It may be argued that emulsions can be prepared sterile by the use of appropriate sterilization procedures but this will not prevent subsequent contamination during use. The most rational approach to the problem therefore appears to be the addition of a suitable amount of preservative to the formulation to destroy chance contaminants all through the period of use. The choice of a suitable amount of preservative is critical since too high a concentration causes irritation to the site of application and is economically wasteful, and too small a concentration, on the other hand, fails to protect the product against microbial infection.

The empirical approach to selecting a so-called suitable concentration of a preservative for incorporation in an emulsion or cream has been to determine the minimum inhibitory concentration of the preservative in a simple aqueous solution and then to employ this concentration in the formulation, or alternatively, to add an arbitrarilly selected concentration and then sample the product over several months to test its sterility only for the experiment to be repeated when the concentration is finally found inadequate. The time and money wastage involved in such hit and miss methods can be colossal. Indeed, the use of either method at all is an open admission of the fact that the factors controlling effective preservation are not fully appreciated.

The present investigation seeks to relate the influence of formulation of a basic arachis oil emulsion to the distribution, and therefore, the activity of some incorporated phenolic compounds.

THEORY

In an emulsion a preservative is distributed between the oil and the aqueous phase according to the formula (Bean, Konning and Malcolm, 1969).

$$Ca = \frac{C\,(U+1.0)}{K_a^o U+1.0} \quad \ldots\ldots\ldots (1)$$

where C = total concentration of preservative in the emulsion, C_a = conc. of preservative in the aqueous phase, U = oil: aqueous phase ratio, K_a^o = oil: aqueous phase partition coefficient of the preservative. The above formula is similar to that derived for oil-water dispersions (Bean and Heman-Ackah, 1964).

The aqueous phase of an emulsion consists of a dispersion of an emulgent (surfactant micelles) in water. The amount of preservative in the aqueous phase of an emulsion (C_a) is therefore the sum total of that associated with the surfactant micelles (emulgent) and that free in the water. The concentration of preservative in the water alone is given (Pisano and Kostenbauder, 1959) by

$$C_w = \frac{Ca}{R} \text{ or } C_a = C_w R. \quad \ldots\ldots (2)$$

where C_w = conc. of preservative in the water, R = total: free preservative ratio.

Substituting eqn. (2) in (1)

$$C_w = \frac{C\,(U+1.0)}{R\,(K_a^o U+1.0)}$$

The above equation describes the influence of the major factors controlling the distribution of a preservative in an emulsion. For any objective study, therefore, the following parameters of the emulsion need be known: the oil: aqueous phase partition coefficient (K_a^o) and the total: free preservative ratio (R). Both parameters are influenced by the amount of surfactant in the formulation.

EXPERIMENTAL

MATERIALS AND METHODS

MATERIALS

Oil: Fixed oils have superior spreading and penetrating ability in comparison to paraffinic oils and are therefore commonly used for the preparation of creams. *Arachis Oil BPC* was selected as an example for study. *Polysorbate 80 BPC* was used as the emulgent. Phenol (AR quality) and *Chlorocresol* (Lab reagent grade) were recrystallized and dried in a desiccator before use. *Nutrient broth.* Oxoid granutes (CM1) at a concentration of 1.3%w/v *Indicator nutrient broth*, nutrient broth containing 1.0% lactose and 0.0016%w/v bromocresol purple.

Organism: *Escherichia coli* (NCTC 5933) cultivated and stored at 40C as a dense suspension until required.

METHODS

Oil: aqueous phase partition coefficient

Equal volumes of oil and aqueous phase containing graded amounts of polysorbate 80 and a fixed amount of preservative were equilibrated at 250 + 0.10 for 24 hr. The amount of preservative remaining in the aqueous phase was determined spectrophotometrically using the method of Johnson and Savidge (1958). The oil: aqueous phase partition coefficient (K_a^o) was calculated.

Polysorbate — preservative interaction

The total: free preservative ratio (R) for solutions containing a fixed amount of preservative and graded amounts of polysorbate were determined at 250 + 0.10 by the equilibrium dialysis technique described earlier (Patel and Foss, 1964) and since used by others (Bean, Konning and Malcolm, 1969).

Extinction time determination

The antimicrobial activities of emulsions containing known amounts of preservative were determined against a standard inoculum of *E coli* at 250 + 0.10 by an extinction time technique as earlier described (Bean & Heman-Ackah 1964). The proportion of both the oil and the emulgent in the formulation were varied one at a time and the corresponding extinction time determined.

RESULTS

Preservative — polysorbate interaction

The greater the interaction of the preservative with the surface the greater is the interaction ratio i.e. total: free preservative ratio (R) and this is linearly related to the amount of emulgent in the formulation (Fig. 1a,b). Chlorocresol has a greater affinity for the emulgent than phenol and this is reflected by the magnitude of the slopes which are 0.27 for phenol and 5.5 for chlorocresol.

Influence of polysorbate on the oil: aqueous phase partition Coefficient

An increase in the amount of polysorbate in the emulsion decreases the concentration of preservative in the oily phase but increases solubilization and therefore the amount of preservative in the aqueous phase; thus the oil: aqueous phase partition coefficient (K_a^o) falls persistently for both phenol and chlorocresol (Fig. 2a,b). Again the relative decreases in the oil: aqueous phase partition coefficient (K_a^o) for phenol and chlorocresol reflect the relative interactions with the emulgent as already illustrated (Fig. 1a,b).

The above physico-chemical parameters (R and K_a^o) may then be used in calculating the proportion of preservative partitioned to the various phase of the emulsion namely the oi7 (C_o), emulgent (C_m) and water (C_w).

Influence of the Proportion of oil and emulgent on preservative distribution in the emulsion

When the emulsion contains a specified amount of preservative and polysorbate (1.0%), increases in the proporation of arachis oil result in decreases in the concentration of

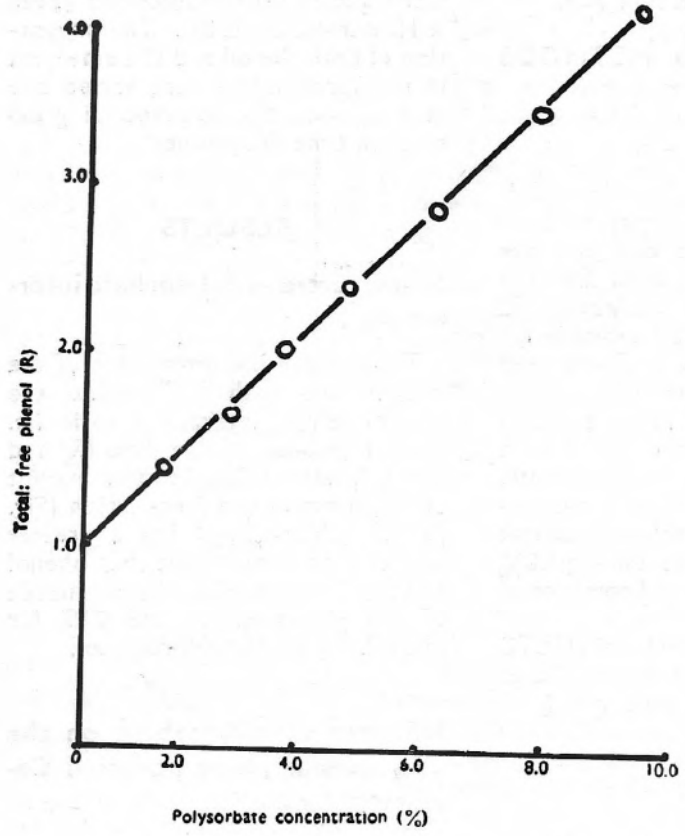

Fig. 1 (a) Phenol—polysorbate interaction

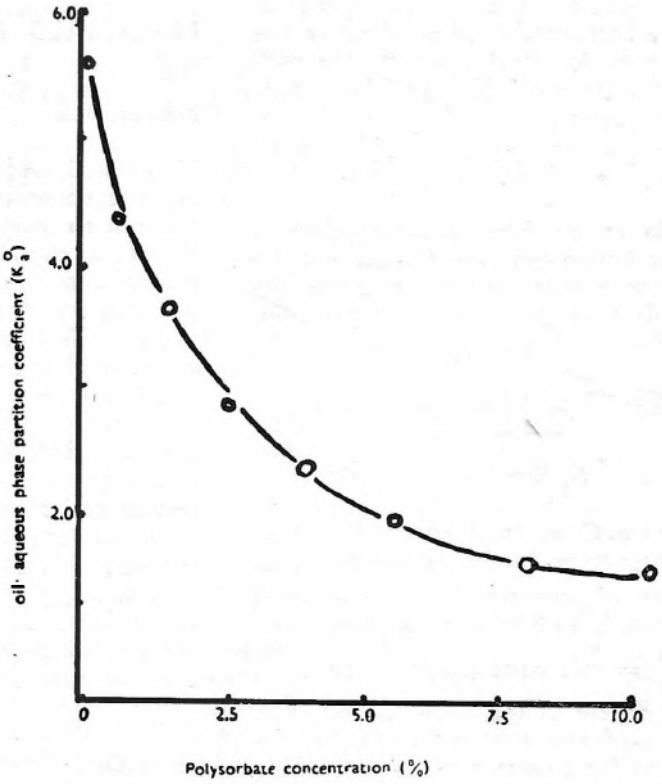

Fig. 2 (a) Effect of polysorbate on the oil: aqueous phase partition coefficient of phenol between arachis oil and water

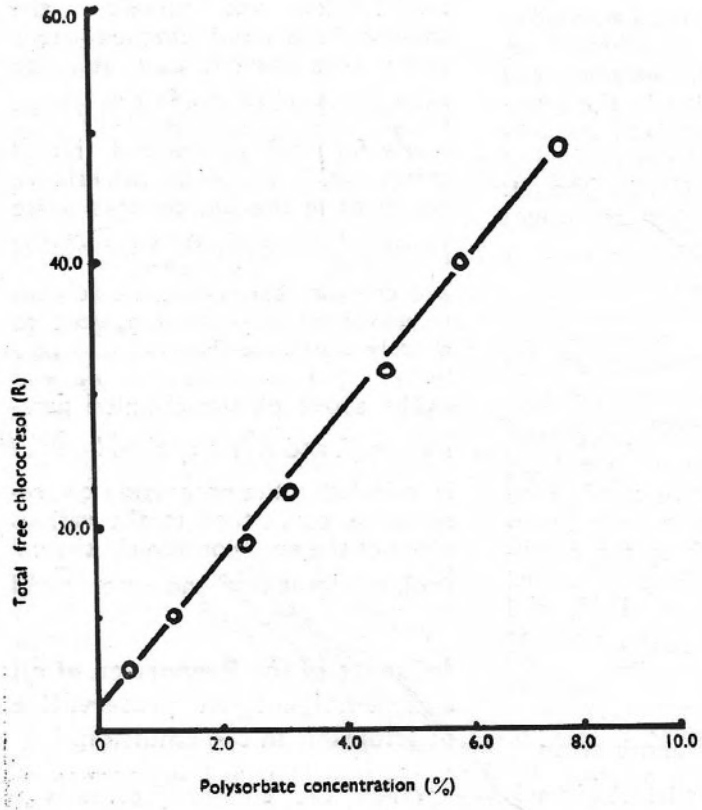

Fig 1 (b) chlorocresol—polysorbate interaction

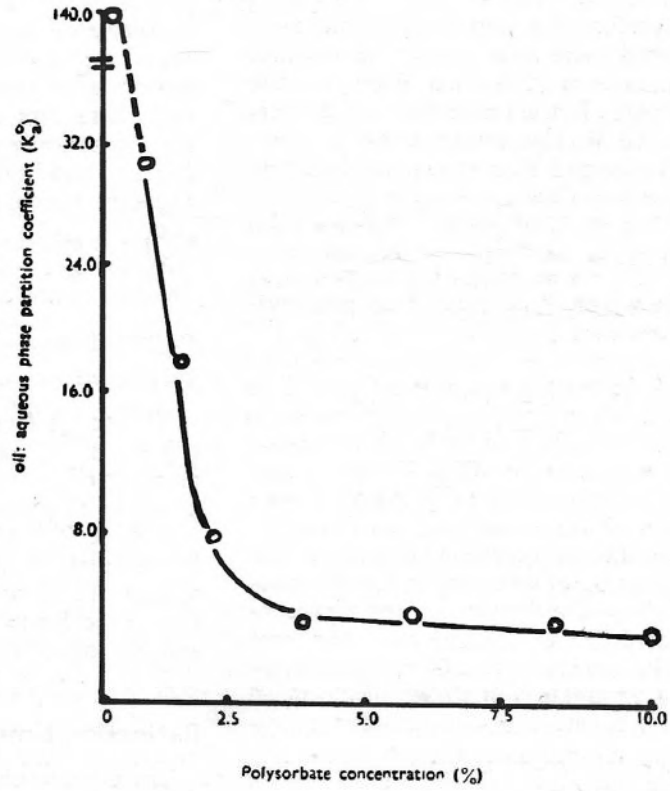

Fig. 2 (b) Effect of polysorbate on the oil aqueous phase partition coefficient of chlorocresol between arachis oil and water

preservative in all the phases i.e. the oily (C_o), emulgent (Surfactant micellar) (C_m), and watery (C_w) phases (Tables I and II). When the emulgent is increased from 1.0 to 10%, increases in the proportion of oil generally produce a similar trend except that for phenol alone the concentration in the oil increases. This change in trend is due to a change in the oil: aqueous phase partition coefficient from above ($K_a^o > 1$) to below ($K_a^o < 1$) unity Fig. 2a).

It is significant to note also that when the amount of emulgent is increased, while the oil: aqueous phase ratio (U) is maintained constant (Tables I and II), the concentration of preservative in all three phases persistently decreases. For any of the emulsions containing a fixed oil: aqueous phase ratio the concentration of preservative in the emulgent micelle (C_m), oil (C_o) and water (C_w) is in the order $C_m > C_o > C_w$.

The crux of the whole problem of emulsion preservation seems to revolve on this. Whereas a specified amount of preservative in a simple aqueous solution is entirely available to micro-organisms exposed to it, the same amount of preservative in an emulsion is partitioned between the oil, the emulgent and the water. Since most microbial contaminants grow and multiply in the watery phase of an emulsion, it is primarily upon the concentration of preservative maintained in the watery phase (C_w) that the activity of the product as a whole depends. The amount of preservative in the watery phase (C_w) may in fact represent a very small fraction of that in the oil or the emulgent; the influence of oil and emulgent on C_w is summarized in Figs. 3 and 4.

The percentage weights (%) of the total preservative partitioned to each phase of the emulsion (Tables, III, IV) further emphasize the tremendous amounts that are taken up by the oil and emulgent both of which make no direct contribution to the anti-microbial activity of the emulsion.

Influence of the proportion of oil and emulgent on the activity of preservatives in the emulsions

The activity of arachis oil emulsions containing a fixed overall amount of phenol or chlorocresol falls persistently as the proportion of oil is increased (Fig. 5).

Similarly, when the concentration of emulgent in the formulation is increased while maintaining the preservative and the volume of oil constant, the activity decreases in the same way as is recorded in Fig. 5.

DISCUSSION

Preliminary attempts to investigate causes of the frequent microbial contamination of so-called preserved emulsions have led to the study of preservative availability in oil-water systems (Hibbott and Monks, 1961; Bean and Heman-Ackah, 1964). Since microbial contaminants reside mainly in the watery phase of an emulsion availability may be equated to the preservative partitioned to the water which is dependent upon the relative solubility of the antimicrobial agent in the oily and aqueous phases, the proportion of oil to aqueous phase, and the degree of interaction between preservative and emulgent.

Whereas for preservatives which are relatively less soluble in the oily than the aqueous phase i.e. with oil: aqueous phase partition coefficient lower than unity ($K_a^o > 1.0$), increases in the proportion of oil increase the preservative in the oily, emulgent and watery phases (Bean, Konning and Malcolm, 1969), the current work shows that for those which are more soluble in the oily than the aqueous phase ($K_a^o > 1$), the concentration in all the phases decreases (Tables I & II). The amount of preservative in the water and therefore available for antimicrobial activity is far less than that in either oil or the emulgent.

In a hypothetical emulsion containing an oil; aqueous phase ratio of 1.5 (60% oil) and 10% polysorbate as emulgent only 6.8% of the total amount of phenol incorporated remains in the water. For higher phenolic compounds which are relatively more lipid soluble, the proportion available in the water is even smaller still. Thus, of the chlorocresol added to an emulsion of similar composition as above, only 0.1% of it partitions to the water; 99.9% is locked up in the oily (arachis oil) and the emulgent phases. This tremendous amount in both the oil and the emulgent is largely out of contact with the majority of the contaminants and therefore makes no direct contribution to the antimicrobial activity of the emulsion.

The activities of arachis oil emulsions containing a fixed amount of phenol or chlorocresol were not iso-active but diminished as the volume of oil was increased (Fig. 5). This clearly underscores the fact that the activity of an emulsion does not depend directly on the total preservative incorporated. The losses in activity recorded are attributable to the decreases in the concentration in the water as a result of the changes in the volume of oil (Figs. 3, 4).

If emulsions including creams, cutting oil emulsions, paints etc. must be self-sterilizing, then the addition of an arbitrarily selected amount of preservative to the product irrespective of composition with the hope of achieving preservation may be quite meaningless. Whereas an omnibus concentration may be adequate for one product, the same concentration may fail to protect another with only a slight change in formulation.

Any attempts to extrapolate results obtained in preliminary tests in simple aqueous systems to oil-water formulated products may also lead to failure. For instance whereas in water chlorocresol is much more efficient (phenol coefficient, 10 to 12) in fixed oil emulsions, however, phenol is rather more active and therefore a better preservative than chlorocresol (Fig. 5). This is because since a relatively greater proportion of chlorocresol than phenol partitions to the two "non-active" phases of the emulsion namely the oil and the emulgent, a comparatively smaller proportion of it than phenol remains in the water (Fig. 3) for activity. It would be quite erroneous therefore to select a preservative for the preservation of emulsions solely on the basis of its performance in simple aqueous solutions.

With a knowledge of all the factors controlling the availability of a preservative in an emulsion it might be

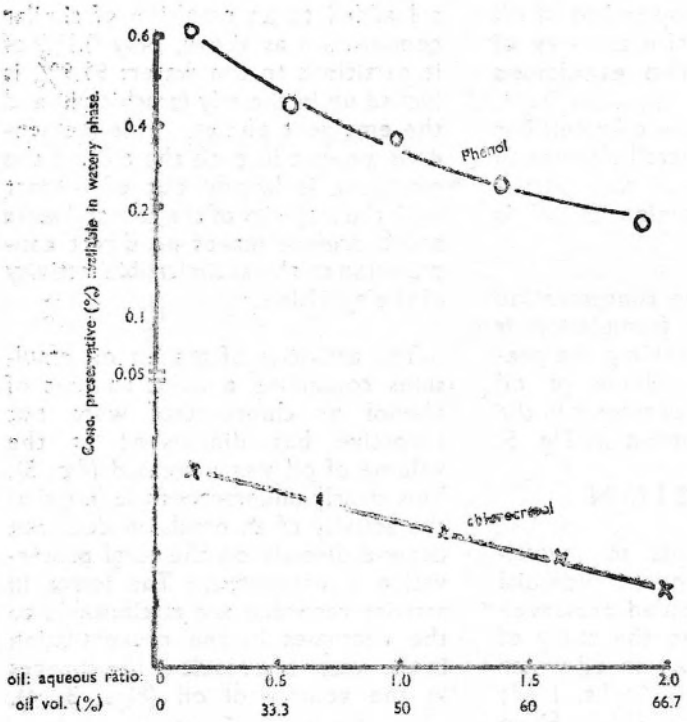

Fig. 3 Influence of proportion of oil on the amount of preservative (2.5%) partitioned to the water phase of arachis oil emulsion containing 10% Polysorbate

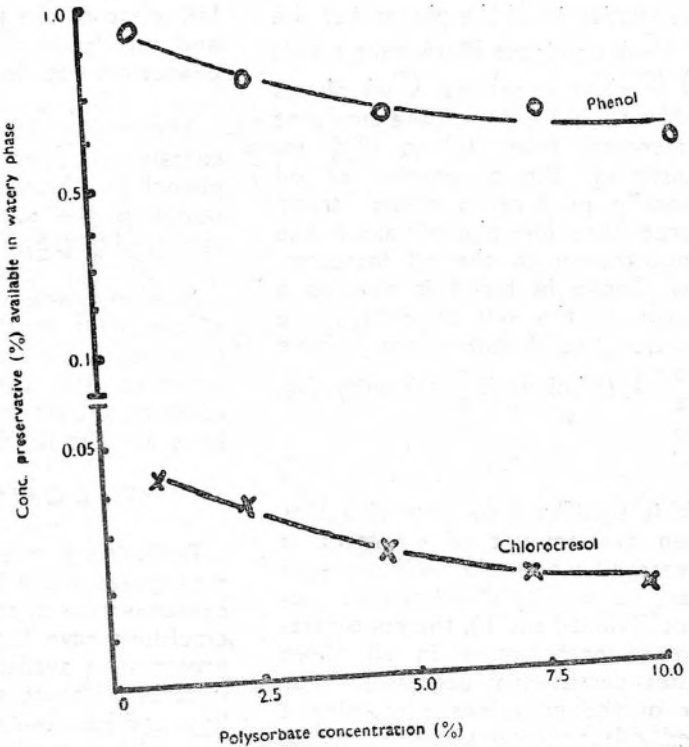

Fig 4 Influence of polysorbate conc. on the availability of preservative (2.5%) in the water phase of arachis oil emulsion containing 33.3% oil (U = 0.5)

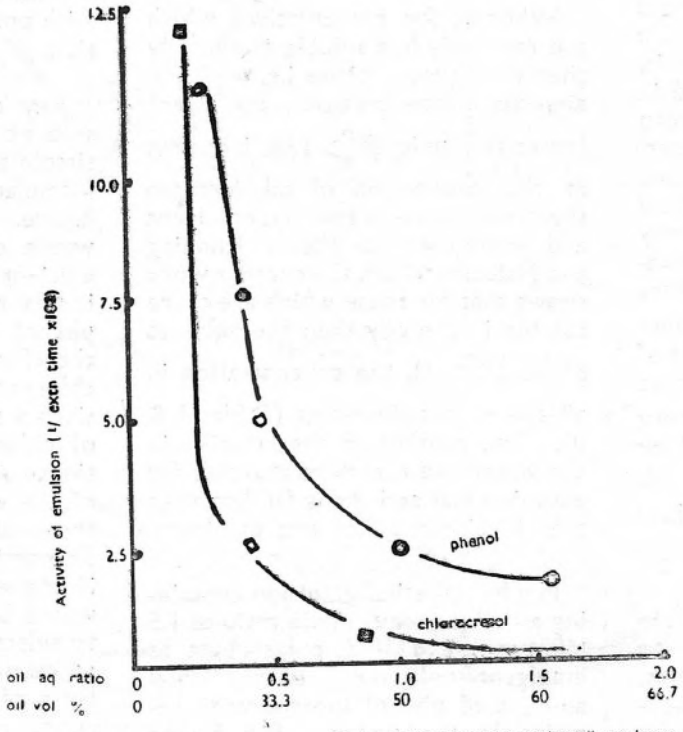

Fig 5 Influence of proportion of oil on the activity of arachis oil emulsions containing 2.5% preservative and polysorbate 10%

TABLE I

Concentration of phenol (2.5%^{W}/v) partitioned to various phases of arachis oil emulsion containing Polysorbate—80 as emulgent

V_o % (U)	1.0% Polysorbate			10.0% Polysorbate		
	C_o	C_m	C_w	C_o	C_m	C_w
15 (0.18)	6.33	39.4	1.38	2.33	18.0	0.61
20 (0.20)	5.96	35.0	1.23	2.35	16.5	0.59
33.3 (0.5)	4.83	26.3	0.96	2.37	14.5	0.52
50 (1.0)	3.91	20.2	0.72	2.38	13.5	0.47
60 (1.5)	3.52	16.8	0.60	2.40	11.9	0.42

Conc. in. C_o = oil, C_m = micelles, C_w = water

TABLE II

Concentration of chlorocresol (2.5%^{W}/v) partitioned to various phases of arachis oil emulsions containing Polysorbate—80 as emulgent

V_o (U)	1.0% Polysorbate			10.0% Polysorbate		
	C_o	C_m	C_w	C_o	C_m	C_w
15 (0.18)	12.4	53.3	0.12	3.9	19.1	0.035
20 (0.25)	10.1	43.7	0.08	3.7	17.6	0.032
33.3 (0.5)	6.7	23.8	0.04	3.2	16.1	0.030
50 (1.0)	4.7	13.5	0.024	3.0	11.8	0.021
60 (1.5)	4.1	9.7	0.017	2.8	8.6	0.016

Conc. in: C_o = oil, C_m = micelles, C_w = water

TABLE III

Percentage weight of phenol (2.5%^{W}/v) partitioned to various phases of arachis oil emulsions containing Polysorbate—80 as emulgent

V_o (U)	1.0% Polysorbate			10.0% Polysorbate		
	W_o	W_m	W_w	W_o	W_m	W_w
15 (0.18)	38.0	15.6	46.4	14.0	67.6	18.4
20 (0.25)	46.8	13.6	39.6	18.8	64.8	16.4
33.3 (0.5)	64.0	10.4	25.6	31.6	56.4	12.0
50 (1.0)	78.2	7.7	14.1	38.0	52.4	9.6
60 (1.5)	84.2	6.2	9.6	48.0	45.2	6.8

%Wt. of total Phenol in: W_o = oil, W_m = micelles, W_w = water.

TABLE IV

Percentage weight of chlorocresol (2.5%) partitioned to various phases of arachis oil emulsions containing Polysorbate—80 as emulgent

V_o % (U)	1.0% Polysorbate			10.0% Polysorbate		
	W_o	W_m	W_w	W_o	W_m	W_w
15 (0.18)	74.8	21.3	3.9	23.2	75.7	1.1
20 (0.25)	80.5	17.0	2.5	29.9	69.2	0.9
33.3 (0.5)	89.3	9.5	1.2	43.2	56.1	0.7
50 (1.0)	94.4	5.1	0.48	59.0	42.5	0.3
60 (1.5)	96.2	3.6	0.27	67.7	32.1	0.1

%Wt. of total chlorocresol in: W_o = oil, W_m = micelles, W_w = water.

possible in the future to predict within reasonable limits the total amount of preservative required for any situation.

Acknowledgement

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Role of Natural Products–Potential of Medicinal Plants in Ghana

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Mr. Chairman, President and Members of the Ghana Pharmaceutical Society, Distinguished Delegates, Ladies and Gentlemen, I consider it a great privilege to be invited by the Pharmaceutical Society of Ghana to address this Conference this morning. It is also a privilege to have as my Chairman for this session, an erstwhile respected colleague and Dean, Prof. A. N. Tackie who now occupies a position of elevated responsibility as the Executive Chairman of the Council for Scientific and Industrial Research. I do very much appreciate, Sir, your kind words introducing me to the Conference in such glowing terms, which I hardly deserve.

It is very apt that "Pharmacy and National Development" has been chosen as the theme for this conference. It is quite in keeping with the national policy of self-reliance that the profession of pharmacy should be addressing itself to the task of national development.

In assessing the role of natural products in national development, I would like to, first of all define the term "Natural Products". Dr. Ikan has dedicated his book on the chemistry of natural products to his wife and their three products! (they have three children). I do not intend to use his definition in my reference to natural products. I shall rather confine myself to the role of those natural products which are of direct concern to Pharmacy, specifically to the potential of medicinal plants in Ghana.

From the beginning of history, man has relied on natural products for sustenance of life on this earth. From natural products his three basic requirements of food, clothes and shelter have been extracted. Plant organs, such as, tubers or tuberous roots of yams and cassava have long been used in this country to provide the carbohydrate fraction of our nutritional requirements, all kinds of beans and legumes for protein, a rich variety of vegetable oils for lipids and delicious range of fruits to provide vitamins and other dietary factors. Also from plants both indigenous and exotic, man has traditionary extracted fibres, from which he has fashioned the famous 'Kente' and the 'Adinkra' cloth dyed in beautiful patterns with pigments extracted from plants. Timber, bamboo and grass have been used for traditional construction of houses in our rural areas. Thus, natural products have met and continue to meet all the basic needs of the human society. Natural products also provide a means to opt out of this society, as many who are sick of modern society choose to do by imbibing natural products which produce narcosis, euphoria or hallucination. Ladies and Gentlemen, if you are aiming at an occasional escape from reality, we have the answer in natural products!

However, there is a still further class of natural products which has from ancient times met another basic need of man — to heal his diseases and to provide the 'cup that cheers but not inebriates!' In his search of natural products for food, our ancestors must have accidentally come upon the alarming results of having imbibed a likely looking fruit or leaf or an exudate. The more discerning of them must have noticed the beneficial effects of some of these plant organs and extracts on specific ailments. In South America tribal people living in the Andes, it is believed, found that drinking the bitter water of pools into which trees had fallen, relieved them of fevers. Maybe that was how Cinchona was originally discovered.

The ancient medicine man was not only interested in the disease-curing properties of plants but also in their ability to produce strange sensations and effects. Thus he was able to put natural products to a variety of non-medical uses. The powers and properties of natural products as claimed by

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ethnic medicine of one country in Africa — which is typical of many a folk medicine — makes a very interesting study. Apart from their ability to cure various diseases they also claim to have information on:—

(i) How to make women love you — maybe they had hit upon a potent aphrodisiac among the medicinal plants. Obviously, they were not beset by the modern problem of population explosion!

(ii) How to be rich — I am sure scientific exploitation of natural products would make one rich — but the medicine man perhaps had other ideas.

(iii) How to be a good fisherman— perhaps they had discovered the use of fish poisons like cocculus indicus which we now know contains a powerful analeptic — picrotoxin.

"Thoughts of a chemotherapeutic agent for cancer certainly were far from our minds when we learned in 1949 that a "tea', made from the leaves of a plant commonly known as Periwinkle enjoyed a folklore reputation in Jamaica for the treatment of diabetics. Indeed as we later learned its use was fairly widespread in many areas where the plants commonly grow as perennials and preparations have even been marketed with glowing testimonials for the treatment of diabetes. Our attempts to influence the blood sugar with various aqueous extracts administered orally were uniformly negative in animals. On injection, however, toxicity was encountered in rats associated with a curiously specific depletion of certain elements of the white blood cells. An active crystalline alkaoid was obtained from *catharanthus roseus* (*Vinca rosea*) by Dr. Beer in the Collip Medical Research Laboratory, London, Canada, in 1958 which in assays run by Dr. Cutts was shown to be a potent depresser of the white blood count and bone marrow in the rat following an injection of 0.3 mg. or less. This substance was christened Vincaleukoblastine originally and abbreviated to VLB but now is named Vinblastine. When this work was presented in 1958 at the New York Academy of Sciences we learned from Dr. Svoboda that he had also prepared extracts of the plant in hopes of obtaining anti-diabetic activity. Instead of this however, Dr. Johnson had noted definite anti-leukemic activity against the P1534 transplantable disease in mice (3, 4). The subsequent isolation and production of a remarkable series of alkaloids from the plant by the group at Eli Lilly is well known to this audience and I note will be extended in papers to be presented at this meeting by Drs. Svoboda, Neuss and Johnson".[2]

But the story does not end there. Dr. Svoboda and his colleagues at Eli Lilly were not willing to discard the antidiabetic claim of folk-medicine as baseless. A thorough investigation of all the 60 odd alkaloids isolated from that single species, led them to conclude "it is highly probable that the continued use of various galenical preparations of *Vinca rosea* in indigenous medicine as an oral hypoglycemic agent is not completely without merit. Experimental evidence is presented which associates varying degrees of hypoglycemic activity with the major alkaloids, catharanthine (.HCl.), Leurosine (.H_2SO_4), Lochnerine, Tetrahydroalstonine, Vindoline and Vindolinel (2HCl)"[3].

The first discovery of a particular pharmacological property of a plant by the primitive man and the subsequent application of this knowledge to his advantage has always been a marvel to me, but the ingenuity with which our ancestors have evaluated the potency of a powerful drug is amazing. The determination of the potency of curare — itself a concoction made from 30 odd species, is a case in point. The South American Indian uses curare as an arrow poison, usually to capture or kill animals, though not averse to using it on suitable occasions, to defend himself against a marauding tribe. In order to be able to use the drug to capture or kill, he must know the exact potency of the potion. Well, he uses a method which are not too different from modern pharmacological methods of assay. Monkey is used as the experimental animal. The arrow head is dipped in the concoction and is shot at a monkey sitting on a tree. If the monkey jumps to the next tree and drops down, the concoction is the most potent and is called 'one-tree curare'. If the monkey is able to jump a second time before falling, it is known as a 'two-tree curare' half as potent, and so on. So he uses the least potent to paralyse and thus capture an animal alive, and the most potent for killing it outright. We know now what a powerful muscle relaxant curare is.

From the foregoing, ladies and gentlemen, you would no doubt realise that in natural products, there is a great potential for providing the means with which diseases can be healed and suffering can be alleviated. What about the situation in Ghana? An indication of 'our plant resources' has already been given recently by Dr. Sarpong[4] I shall therefore, single out three outstanding plant families to illustrate the great potential of medicinal plants in Ghana.

1. **Apocyanaceae**

An illustrious family claiming such established drugs as *Rauwolfia*, *Strophanthus*, *Vinca* (*catharanthus*) as members, all of which are plentifully distributed in Ghana. In addition, *Funtumia* and *Holarrhena* provide further possibilities due to their steroidal constituents. The almost ubiquitous *Thevetia* (yellow oleander) has been shown recently in India to have tremendous potential as a cardiac drug, even superior to digitalis.

The African Rauwolfia (*R. vomitoria*) is richer in reserpine content than the original Indian Rauwolfia. In the Faculty of Pharmacy, Professor Tackie and Dr. Dwuma-Badu have developed a very simple process for the extraction of reserpine from the Ghanaian root. I see absolutely no justification for the continued importation of reserpine for conversion into tablets and injections. We can extract from our local species all the reserpine required for home consumption and to spare for export.

2. **Menispermaceae**

One of the chief raw materials from which curare is produced — namely, the species *Chondodendron tomentosum*, belongs to this family. A powerful analeptic — picrotoxin—

is obtained from another member—*Anamirta paniculata* — of the same family. Recently, as a result of systematic investigation several genera of this family e.g., *Mitragyna*, *Triclisia*, *Tiliacora*, etc., at Kumasi, some species have been shown to exhibit important pharmacological properties — muscle relaxant, hypotensive, cytotoxic etc. — opening up a tremendous potential for these Ghanaian species.

3. Solanaceae

Belladonna is a classical example of members which belong to this family. The way this drug has been named by people of latin and teutonic origins reflects perhaps their racial character! The Italian name "Belladonna" literally means beautiful woman, while the German name "Tollkirschen" means mad cherry!

In addition to several foods and spices-potato, tomato, garden egg, capsicum etc., the family also provides important medicinal and commercial plants such as tobacco, stramonium, hyoscyamus and of course belladonna. Of these tobacco is already a very important cash crop in this country. There are several local species known as the "Daturas" containing mainly the tropane alkaloid, hyoscine, which could be commercially extracted by systematic cultivation of this species. On the other hand, exotic species rich in the other important alkaloid—hyscyamine — could very well be introduced to supplement indigenous resources. Two such species — *Duboisia myoporoides* from Australia and *Hyoscyamus muticus* from Egypt appear suitable for introduction.

The genus *Solanum*, of which some eighteen species occur in West Africa, has been the subject of current investigations in our own laboratories at Kumasi. Two types of steroidal constituents — the solasodine and the hecogenin types — have been isolated from two local species. Such steroids are commercially important as intermediates for conversion into steroid hormones, thus indicating the potential of Ghanaian species containing such steroidal constituents.

4. Aromatic plants

There is an abundance of aromatic species which could be commercially exploited both for pharmaceutical purposes as well as for other industrial uses.

(*a*) Lemon grass (Cymbopogon spp.)

The chief component of the essential oil distilled from this grass is citral, a very valuable industrial raw material, particularly for conversion into vitamin A. Another species of *cymbopogon* which yields a very important raw material for the perfumery industry is "palma rosa." These exotic species could be introduced for commercial cultivation in Ghana. Experiments in India have shown that these thrive well in semi-tropical conditions and on laterite soils.

(*b*) Clausena anisata

From preliminary experiments conducted at the Faculty of Pharmacy, we have found that this species — a small herb growing in the Mampong scarp — yields a volatile oil, 90 per cent which is anethole, a phenolic ether of the phenylpropide class of aromatic constituents. Now, this leaf can be very well used as a substitute for anise, star-anise, fennel or any other foreign species which is used for its anethole content, or the anethole extracted and marketed as such.

(*c*) Ocimum

A species which has been found to be rich in thymol content could be systematically cultivated. Indian ajowan, *Trachyspermim ammi*, which is also very rich in thymol could be introduced.

(*d*) Ginger

I understand ginger is now being exported on a large scale. It would be more profitable to extract the oleoresin and export it rather than the rhizome. Processed products occupy less bulk and therefore do not attract as high a freight as the raw material. Besides, they fetch a higher price than the raw material. In Ethiopia, formerly red pepper was exported as such. Now they extract the oleoresin (which contains the pungent constituent, capsaicin) and thus obtain a better price.

(e) Cinnamon

This is an example of a successful introduction of an exotic species, originally form Ceylon. From experimental cultivation at the Faculty of Pharmacy, we have demonstrated that the cinnamon tree can be exploited for three imporant products — cinnamaldehyde from the stem-bark, eugenol from the leaf and camphor from the root-bark. There is no need to import cinnamon as spice. Cultivated in a compact area, it can meet all local needs and for export to all of West Africa.

(*f*) Japanese peppermint, *Mentha arvensis*, var. *piperascens*, has been found suitable for introduction into semi-arid zones in India[6]. I do not see any difficulty in introducing this exotic species into northern regions of Ghana. However, irrigation facilities must be available.

Time does not permit me, Mr. Chairman, to give an extensive list of plants with medicinal and other potential, but from what I have said so far, it will, I hope, be realised that medicinal plants could play a very important role in national development. We have the expertise; the nation must now show the will to avail itself of the expertise and exploit the rich natural resources with which this country is blessed. Thank you.

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RADIOPHARMACEUTICALS (RADIOISOTOPES IN PHARMACY)

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INTRODUCTION

This century is notable not only for the two tragic world wars and the birth of several independent African states, but also for fantastic scientific discoveries.

Pierre Curie and P. Villard showed that three quite distinct types of rays, alpha, beta and gama originate from within the nucleus of the atom of an element (Radium) in 1900. Albert Einstein published his famous theory of equivalence of mass and energy in 1905 F. Soddy identified isotopes and isobars in natural radioactive substances in 1910. Hevesy and his co-workers described the importance of these naturally occurring isotopes (lead, bismuth and thorium) in chemistry and physics in 1913. Geiger and Muller described detecting possibility of these isotopes in 1929. E. D. Cokroft and E. T. S. Walton produced nuclear transmutation by artficially accelerated protons in 1932. In the same year E. O. Lawrence invented the cyclotron and in 1934 he produced artificially radioactive nuclide by bombardment with artificially accelerated particles. This trend of discoveries continued, resulting in the discovery of nuclear fission by O. Hahn and F. Strassman in 1939 and the explosion of the Atomic bomb on July 16th in New Mexico, August 6th and 11th over Hiroshima and Nagasaki, Japan in 1945.

I doubt whether any of the celebrated theoretical physicists and chemists could have ever imagined what practical applications their discoveries would have several decades later.

Biological and Medical scientists have used great ingenuity in adapting many of the tools and techniques of the physical sciences to their complex problems. Radioisotope techniques are making such a tremendous contribution to our understanding, diagnosis and treatment of diseases that today Nuclear Medicine and Radiopharmacy have gained recognition as separate specialities in medical sciences. It is, therefore, reasonable for pharmacists in this country to know something about Radiopharmacy, especially those in the Universities and research institutions and to appreciate how useful a tool radioisotope is in research and teaching.

In view of the technical complexity of this subject, I shall attempt to pick out the salient practical points and discuss them under the following headings:

1. What is a radioisotope?
2. What is a radiopharmaceutical?
3. Uses of radiopharmaceuticals
4. Choice of radiopharmaceuticals.
5. When should a radiopharmaceutical be used?

For the purpose of this presentation atoms may be considered to be composed of charged particles known as protons and uncharged particles called neutrons. An insufficient number, or an excess, of neutrons may cause the nucleus to be unstable. The spontaneous disintegration of this nucleus, accompanied by a loss of energy in the form of radiation is the phenomenon known as radioactivity.

Atoms of an element which contain the same number of protons but different numbers of neutrons are called isotopes of that element. If the atom is unstable, these isotopes are described as radioisotopes. The total number of protons and neutrons in the nucleus, known as the mass number, is used to designate a particular radioisotope; e.g. iodine — 131 (131_I) is the isotope of iodine which has a total of 131 protons and neutrons in the nucleus. This is isotope is radioactive.

It is believed that many unstable isotopes existed in nature at the time when the world was created, but almost all of them have disappeared since then. Only a few were so nearly stable that some of their atoms have not yet changed. These are some of the heavy elements, a few of which have no stable form, like Uranium. There are also a few of other elements, for example Potassium 40.

Modern physics techniques have made it possible to recreate many of the unstable isotopes which are supposed to have existed in nature, and perhaps some others besides. This can be done in one of two ways: either by bombarding stable elements with small atomic particles (electrons, protons, neutrons, Deuterium, etc.,) and thus building up elements or by breaking elements into pieces. The first of these processes can be carried out in a special machine like a cyclotron or high voltage accelerator if charged particles are used or in an atomic reactor with neutrons. Recently, radioisotope generators have been introduced. These generators consist of a longer-lived parent nuclide or radioisotope that produces a short-lived daughter in its decay scheme.

Units

There are primarily two units of measure applied to nuclear radiation. One is used to tell how many radioactive atoms will decay in one second in a given amount of material: this is the "curie." The other unit is used to measure the effect, in terms of ionization, produced by the radiation: this is the "roentgen" or "rad."

The curie is simply defined as the amount of radioactive material in which 3.7×10^{10} atoms (37 billion) will decay by radiation emissions in one second. There are several sub-units, the "millicurie" (3.7×10^{7} disintegrations per second) and the "microcurie" (3.7×10^{4} disintegrations per second). When an atom disintegrates

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usually changes its form since the charge of the nucleus may have changed, and therefore the atom is transformed into an atom of another element. After a certain time, the number of the original atoms present will have decreased to half their number. The time taken to reach this state is known as the physical half-life or simply half-life, of the radioisotope. For example, the half-life of radioidine ($I31^{1}$) is eight days. That is to say, if an ampoule contains one millicurie on delivery, eight-days later it will contain only 0.5 millicuries, another eight days it will be 0.25 millicuries and so on.

The unit of absorbed dose is the "rad" and is a measure of absorbed energy per gramme of tissue. A radiation dose to the whole body is considered to be potentially more harmful than a comparable dose to a local region.

The energy of the various radiations is described in terms of electron volts (ev), which is defined as the energy acquired by an electron in falling through a potential difference of one volt. In the more commonly encountered radioisotopes, beta and gamma ray energies seldom exceed 3 MeV (million electron volts). The other sub-unit of energy is the KeV (kilo or thousand electron volts).

Detection

If the amount of radioactive material in a given substance or location is to be determined, then the measurement is of the type which gives values in curies. The basic mechanism which facilitates this determination or detection is the conversion of the radiation into an electrical signal which can subsequently be amplified and used to operate some counting device. More commonly used detectors are the scintillation detector or the Geiger tube. The actual measurement consists of accumulating (counting) the individual signals emitted by the detector during a given period of time. The information is therefore presented as counts per unit of time, usually counts per minute (CPM).

2. What are Radiopharmaceuticals?

During the last 22 years, radioisotopes have become increasingly important in medical research, diagnosis and therapy. Radioactive materials or labelled substances used in Medicine are termed radiopharmaceuticals.

Since the introduction of isotopes as tracers in humans in the thirties and up to the sixties, only radio-chemicals have been used in medicine. During the sixties, however, a new approach has started and greater attention is being paid to pharmaceutical problems since these substances in fact are drugs, regardless of whether they are used for therapy or diagnosis and whether in vivo or in vitro.

The Federal Food, Drug and Cosmetic Act of U.S.A. defines them as "articles intended for use in the diagnosis, cure, mitigation, treatment or prevention of disease in man or other animals".

These drugs, however, differ from other drugs in that they are usually given to provide information rather than to elicit a pharmacological response. Thus we cannot simply apply pharmacological principles, such as dose-response relationships directly to radioactive drugs, although problems such as sterility, pyrogenicity, chemical stability and quality control measures apply to all drugs whether radioactive or not.

3. Uses of Radiopharmaceuticals

Radioactive pharmaceuticals are divided into two major categories; in the first group are those drugs that will eventually be used in non-radioactive form. In such cases, the labelled drug is used as a tracer, to provide fundamental information about the biochemistry or pharmacology of the stable drug. In the second group, the radionuclide remains an essential part of the drug, which will always be given in radioactive form either to gain information or to suppress a biological function, such as the function of the thyroid gland in hyperthyroidism.

(a) Drug Distribution

Labelled pharmaceuticals have been used to study drug localization, mechanisms of catabolism, rates of excretion, absorption from the intestinal tract or injection sites, metabolic products, homogeneity of preparations, and rates of disintegration and release. They are also used to identify products, to determine the age of a product, to sort tablets according to activity and to provide control of production line operation. For example, the Food and Drug Administration of the U.S.A. requires companies to provide experimental proof or demonstrate that newly introduced food preparations or drugs are not toxic or harmful. Whereas in pre-isotope days, it would have taken years to determine whether a drug has harmful side effects by performing prolonged toxicity tests, it is now possible sometimes to decide the matter within days. This enables industrial firms testing new drugs rapidly to demonstrate their harmlessness to the satisfaction of the F.D.A. For instance: it had been discovered in the early 1950s that the synthetic female sex hormone diethylstilboestrol, when fed to steers, caused greatly improved weight gains and meat quality. The question had to be settled whether this compound might contaminate the meat and thus exert its hormonal influence on people eating it. $H.^{3}$ (Tritium) labelled diethylstilboestrol was fed to steers in the usual way. After slaughter, the meat was analysed. Over 50 per cent of the radioactivity had been excreted in urine and faeces. Lean meat contained 0.3 part per billion, fat 0.35 and liver 9.12 parts per billion of the hormone, as determined by radioactivity. These quantities are so minutely small that, quite probably, they recomparable to the amount of naturally occuring sex hormones present in ordinary untreated men. The case was therefore clearly proved that the hormone could be safely fed to livestock, since the compounds simply do not penetrate to the parts of the animal which are eaten.

Drug efficacy, in the sense of how much of it reaches the target organ, can be investigated. For example, ointment bases of different fats influence the absorption of the active ingredients of ointments: lanolin caused the fastest absorption of radioactive sodium chloride $Na^{24}Cl$ through the skin, in a series of ointment bases which were compared.

(b) Clinical Applications

The principal contributions that radioisotope have made to medicine is that they let us evaluate both structure and function. We do this by measuring the time course of radioactive tracers within the human body with the best possible spatial and temporal resolution. Biochemical abnormalities that other wise could be described only in terms of the whole organism, can be localized to particular organs or parts of organs. For example, we can determine that proteins are being lost from the body

TABLE I — "WELL ESTABLISHED" RADIOPHARMACEUTICALS

Isotope	*Chemical Form*	*Use*
^{131}I	Iodide	Diagnosis of thyroid function
^{125}I	Iodinated human serum albumin	Blood volume determinations; pericardial eff sions; cardiac scans circulatory studies; a placenta previa.
^{131}I	Iodinated human serum albumin macroaggregates	Lung scans
^{131}I	Rose bengal	Liver function studies
^{125}I		
^{131}I	Cholografin (iodipamide)	Cardiac scans for pericardial effusions
	Labeled renal function compound	Kidney function studies
^{131}I	Labeled fats or fatty acids	Fat absorption studies
^{51}Cr	Chromate	Spleen scans (labeled red cells) red cell taggi and survival studies placenta previa; and plasm and blood volume determinations.
^{59}Fe	Chloride or citrate	Iron turnover studies
^{57}Co or ^{60}Co	Labeled vitamin B12	Diagnosis of pernicious anaemia
^{131}I	Iodide	Thyroid scans
^{125}I		
^{131}I	Iodinated human serum albumin	Brain-tumour localization
^{131}I	Rose bengal	Liver scans
^{125}I		
^{131}I	Labeled renal function compounds	Kidney scans
^{125}I		
^{198}Au	Colloidal	Liver scans
^{203}Hg or ^{197}Hg	Chlormerodrin (Neohydrin)	Brain scans and kidney scans
^{131}I	Iodide	Treatment of hyperthyroidism or cardia dysfunction
^{32}P	Soluble phosphate	Treatment of polycythemia vera and bon metastases
^{32}P	Soluble phosphate	Treatment of leukemia
^{131}I	Iodide	Treatment of Thyroid carcinoma Interstiti treatment of Cancer
^{198}Au	Colloidal	Intracavitary treatment of pleural and perito
	Colloidal chromic phosphate	neal effusions
^{32}P		
^{32}P	Colloidal chromic phosphate	Interstitial treatment of cancer
^{85}Sr	Nitrate or chloride	Bone scans on patients with diagnosed Cancer
^{51}Cr	Human serum albumin	Diagnosis of gastrointestinal protein loss.

through focal lesions of the intestinal tract, that vitamin B^{12} is lacking because of a specific genetic defect of the stomach and that red blood cells are being destroyed at an abnormally rapid rate by the spleen or are being produced at an excessive rate in a particular area of bone marrow.

At other times, radiopharmaceuticals are used to determine whether a tumour actively concentrates iodine or to measure differences in regional blood flow; they are also used to obtain an image of an organ lesion for example, to visualize space-occupying lesions of the kidneys and the liver. Certain other agents are used to deliver therapeutic radiation to a particular biological site, for example, to the thyroid. These therapeutic techniques are based on the tissue destroying property of ionizing radiation, and thus use the same mechanism employed in X-xay therapy. From the point of view of physical state, these substances are most frequently used in the form of solutions, colloidal solutions, capsules, sometimes in the form of gases, emulsions or aerosols.

Table I—"Well Established" Radiopharmaceuticals

4. Choice of Radiopharmaceuticals

In the selection of radiopharmaceuticals for diagnostic work, there are certain criteria to be considered. Relatively few special requirements are made on Radioactive compounds used for tracer techniques in vitro tests, eg. determination of trilodothyronine concentration in the blood using the resin uptake test, or determination of concentration of some proteic hormones using radioimmunoassay, the diagnosis being based on their results. Practically the only essential requirement is a sufficient radiochemical and radionuclidic purity. Otherwise isotopes with a longer physical half-life and radiation characteristics, which enable easy detection, are generally more suitable. From the point of view of labelled compounds they should be sufficiently stable during storage and should consequently have the longest possible shelf-life.

The requirements on radiopharmaceuticals applied in vivo are much stricter. Besides having high radionuclidic, radiochemical and chemical purity together with low toxicity, applied solutions must be sterile and pyrogen-free. The radiopharmaceutical should give a good response in the detection or measuring equipment. An important aspect is the choice of the right gamma energy for scanning techniques. The radiation dose to the patient should be as low as possible. In general, this means emphasis on radiopharmaceuticals that emit neither hard beta nor hard gamma radiation. In addition it is desirable that the radiation dose to the patient from residual activity in the body after completion of the diagnostic procedure be low. One method of achieving this is by the use of short-lived radionuclides. Compliance with this requirement also makes serial measurements possible. The nuclide should have suitable chemical properties, i.e. it should be possible to fashion it into chemical forms with the desired biological behaviour. This biological behaviour is important in determining the radiation exposure to each individual organ system as well as in the interpreting the results. Where the radiopharmaceutical accumulates, what its turn-over rate is in these areas, and when and how it is eliminated from the body all play a part in establishing the exposure rate to individual organ system.

5. When should a Radiopharmaceutical be used?

A radiopharmaceutical should be used when the value of the information gained or effect produced outweighs the risks involved. Whenever the use of a radiopharmaceutical is considered, the decision for use should not be made unless the user can say with some certainty that the information gained will be sufficient for the diagnosis or that the effect achieved will be useful in treatment. With radiopharmaceuticals, both underdosing and overdosing are serious errors. If too few microcuries are administered and insufficient information is gained, the patient has been exposed to needless radiation. Pregnancy is a high risk period for drug administration. Radiopharmaceuticals should therefore be avoided in pregnancy to prevent any adverse radiation on the foetus.

Conclusion

In recent years many of the diagnostic radioisotope procedures have become routine tests in haematology, endocrinology, hepatology, urology, brain and cardiovascular disorders.

This rapid growth has been due to many factors: the first factor lies in the truly fantastic sensitivity with which they can be detected, and the fact that observations made with them lend themselves to quantitative measurement, giving valuable information not attainable by any other means; second, the simplicity and low morbidity associated with the procedures and lastly, the awareness of the clinician or the research officer as to the worth of the tests. The use of these techniques in this country is limited by lack of trained personnel, equipment and ready availability of radiopharmaceuticals.

There is a small Radioisotope Unit in the Department of Medicine and Therapeutics at the Korle Bu Teaching Hospital and with a little support, this unit could undertake a variety of established diagnostic tests and support research investigations requiring radiopharmaceutical techniques.

It is estimated that the demand for the use of radioactive materials in medicine (diagnosis and treatment) agriculture, industry, research and teaching in this country is likely to increase considerably in the near future. It is, therefore, gratifying to learn that the University of Science and Technology, Kumasi, is establishing a Unit of Radioisotopes which we hope will expose pharmacy students and graduates to the fundamentals of radiopharmacy.

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THE ANTIBACTERIAL ACTIVITY OF SOME GHANAIAN CHEWING STICKS

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Summary: The antibacterial activity of some chewing sticks used in Ghana has been examined. These investigations have established that the chewing sticks possessed antibacterial activity against *Escherichia coli, Bacillus subtilis, Pseudomonas and aeruginosa* and *Staphylococous aureus.* The activiry of the chewing sticks has been compared with a tooth-paste.

Introduction

That chewing sticks possess antibacterial activity was first reported by El Said and his co-workers (1971) who working with certain Nigerian chewing sticks demonstrated that chewing sticks destroyed the oral flora, a view confirmed by Duorinaa (1973). El Said et al found that extracts from Fagara zanthoxyloides —a popular chewing stick in Nigeria preserved the colour of blood within its zones of inhibition. Further work by Sofowora and Issaacs (1971) showed that extracts of this plant led to reversal of sickling and crenation in erythrocytes.

MATERIAL AND METHOD

The nutrient broth used consisted of 13g/litre of Oxoid nutrient broth powder in distilled water. Nutrient agar was prepared from the nutrient broth by adding 15g/litre of Oxoid Agar No. 3. Test organisms were *E. coli, Ps. aeuginosa* (Gram negative), *B.* subtilis, and *St. aureus* (Gram positive). The plant material used consisted of the sliced stem and whole branches of plants used locally as chewing sticks.

The plants used were:—

Local Name	*Botanical Name*
Gyama (Twi)	Alchornea cordifolia
Duo (Hausa)	—
Bakyi Asawache (Hausa)	—
Dua Homa (Twi)	Milletia zechiana
Kokrodoso (Hausa)	—

They were dried, powdered and extrated with alcohol (45%). Different weights of the powdered material were extracted with 20 ml of the 45% alcohol and the activity of the extracts measured.

The agar cup plate method was used in the determination of antibacterial activity. Zones of inhibition produced by alcoholic extracts of the chewing sticks and alcoholic solutions of the tooth-paste were measured. The extinction time method was also used.

RESULTS AND DISCUSSION

Extracts from all the chewing sticks showed activity against the test organisms. It was found that the zones of inhibition increased as the weight of the powder was increased. It was further found that the Gram negative organisms were more susceptible to the extracts.

Extracts of the different plants differed in activity. The activity of the extracts was in the decreasing order: Bakyi Asawache, Kokrodoso, Gyama, Dua homa, Duo. These results are summarised in Table I.

Analysis of the phenolic content of the extracts showed a similar order as activity. This shows that the antibacterial activity of the chewing sticks may probably be due to the presence of phenolic compounds. The bactericidal activity of phenolics has been extensively studied (Banett, 1959; Cook 1960; Sykes 1965; Starr & Judis, 1968 and Buadu 1971).

A preliminary investigation of the activity of Tooth-paste X using the Agar Cup Plate technique showed that the toothpaste did not possess any antibacterial activity against the test organisms, since there were no zones of inhibition. This test is not conclusive since zones of inbition depend mainly on the intrinsic diffusion coefficient of the substance being assayed. The Extinction Time method was therefore employed to compare the activities of Bakyi Asawache and Tooth-paste X and the results are summarised in Table 2.

The Extinction Time of Bakyi Asawache 0.25% (concentration) was 60 mins. but a 1% concentration of the tooth paste could not kill within 180 mins. Again, the high phenolic content of Bakyi Asawache may explain the superiority of the chewing sticks to the toothpaste as an antibacterial agent.

Acknowledgement

Authors wish to express their gratitude to Dr. K. Sarpong, Department of Pharmacognosy and Mr. S. A. Ampofo, 4th year B.Pharm. (Hons) Student for their assistance.

TABLE I

WEIGHT OF POWDER

(GM)/20ml solvent

Plant used	0.5	1.0	2.0	0.5	1.0	2.0	0.5	1.0	2.0	0.5	1.0	2.0
	ZONES OF INHIBITION (MM)											
	E. coli			Ps. aaruginosa			B. subtilis			St. aureus		
BAKYI ASAWACHE	15.0	17.8	19.7	16.0	16.8	18.2	14.5	17.2	19.2	12.5	17.5	17.8
KOKRODOSO	13.8	15.4	17.3	14.5	15.5	16.8	13.2	15.6	17.5	12.5	15.2	16.2
GYAMA	12.5	14.5	14.7	12.8	14.9	13.8	12.8	14.1	16.4	12.3	14.3	14.9
DUA HOMA	11.3	12.3	13.2	11.3	12.1	13.1	11.5	11.9	12.7	12.0	12.3	12.9
DUO	10.8	12.0	13.0	10.5	11.0	12.7	10.5	10.9	12.4	10.3	11.6	12.2

TABLE 2

ACTIVITY OF BAKYI ASAWACHE COMPARED TO TOOTHPASTE

Sample	CONC.	RESULTS					
		30 mins	60 mins	90 mins	120 mins	150 mins	180 mins
BAKYI ASAWACHE	0.25%	+	—	—	—	—	—
TOOTHPASTE	1.0%	+	+	+	+	+	+

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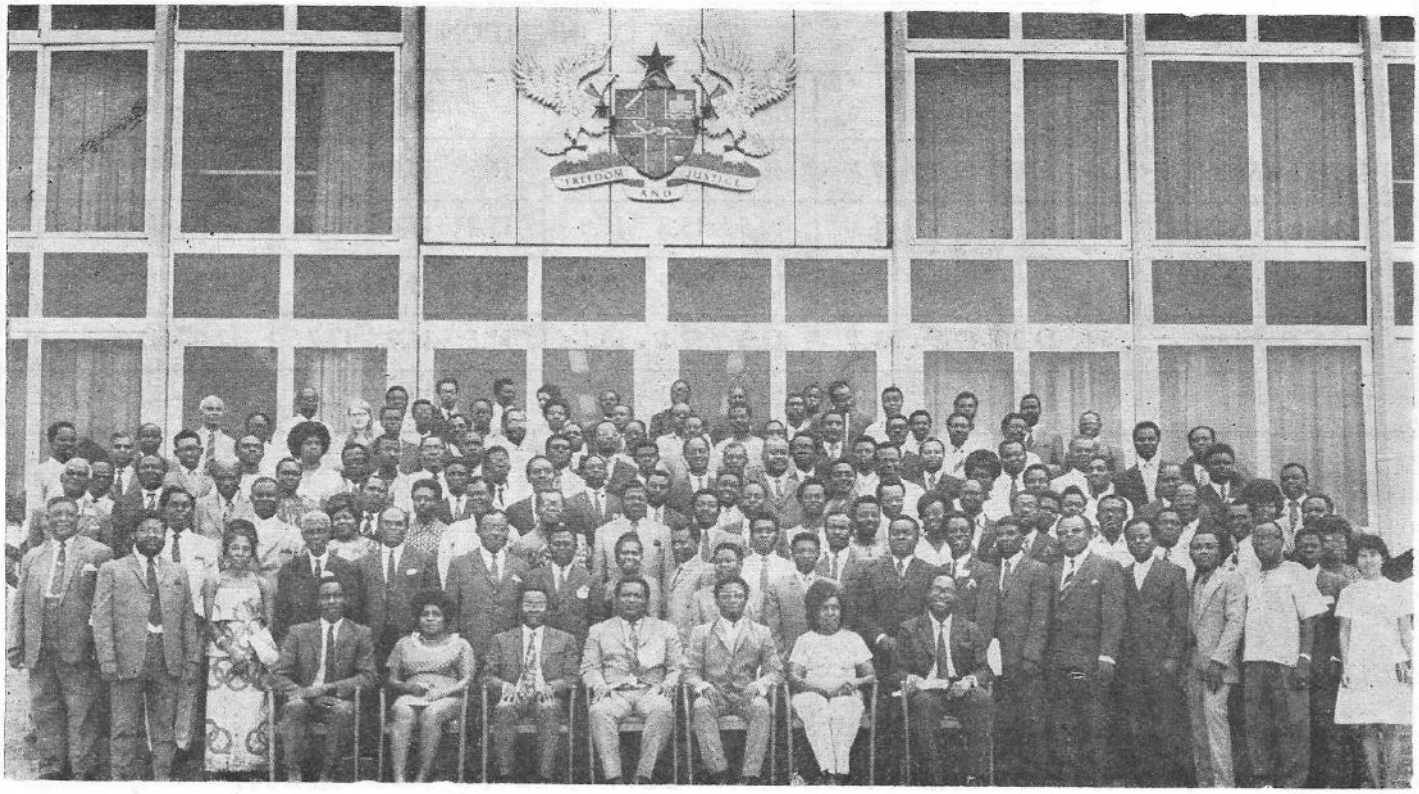
THE 32nd CONFERENCE & EXHIBITION —A REPORT BY THE HON. GENERAL SECRETARY



A group photograph of some of the participants of the Conference taken at the Main Entrance of the Conference Hall of the State House. Sitting in the centre is Mr V. K. Aidoo, the President and on the extreme right is Prof. Gabriel Osuide, the Guest Speaker.

The 32nd Pharmaceutical Conference and Exhibition of the Society opened with pomp and pageantry at the Conference Hall of the State House, Accra, at 5.30 p.m. on Thursday, 2nd August, 1973, with His Excellency the Head of State and Chairman of the National Redemption Council, Col. I. K. Acheampong, performing the opening ceremony of the Conference and the Honourable Commissioner for Health Major A. H. Selormey, opening the Exhibition. The Head of State's opening address and the Presidential address appear in full elsewhere in this issue of the Journal; and so also does the speech of the Commissioner for Health at the opening of the Exhibition.

The 4-day event which was attended by a record number of over 60 per cent of all Pharmacists in the country was given prominence in the National Press, Television and Radio. The Opening Ceremony was also shown on all net-works of Television in Nigeria from which country the Conference Guest Speaker, Prof. G. E. Osuide, Head of the Department of Pharmacy & Pharmacology, Ahmadu Bello University, Zaria, came. Prof. Osuide's Guest speech is also published in full in this issue of the Journal.

The Ghana Film Industry Corporation also filmed the event and copies of the film have been purchased by the National Headquarters. (Branch Secretaries could arrange with the National Headquarters to obtain the film for showing at their meetings).

The Conference adopted the new Code of Ethics which appeared in Vol. 1 No. 2 of the Journal with minor modifications, and also adopted the revised Constitution. The revision of the Constitution became necessary in view of the Government's Professional Bodies Registration Decree (NRCD 143) which confers more responsibilities on the Society.

Among decisions the Conference took are:

(1) In view of the extra responsibilities the professional Bodies Registration Decree imposes on the Society and the generally increased work involved in the running of National Headquarters because of our expanded activities, Conference empowers Council to appoint an Administrative Assistant immediately and appoint an Executive General Secretary as soon as practicable.

(2) It was also agreed by Conference that, as from January 1974, Membership and Annual Retention fees should be increased to ₵20.00 and

¢30.00 per person respectively.

(3) All Dispensing Chemists should wear their white overcoats when on duty. The Society's Crest and the name of the Pharmacist must appear on the left breast pocket of the coat.

(4) All pharmacy shops should display the illuminated sign adopted by Council on the recommendation of the Council of the Commonwealth Pharmaceutical Association. Council was requested to obtain the signs in bulk and sell them to pharmacies.

(5) In view of the fact that Government has decided Ghana should go metric as from August 1974, the appropriate steps should be taken to ensure that metric weights and measures are made available in all dispensaries. Council should liaise with the Council of the Ghana Medical Association to ensure that all prescriptions are written in the metric system.

(6) To ensure the viability of retail practice and also make it inexcusable for any pharmacist to attempt illegal practice of medicine, Conference asked Council to negotiate with the Ghana Medical Association and the Medical and Dental Council to get dispensing doctors stop the practice. Council was also asked to take the appropriate measures to ensure that no wholesaler sells large quantities of any drug direct to a doctor except where the doctor's practice is not in the neighbourhood which is adequately served by pharmaceutical services.

(7) That appropriate measures be taken to ensure that members pay up their contributions of ¢100 per head to the National Headquaters building Fund.

(8) All officers were re-elected un-opposed for a further two-year term, namely:—

Mr V. K. Aidoo – President
Dr. K. Sarpong – Vice President
*Mr K. A. Ohene-Manu–Hon. General Secretary
Mr J. Y. Binka – Asst. Hon. General Secretary
Mr E. Osei-Tutu – Hon. Treasurer.

*It was agreed that Mr K. A. Ohene-Manu will relinquish his office as Hon. General Secretary as soon as an Executive General Secretary is appointed by Council.

Dr. K. Boakye-Yiadom and Mr D. Anim-Addo were also elected unto Council, and Mr Ago Simmonds elected Editor of the Journal.

Fellows:

At the Pharmaceutical Dinner and Dance held at the Banquetting Hall of the State House on Saturday, 4th August as part of the Conference programme, for the first time in the Society's thirty-eight years history, five members were made Fellows:

The investiture which was performed by Mr V. K. Aidoo, the President of the Society was witnessed by members and guests including Commissioners, members of the Diplomatic Corps, representatives of other professional associations, and Senior Civil Servants. The fellows are:

Samuel Benson Adjepong, 59, a product of Chelsea, was the first

The Honourable Commissioner for Health, Major A. H. Selormey, cutting the tape to declare open the Pharmaceutical Exhibition. On his immediate right is Mr K. A. Ohene-Manu, Hon. General Secretary and Major Kwame Ag. Director of State Protocol. On the Commissioner's left is Prof. A.N. Tackie (in glasses) Executive Chairman of the Council for Scientific and Industrial Research followed by Mr V. K. Aidoo, the President and Mr T. E. C. Sagoe, Chief Pharmacist, Ministry of Health.

Col. I. K. Acheampong, Head of State and Chairman of NRC at the Display Stand of GIHOC Pharmaceutical Division at the Pharmaceutical Exhibition. Behind him (in beret) is Major A. H. Selormey, Commissioner for Health. Flanking him on his right and left respectively are Dr J. A. Bluckoo-Allotey, General Manager of GIHOC Pharmaceuticals Division and Mr T. E. C. Sagoe, Chief Pharmasist, Ministry of Health.

Charge d'affaires of the Polish Embassy in Ghana, Mr Z. Krolak speaking at the luncheon organised by Polafco (Ghana) Limited on behalf of the Polish Pharmaceutical Industry for participants of the Conference. At this function, the Ambassador presented a Cheque for C500 as the Polish Pharmaceutical Industry's donation to the Pharmaceutical Society of Ghana Headquarters Building Fund and also announced the offer to the Society of a postgraduate scholarship in pharmacy tenable in a Polish University. Sitting on Mr Krolak's immediate left is Mr E. K. B. Yao, Managing Director of Polafco (Ghana) Limited followed by the President of the Society.

● *S. A. Allotey*

Chief Pharmacist of the Ministry of Health. In that capacity, he played a very active role in the enactment of the Pharmacy and Drugs Act, 1961, Act 64 which made membership of the Society mandatory for the practice of pharmacy in Ghana.
Mr Adjepong later retired from the Civil Service and he now owns a Pharmaceutical Manufacturing Company.

Samuel Addotey Allotey, 60, has played active role in the affairs of the Society since 1941. He was Hon. Treasurer from 1954 until 1963 when he was elected Hon. General Secretary. He held this latter office for eight years and during that period he played an effective role in making the Society's views on pressing matters heard, especially at the Pharmacy Board on which he served for 12 years.

James Ebenezer Kwasi Djan, 55, became a member of the Society in 1952 and soon became a Vice-Chairman of the Greater Accra Regional Branch and later a member of Council. From 1963 to 1971, he held the office of Honorary Treasurer of the Society and looked after the financial affairs of the Society creditably.

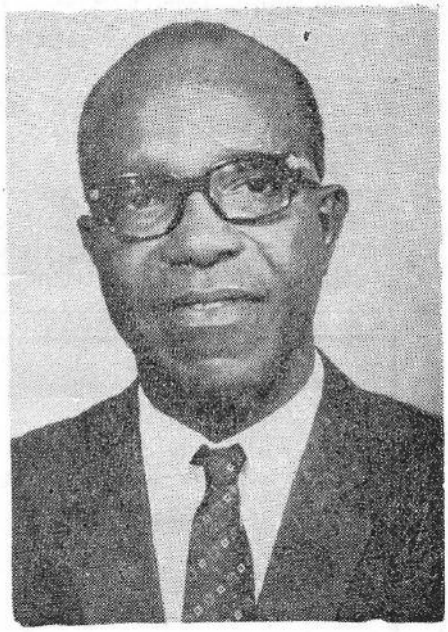
Bernard Eugene Dua Ofori-Atta, 54, qualified in 1940 and became a very active member of the Society in 1949. He was elected Vice-President in 1952 and contributed significantly to the enactment of the Pharmacy and Drugs Act, 1961. He held the office of Vice-President until 1966 when he was deservedly elected President and remained in the latter capacity for five years. During the period 1952–1971, he served on various Boards and Committees including the Pharmacy Board, Committee on Prices of Drugs (Chairman) and represented the Society on the 1968 Constituent Assembly which drew up the Constitution for the Second Republic. Mr Ofori-Atta made excellent and selfless contribution to the progress of the Society during the twenty years that he held offices of Vice-President and President.

Albert Nii Tackie, 49, holds B.Pharm and Ph.D degrees from Chelsea and was appointed Professor and Head of Department of Chemistry, Faculty of Pharmacy, University of Science and Technology, Kumasi, in 1964 and the same year was made Dean of the Faculty a post he held until July 1973 when Government appointed him the Executive Chairman, Council for Scientific and Industrial Research (CSIR). Prof. Tackie who is a member of both the Pharmaceutical Society of Ghana and the Pharmaceutical Society of Great Britain has been a member of the National Council of the former since 1957.

Dean Tackie who is a Fellow of the Ghana Academy of Arts and Sciences was the first Ghanaian Fulbright Professor to teach and carry out research in medicinal chemistry at the School of Pharmacy, Duquesne University, Pittsburgh, U.S.A., and he is a member of the Pharmacognostical Society of the U.S.A.

Professor Tackie had held a number of key positions on various Boards and Committees in industry, Academy of Arts and Sciences, the University of Science and Technology and has been on several University and Government delegations to various Conferences worldwide—Nigeria and China (1964), Switzerland (1965), Australia (1968) and Zaire (1969).

Prof. Tackie has to his credit some twenty principal publications either alone or jointly with eminent Scientists like Prof. Arnold Beckett and Prof. E. J. Shellard both of Chelsea; and J. E. Knapp and P. L. Schiff, Jnr. both of the University of Pittsburgh, U.S.A.
Dr. K. Sarpong, the Vice-President, read the citations.



● *J. E. K. Djan*

Postgraduate Award tenable in Poland:

At a luncheon organised by Polafco (Ghana) Limited on behalf of the Polish Pharmaceutical Industry for the Conference participants on Saturday 4th August, the Charge d'affaires of the Polish Embassy in Ghana, Mr Z. Krolak, presented a Cheque for ₵500.00 as the contribution of the Polish Pharmaceutical Industry to the Pharmaceutical Society of Ghana Headquarters Building Fund. He also announced the offer of one postgraduate scholarship in pharmacy tenable in a Polish University and asked the Society to nominate one of its members for the award.

SOCIETY NEWS

National Headquarters: With effect from 1st November, 1973 the National Headquarters Secretariat has been moved from the Knutsford Avenue premises to BRUN BUILDING, C353/1 NSAWAM ROAD, adjacent to the Accra North Post Office. The postal address of the Headquarters Secretariat and the Journal's Editorial offices are now BRUN BUILDING, C353/1 Nsawam Road, P.O. Box 2133, Accra, Telephone 28341.

National Health Planning Committee: The government last September appointed a 17-member National Health Planning Committee to formulate proposals for the development of all aspects of the Health Service for the five year period 1974-78. Among other things the Committee's proposals are expected to include Manpower and Training, provision of new hospitals and Health Centres and expansion of existing ones, Research into local medicinal plants, possible setting up of more state pharmaceutical factories in regional centres and the control of the importation of drugs.

Mr. V. K. Aidoo, the President, and Mr. K. A. Ohene-Manu, the Hon. General Secretary are members of the committee.

The Greater Accra Regional Branch at a meeting in September elected the following new officers:
Mr. R. Q. Lamptey, (*Chairman*)
Mr. J. Pearce-Biney, (*Vice Chairman*)
Mr. G. K. Acheampong, (*Secretary*)
Mr. J. K. Korsah, (*Treasurer*)
Mr. I. N. Kankam, (*member*).

Northern/Upper Regional Branch have also elected new officers for 1973-74. They are:
Mr. J.P. Brown-Pobee, (*Chairman*)
Mr. J. Y. Kusi, (*Vice Chairman*)
Mr. D. C. Ashiabor, (*Secretary*)
Mr. M. A. Tabi, (*Treasurer*)

Co-operative Pharmacy: The Society intends that a co-operative pharmacy should be opened in Accra and that members of the Society in the Greater Accra Region should be encouraged to become members of the Accra Pharmaceutical Co-operative Society. Membership fees have been fixed at ₵10.00 per head and each member should subscribe at least ten shares each of which is priced at ₵10.00.

Interested members should contact either Mr. V. K. Aidoo or Mr. D. Anim-Addo, c/o. Pharmaceutical Society of Ghana, P.O. Box 2133, Accra.

THE PHARMACEUTICAL SOCIETY OF GHANA

The NATIONAL HEADQUARTERS SECRETARIAT

announces for the information of all members that:

The National Secretariat

and the

Journal's Editorial Offices

have been moved from

KNUTSFORD AVENUE to the Second Floor of BRUN BUILDING, C. 353/1 NSAWAN ROAD (Adjacent to the Accra North Post Office)

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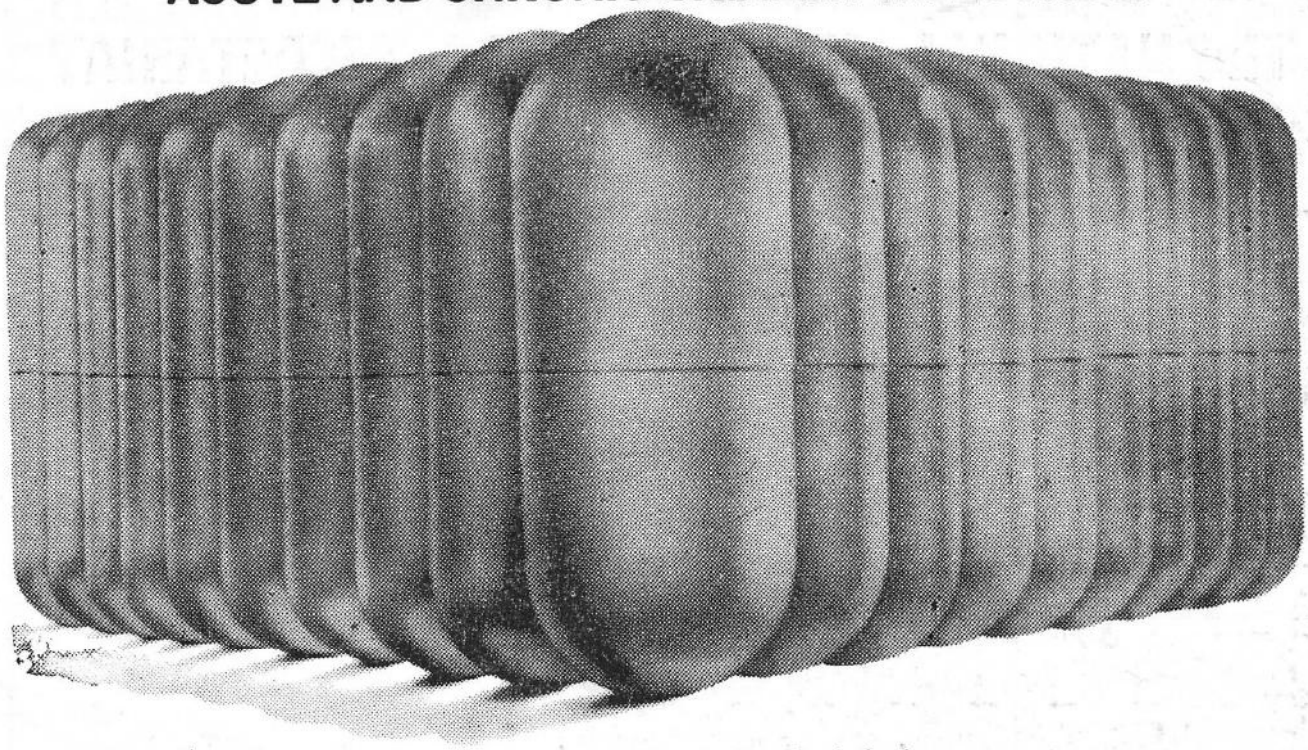

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