

# HISTORY OF CSIR-FOOD RESEARCH INSTITUTE



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## **CSIR-FOOD RESEARCH INSTITUTE**

### **FORMAT FOR COMPILATION OF INSTITUTE'S HISTORY**

#### **1.0 Executive Instrument of the Academy**

On 1<sup>st</sup> January, 1963, the Ghana Academy of Sciences was reconstituted by an Executive Instrument of parliament in exercise of the powers conferred on the President of the Republic of Ghana by the Statutory Corporations Act, 1961 (Act 41), Simultaneously, the Instruments of incorporation of the Ghana Academy of Sciences and the National Research Council made on November 21, 1959 and September 20, 1960 respectively were revoked. The assets and responsibilities of the former Academy and of the former Council were vested in the new Ghana Academy of Sciences.

#### **1.1 Objectives of the Academy**

2. Under the new Instrument, the Academy was charged with the following functions:
  - (a) the organization and co-ordination of research, both pure and applied, in all branches of knowledge;
  - (b) the promotion of the study of all sciences and learning;
  - (c) the establishment and maintenance of proper standards in all fields of Science and learning in Ghana;
  - (d) the recognition of outstanding contributions to the advancement of Science and learning in Ghana; and
  - (e) the discharge of such other functions as may be assigned to it by the President of the Republic of Ghana.

#### **1.2 Divisions of the Academy**

3. The executive Instrument provided for two main divisions within the Academy, namely,
  - (a) the Sections of the Academy; and
  - (b) the Research Division of the Academy.
4. The sections comprised fellows of the Academy and were concerned with scientific and learned problems of a basic nature. There were, at that time, three Sections of the Academy –

the Physical Sciences section, the Biological Sciences section and the Humanities Section. The responsibility for planning and co-ordinating the work of the sections was entrusted to the sectional co-ordinating committee.

5. The Research Division of the Academy was tasked with the organization and pursuit of research specifically related to national, economic and social development. The Research Division was directed by the Research committee of the Academy.

### **1.3 The Praesidium**

The governing body of the Academy was the Praesidium. It was constituted of the President of the Academy, the two Vice-Presidents, the Chairmen of the sections of the Academy and not less than four (4) and not more than seven (7) elected Fellows of the Academy. The Secretary of the Academy was the secretary of the Praesidium.

On 25<sup>th</sup> January, 1963, the Praesidium decided to establish a general purposes committee which would serve as its Executive Committee. The general purpose committee replaced the former standing committee of the Academy.

The end of 1964 marked the completion of two years by the reconstituted Academy which was a merger of the erstwhile National Research Council (founded in August, 1958) and the Ghana Academy of Learning as originally founded in November, 1959. The 2-year period witnessed the steady implementation of the provisions of the new Instrument of incorporation which came into effect on 1<sup>st</sup> January, 1963. The merger of the two bodies could be said to have resulted in a new lease of life, evidenced by the rapid and vigorous expansion of the national research effort and by the active participation of Fellows of the Academy in the formulation of national research policy.

Towards the end of the year 1964, the Praesidium reviewed the structure and plans of the Academy in the light of experience gained over the two years, and especially, in relation to the policy of rapid economic and social development of the country. The new seven-year Development plan was launched in March, 1964. The scale and pace of development envisaged

under the plan necessitated a thorough reappraisal by the Academy of the research needs of the country. The plan was quite explicit on the role of the Academy in this regard. In the field of agriculture, for instance, the plan states: "The importance of agricultural research in promoting the objectives of the Seven-Year Development Plan in the field of agriculture has been emphasized at different points. The Academy of sciences and the universities will be expected to organize research into problems indicated by the Ministry of Agriculture as being of particular interest." In the field of industrial development there were numerous references in the plan to technical problems requiring solution. In its effort to anticipate the research problems of national importance in the various sectors of the economy, the Academy made a comprehensive survey of the short and long-term needs of the country and decided on areas for which new research institutes would be required by the country.

## **2.0 New Research Institutes**

Of the new institutes approved by the Praesidium the following were in various stages of development or of planning:

- Food Research Institute
- Institute of Aquatic Biology
- Industrial Standards Institute
- Nuclear Research Institute
- Marine Fisheries Research Institute
- Institute of Geology and Geophysics

The Food Research Institute was being established to carry out applied research through laboratory and pilot scale investigations into problems of food storage, preservation, processing and utilization. The Institute would assist the development of the food processing industry in Ghana, promote the optimum use of agricultural and marine produce and encourage sustained production in agriculture. By the end of the year 1964 the Institute had actually begun research work in temporary accommodation at 17 Kanda Estate, Accra, the Faculty of Agriculture, Legon, and at the Academy's Food Storage Unit (Crops Research Institute) at Pokuasi.

The origin of the Institute dates from about July, 1961 when the Ghana Government submitted a request to the United Nations Special Fund for assistance in developing a Food Research and Development Unit. The request was based on preparatory work by Professor F. Aylward of the University of Ghana. A revised form of the request was resubmitted in March, 1962, and this was approved in 1963 subject to some modifications. The executing Agency for the United Nations Special Fund was the Food and Agricultural Organization and the Co-operating Agency for the Government of Ghana was the Academy. It was expected that the tripartite Agreement involving the United States Special Fund (U.N.S.F.), the Food and Agricultural organization (FAO) and the Ghana Government was to be signed early 1965. The final form of the Agreement was to take the form of assistance by the U.N.S.F. for the development of a Food Research and Development Unit within a Food Research Institute already established by the Ghana Government under the Academy. The draft executive Instrument establishing the Institute had been completed by the end of the year 1964.

Under the proposed five-year agreement, the U.N.S.F., would provide equipment, fellowships and expert services, and the Ghana Government, buildings, counterpart services and funds for the general running of the Unit. In all, the Ghana Government was to contribute £800,000 over the five-year period and the U.N.S.F., £300,000.

Mr. Ouni Rauha from Finland was appointed the FAO Project Manager for the Unit towards the end of the 1963 and at about the same time Mr. F.W.K. Christian was appointed his Ghana Government counterpart. The unit had a standing co-ordinating committee whose membership embraced interested national organizations and international experts.

Recruitment of research staff began during the year 1964 and fellowships were awarded to suitably qualified Ghanaians for courses in various aspects of food technology. Dr. W.R. Bannatyne, an expert in food analysis and laboratory design, arrived in Ghana in November, 1964.



The permanent laboratories of the Food Research Institute were to be sited at South Legon near the then new Chemical Laboratories of the Ministry of Health. Building of residential accommodation for research staff were began at the Fifth Avenue Extension, Accra.

## **2.1 Food Research Institute**

At the request of the late Dr. Kwame Nkrumah's government, the United Nations Development Programme (UNDP) put together a team of experts to plan the establishment of the Food Research Institute. The team was made up of seasoned food technologists from developed and developing countries, who had relevant experience in similar institutions. It was led by Dr. Parpia who was then the Director of the Central Food Technology Research Institute (CFTRI) in Mysore, India.

Subsequently, The Council for Scientific and Industrial Research- Food Research Institute (CSIR-FRI) was started as a national project with UNDP as the funding agency and the FAO as the executing agency. The project was called "UNDP/FAO Project-Food Research and Development Unit". It lasted for five years, from October 1965 to September 1970. Mr. Ouni Rauha was the Project manager with Mr. F.W.K. Christian as the counterpart manager.

The original plan of the project was to establish a unit with appropriate infrastructure equipped with required facilities and manned by trained Scientists in relevant areas of specialization. Secondly, the project was to assist the Unit to carry out a coordinated programme of applied research in the storage, processing, preservation and marketing of foods. The purpose of these studies was to contribute towards the development of the food industry in the country. Findings of these research studies were expected to guide Scientists of the unit to play the crucial role of advising the food industry in their operations as well as advising the government in its policy implementation aimed at increasing food productivity.

At the initial stage of project implementation, 13 bungalows were built by the government to accommodate expatriate resident scientists on the project. At the same location behind the Police headquarters pre-fabricated buildings were put up by UNDP to serve as temporary laboratories, offices, a conference room and a part of the expected project outputs, permanent

buildings were planned to be constructed at Okponglo, behind the Ghana Standard Authority. These were to include a pilot plant, which was seen as an essential facility for food product.

International experts were recruited by FAO as resident research scientist who named the project. They had specialization in various areas of Food Technology; nutrition. Refrigeration engineering, economics and marketing. Each expatriate scientist had a Ghanaian counterpart scientist who worked with him/her.

Unfortunately, on 24<sup>th</sup> February 1966, the government of Dr. Kwame Nkrumah was ousted by a military coup. The policy agenda of the new government did not regard the project as a priority. This adversely affected the progress of the project.

In the light of the political disruption of the country which began in early 1966, started the end of the six (6) year management period of the National Research.

From 1963-66, the Research Institutes under the management of the Academy were intense with activity, worked briskly, made progress and recorded significant achievements.

It may be unrealistic to attempt an assessment of the work done by each institute in that period. Undoubtedly, all the Institutes and units had worked and been productive.

The new research Institutes, including the Food Research Institute had been reasonably established and accommodated. The CSIR-FRI had already devised a new commercial fish processing oven which had been adopted by other countries in the Region and had made progress with issues related to food preservation and storage.

The coup de tat by the Ghana Military on the 24<sup>th</sup> of February, 1966 resulted in the removal of the President, Osagyefo Dr. Kwame Nkrumah. The overthrow came with the usual recriminations which are normally associated with such events. Some of it was directed against the Academy, of which until then, was chaired by the president of the Republic.

In the climate of hostility against the ex-president, it was not surprising that shortly after the coup, the Praesidium of the Academy gave consideration to the expulsion of the ex-president, which was effected to the displeasure of some of the fellows. And in this way, the extra-ordinary

history was made on 22<sup>nd</sup> April 1966, as the founder and President of the Ghana Academy of sciences was expelled.

Soon after the disruption and change of Government, Fellows of the Academy had also felt it opportune to review the role, structure and functions of the Academy so that it may better and more effectively serve the nation Ghana.

At its meeting of April 13. 1966, a committee was appointed, headed by Prof. F.G. T Torto to consider the future of the Academy. Rumours about the impending closing down of the Research Division of the Academy and the transfer of its Research Institutes to other institutions, like the Universities became widespread.

It was indeed a difficult time for the Research Division of the Academy. It seemed like the impending destruction of the basis of the nation's capacity for research. It was a period of major threat for the National Research institution for which the Academy had given undivided attention for four (4) years and worked together to upgrade and enhance.

On May 25, 1966, the Prof. Torto's committee which had been mandated to consider a way forward for the Academy recommended, at a general meeting of Fellows that the Academy should revert to its original role of a learned Academy and dispersed with the responsibility for national research and the management of the National Research Institutes.

The military Government also organized a committee under the chairmanship of Sir John Cockroft, the famous Physicist, to review and recommend a future for the Academy.

The interference caused by the coup notwithstanding, several activities which had been planned by the Academy for 1966 were satisfactorily pursued.

In January 1967, the Cockcroft Committee after interviewing many people, including the Fellows of the Academy, the Universities and Directors of Research Institutes submitted its report to the government. The recommendation was that the Academy of Sciences be split to the original Learned Academy and a National Research Council.

The recommendation accepted on the 11<sup>th</sup> of October 1968 by NLC Decree 219, Ghana Academy of Sciences Act 1968, the Military Government split the Ghana Academy of Sciences into two (2) organizations that is the Ghana Academy of Arts and Sciences and the Council for Scientific and Industrial Research (CSIR).

In the first CSIR Annual Report which covered the period 12<sup>th</sup> October, 1968 to 30<sup>th</sup> June 1969, an account was given of the various developments which led to the re-organization of the former Ghana Academy of Sciences and the re-constitution to its Research Division under the present council. An account was also given of the various steps taken, before and after the formal inauguration of the council, to give practical effect to the provisions of NLC Decree 293 by which the Council was established.

The entry of the council into its second year on 1<sup>st</sup> July 1969 (i.e. the beginning of the financial year of the Government), saw the new structural machinery for the administration of research under the council fully instituted and running smoothly: the management Boards of the Research Institutes had been properly constituted and had begun to function satisfactorily; and so had the main committees set up directly under the council itself, namely, the Executive committee, the Finance and Development committee, the personnel and establishment committee, the Research co-ordinating committee, and the appointments and Promotions committee.

By the end of the reporting period, draft bye-laws had been approved by the Council and referred to the Attorney-General's Office for scrutiny. Considerable progress had also been made on the revision of the scheme and conditions of Service for the staff of the council in the light of the recommendations of the Cockcroft Committee and of the Senior Staff Review Committees.

At the end of the reporting year, under the Directorship of Mr. F. W. K. Christian, there remain only three months for the completion of the United Nation's Programme of assistance of the Food Research Institute. Of significance during the year, therefore, was the final preparation of the Food Research Institute to assume full responsibility for the future development of the Institute, while the United Nations counterparts concluded their contribution for a smooth withdrawal.

At the time, the United Nations had virtually fulfilled their part of the agreement for assistance. The bulk of equipment to be supplied by them, to the value of \$91,000, had been received with the remainder on order. Only a balance of a five-week fellowship award for an external tour remained to be executed on the fellowship training programme. Apart from necessary modifications in field of discipline and experience, the full expert counterpart programme had been carried out.

On the other hand, the contribution of Ghana Government, owing to the financial straits of the times which threatened to continue for some time, fell far below expectation. The Pilot Plant which should have been completed in 1967 would not be completed before 1972. Allocation for recurrent expenditure on servicing materials and equipment was very stringent; this applied to staffing also. The construction of a permanent laboratory appeared to have been shelved indefinitely.

In spite of these problems the project, as a joint effort, succeeded to establish a good foundation from which a viable Food Research Institute had emerged. It was on this score that a consensus was reached that an extension of this project, in this form, would no longer be necessary when it ended.

## Report of UNDP evaluation mission

A visit to FRI-Ghana, in January 1971, of the UNDP/FAO Evaluation Mission took place. The report of the Mission was received in 1972. The report observed that despite the much-publicized vicissitudes of Ghana's economy, the concept of the CSIR-FRI was a reasonable one. Ghana imports substantial amounts of food, the greater proportion of which could be produced locally. There was therefore considerable scope for local processing not only to permit storage and transport, but to provide variety and improve palatability and nutritive value. The mission noted that a number of processing factories had already been constructed; and, as the market for processed products also existed, the problem was to decide which of the manufacturing plants could benefit most in economic terms from the application of food science and technology.

The mission noted that a good number of Ghanaian staff had been trained in a number of specialized fields. This was reflected in the considerable number of papers published. One shortcoming in the staffing position, however, was the absence of a substantive Director for the Institute throughout the duration of the Food Research and Development Project. The Acting Director of the Institute who was the project Co-Manager in the person of Mr. F.W.K Christian resigned in November 1970, and there was no one immediately available to fill up the vacant post leaving Mr. J.E.M. Bartels, BSc. (Lond.) M.S. Wisconsin) as the officer-in-charge. The mission recommended that as a matter of urgency the vacant post of Director should be filled with a Ghanaian. Staff should also be selected for further training to the Ph. D. level and for courses designed to give them additional industrial experience.

The mission was of the view that the existing premises were unsatisfactory since only small items of equipment such as grinders, slicers, sieves and drying cabinets could be housed in them. Heavy equipment requiring water, steam disposal and heavy electrical systems could not be accommodated. The point was emphasized that the UNDP/FAO share of the cost of equipment was small and was used primarily for instruments, glassware and very light equipment.

In spite of these shortcomings, a corpus of knowledge useful to food processing entrepreneurs, marketing organisations, farmers and government ministries had been built up, and there was every indication that the application of this knowledge would increase as the institute became more firmly established in the local setting. Actual work in progress, however, appeared to be too diversified and not adequately co-ordinated with each other while liaison and co-ordination with other bodies tended to be ad hoc.

#### Re-organization of research and service structure

The Management Board had independently expressed concern about the need for the research staff to gain appropriate industrial experience. It was, therefore, considered worthwhile to place great emphasis on the attachment, for limited periods, of research staff to food industries abroad under technical aid. This could be followed by further attachment to local industries. It had also been noted by the Management Board that research activities needed a more co-ordinated approach and that it was important to strengthen the links with the private sector especially.

In the execution of research, it was realized that undue prominence had been given to subject matter specialization without establishing the appropriate working relationships that would create the relevant administrative and technical groups. Besides, the more pressing needs of the newly-established food industries, such as expert services, advice and extension work, were not being adequately met. Since the senior research staff were often required to undertake these routine activities, research work was frequently interrupted and the rather weak co-ordinating links that existed were often unduly strained.

A special effort was therefore to be made to lay the foundation for an organizational structure that would cater for research and services without any cross-interference. The distinction between research and services of a routine nature was formalized: research would be conducted by the research officers and services provided by the technicians in consultation with the research officers to whom the former were responsible.

The institute was reconstituted into the following Divisions:

- (a) Processing and Engineering
- (b) Chemistry, microbiology and Nutrition Biochemistry
- (c) Consumption Surveys, Economics and Marketing

Cutting across each Division are the research and services components.

With the return of Mrs. Juliana Maud Kordylas from study leave, in April 1971, a nutritional-biochemical laboratory as well as an animal laboratory were equipped and organized. Problems of space however, limited the requisite development.

Even though it was early to evaluate the effectiveness of the above restructuring there were indications that the institute was in a much better position to pay closer attention to the following specific needs of the food industries:

- (i) Standardization and quality control of locally manufactured foods and food products.
- (ii) Development of new food products from local raw materials.
- (iii) Improvement of existing food products
- (iv) Studies on local food habits and consumption patterns.
- (v) Collection of relevant statistical data on the local food marketing and distribution centres
- (vi) Costing of manufacturing operations
- (vii) Development and construction of cheap and simple mechanical aids to food processing establishments based on local materials and essential imports.
- (viii) Development of cheap, easy but efficient means of food preparation.

Consultancy and services to outside bodies

One of the most important undertakings of the Government during the period 1972 was the "Operation Feed Yourself" programme which was launched in March 1972. Owing to the emphasis placed on the production of raw foodstuffs, the institute was called upon to play a very important part in the programme. The institute was fully represented on the sub-committees



appointed by the Commissioner for Agriculture to identify the storage facilities in the country that would be mobilized to handle the expected bumper harvest.

The Institute participated in the following Exhibitions:

- (i) Greater Accra Regional Agricultural Show – the 2<sup>nd</sup> phase of “Operation Feed yourself”, 9-10th November 1973, Trade Fair Site, Accra
- (ii) 2<sup>nd</sup> Anniversary Celebration of the National Redemption Council 11-20th January 1973, Arts Centre, Accra.

Another sub-committee, on which the institute was represented, was charged with the responsibility to examine questions related to the preservation and storage of vegetables and fish. To this sub-committee the institute made available all the information and experience accumulated over the years in product development, preservation and storage.

Another major involvement was the reactivation of the Tema Interlocking Food Complex, the development had taken place in various stages. The fish Canning Unit of this Complex relied to a considerable extent on the facilities and personnel of the institute in the evaluation of the local sardines for canning and the local sources of oil as canning media.

In the field of industrial consultancy, the evaluation and advice of various products were met. Requests for routine chemical and microbiological analyses increased. The then national Standards Board remained a very important client in connection with its work on the certification of food products; and the Government Chemical laboratory continued to rely on the institute for its microbiological tests.

In the institute, a number of products were added to the products already developed. The instant *tatale* mix was tested for shelf life with noteworthy success. A dehydrated oil palm preparation for ready-to-use palm soup was produced and packed in polythene bags. This form resulted in a longer storage and eliminates the drudgery in the pounding of the fruits.

A continuous search for opportunities for import substitution either in part or wholly was maintained. Part-substitution offered a better chance of success, and the major item under consideration was wheat flour. Various trials were conducted on the incorporation of sorghum meal and corn flour in cakes and bread at a variety of levels with corresponding reduction in the level of wheat flour.

Work on wine production from local fruits and vegetables also gained the full support of the State Distilleries Corporation. The use of bakers' yeast in this preparation yielded an alcohol level that was below expectation. The Corporation then provided the conventional wine yeast in support of this experiment. The local sources of raw materials were pineapples, oranges, tomatoes and grapes.

#### Development in 1972

The institute's inability to conduct pilot scale trials because of the non-completion of the pilot plant left unsolved certain basic and practical questions about processing on a commercial scale. Besides, there had not been the opportunity to test the raw material supplies situation and market preference. The absence of the pilot plant, even though crippling, had not completely eliminated the effort to reach the food processing industries. Important personal contacts were made although these were limited in scope. The institute also launched a bi-monthly newsletter that was distributed to as many food factories as possible and the allied Government and private agencies. The feedback was sporadic but with time it was expected that the newsletter would serve as a useful channel of communication.

Towards the end of 1971, a proposal was submitted to the Ghana government for co-operation with the International Development and Research Centre (IDRC), Ottawa, to develop coastal fisheries in West Africa with the initial project in Ghana. A team of experts arrived in the country about the same time to prepare a draft plan of operation. Quite apart from the active

participation of the institute in the planning, the team drew on the fish-processing experience of the institute, especially for the fish-processing programme for the project.

The agreement to implement the project was signed in May, 1972 and the project was based at Elmina. Three Research Officers of the institute who were closely associated with the field work of the project undertook research relevant to its objectives.

### Development

The pace of the pilot Plant was very slow owing to failures of the main contractor which affected the schedule of supplementary works. With prospect of completion further postponed, the Institute embarked on additional temporary measures to support expansion in staff and increased load of work from internal sources and from the food industry.

Extension were therefore made to the existing pre-fabricated buildings of the institute. The additional rooms provided further accommodation for administrative and accounting offices and a hot and a cold processing laboratories. The re-allocation of rooms also allowed renovation for a meat processing hall. The extreme congestion was thus relieved even though it was only a temporary measure.

### Fellowships

The turn-over of fellowships diminished considerably since the main support had come from the U.N.D.P. which had accomplished part of the programme with the most of the recipients already returned. The only award for the year was granted to Miss G. Okraku-Offei for attachment programmes, for a period of six months, with the Institute for Fishery Products in the Netherlands, Ross Fish Limited in Hull, Marshall and Company in Aberdeen (Fish canning), and Tropical Products Institute in London (fresh foods section). She returned on the 28<sup>th</sup> June 1970.

Other arrivals were Messrs' John Dei Tutu and John K Amenu. The former completed his Master of Science degree in Food Technology at the University of New South Wales in Australia. He

returned to initiate research in fruits and vegetables. The latter resumed his work on Food Storage Research.

#### U.N.D.P/F.A.O. Experts programme

The only addition to the cadre of U.N.D.P/F.A.O. Experts was Mr. L. A. Antoun for the fats and oil. The following experts completed their assignment; Dr. A. R. Sundararajan, Food Chemist, Dr. L. Eisfeld, Food economist, and Mr. A. Trenning and Associate Experts.

#### Staff Matters

With the improvements of equipment and accommodation facilities for the other units in the Institute, the locus of appointments began to spread out more evenly in place of the former bias towards chemistry. The staffing position remained more stable than previously and recruitment was induced more by growth than the need for replacements.

#### Relationship with Industry

Further progress was made by the Institute in strengthening its relationship with both Government and Private Food Industries and allied agencies.

Three members of staff including the Acting Director were appointed in advisory capacities to serve on the Task Force, the newly-created Food Distribution Agency of the Ministry of Agriculture. An equal number of staff were also appointed to the management committees of three food divisions of the Ghana Industrial Holding Corporation, viz. The State Cannery Division in Nsawam, the Vegetable Oil Mills Division and the Meat Factory at Bolgatanga. The vegetable oil mills received additional technical assistance in refined oil development, quality control and limited training in laboratory techniques of the staff.

Leads were given to private food manufacturing enterprises in the research and development of a number of products. These included instant *fufu* granules from cassava, yam and plantain, *tatale* or *kaklo* mixes from plantain and maize meal, shortening from shea butter, and other dehydrated foods. The need to bridge the gap between development and commercial production

was strongly felt. With the completion of the Pilot Plant still outstanding, existing facilities were fully stretched to make up for this deficiency.

A distinction was made during the 1973- 1974 reporting year between the Control Laboratory Services, which are in high demand, and the Industrial Consultancy and Advisory Services, which were in high demand, and the Industrial Consultancy and Advisory Services which obtained their support from the sphere of research. It was hoped that a specialized Control Laboratory would eventually evolve together with a Development Service which would form a liaison between research and control services on the one hand and with the user sectors on the other.

This organizational structure which was anticipated was based on the experience so far gained in the Institute's relationships with the food industries. This had been markedly fostered by Institute's participation in various exhibitions and by the bi-monthly FRI Newsletter for which a wide circulation was planned.

### **3.0 Research and Development Projects of the Institute**

All Directors of the Institute were successful in assisting in attracting funds to the Institute for Research and Development activities from external agencies such as Danish international development Agency (DANIDA), International fund for Agricultural development (IFAD), United States Agency for International Development (USAID), GATSBY Foundation, United Nations Industrial Development Organization (UNIDO), Bill and Melinda Gates Foundation, the European Union (EU), UK Department for International Development (DFID), the British Council, and the Millennium Challenge Account. In addition, several pieces of equipment were acquired through these projects. A brewing plant worth US\$500,000.00 was also acquired and commissioned through CFC/UNIDO funding.

From the start of CSIR-FRI in the 1960's, the following projects had been successfully implemented, however, the following table indicates the projects executed by CSIR-FRI starting 2007 up until date/ 2021.

- Ghana-Netherlands Artisanal Fish Processing Project
- DANIDA Project (KVL-Denmark) (Fermentation, Microbiology, Mycotoxins, SANAS Accreditation etc.),
- United States Agency for International Development(USAID) Soybean Project
- United Kingdom Department for International Development (DFID)/Crop postharvest program (CPHP) Bambara Project, Rice Project, Cassava Project, Street Foods Project
- UNIDO Sorghum Malt Project
- Agricultural Services Sub-Sector Investment. Program (AgSSIP)- Building of CSIR-FRI Administrative block and other Research and Development activities
- Natural Resources Institute of University of Greenwich (NRI) Projects- (Cassava, Rice, Streetfoods),
- National Agricultural Research Programme (NARP)
- West Africa Agricultural Productivity Programme (WAAPP) projects,
- International Fund for International Development (IFAD) Sorghum Project,
- Improving post-harvest quality and packaging of rice, sorghum/millet and cassava products to enhance marketability in West Africa

**Table 1: Past and current projects in CSIR-Food Research Institute**

	<b>Title</b>	<b>Estimated Duration</b>	<b>Start date</b>	<b>Expected date of completion</b>
1.	Tailoring Food Science and Technology to endogenous patterns of food supply for future nutrition	4 years	February, 2007	December, 2011
2.	Cassava: Adding Value for Africa project-C:AVA-Ghana	3 years	May, 2008	March, 2013
3.	Millennium Development Authority (MIDA) Agricultural Project	4 years	May, 2008	February, 2011
4.	Cassava: Adding Value for Africa project- CSIR-FRI	3 years	June, 2008	February, 2011
5.	Developing Protein-enriched extruded plantain snack for Ghana	1 year	7/01/09	30/06/10
6.	CSIR-FRI/GTZ/MOAPP Storage of dehydrated fruits Projects	2 years		
7.	Unleashing the power of cassava in Africa in response to the food price crisis	1 year, 7months	May, 2009	December, 2010
8.	African Food Tradition Revisited by Research (AFTER) Project	4 years	June , 2010	June 2014
9.	Micronutrient enrichment of meals fed to pupils, using highly nutritious and low-cost underutilized fish under the	1 year	November, 2010	July, 2011

	school feeding programme in Ghana			
10.	Development and optimization of choco-peanut spread and development of high quality stabilized peanut butter	2 years	March, 2011	October, 2011
11.	Use of alternative food flours for baking-Capacity and capability building of local bakers and educational Institution in coastal communities	1 years, 6months	April, 2011	September, 2012
12.	Rice Sector Support Project- Technical Assessment of Rice production and Post harvest Practices (RSSP)	2 years	August, 2011	August, 2013
13.	CIDA-funded/AfricaRice Project on Rice post-harvest handling, marketing and the development of new rice-based products	5 years	August, 2011	31 <sup>st</sup> March, 2017
14.	Tackling Malnutrition in Northern Ghana-Cereal Flour Fortification	2 years	2011	2013
15.	Effect of body fat, lifestyle, dietary habits and physical activity on the health outcome of Research Scientist in CSIR	1year		
16.	Impact assessment study of a community-based milling and fortification study in Northern Ghana	3 months		



17.	Improving food security by reducing post harvest losses in the fisheries sector (SECUREFISH)	3 years	1st Jan, 2012	1st Jan, 2015
18.	Gains from losses of root and tuber crops (GRATITUDE)	2 years, 8 months	January, 2012	January, 2015
19.	Improving livelihood of small holder cassava farmers through better access to Growth Markets(CASSAVA G MARKETS)	4years, 6 months	1st June 2012	31st December, 2016
20.	Characterization, conservation and domestication of indigenous edible and medicinal mushrooms on agricultural residues (CEDDEM)	2 years	January, 2013	2015
21.	West African Agricultural Productivity Project- WAAPP2A	5 years	20th January, 2013	December, 2017
22.	Development of edible and medicinal mushrooms as functional foods in GHANA (PEER)	3 years	August, 2013	March, 2016
23.	Cassava: Adding Value for Africa (C:AVA II) Project-Ghana	5 years	Jan, 2014	
24.	Upscaling the Nigerian Flash Drying Experience for Sustainable Regional Trade and Income Generation in West Africa (UDESWA)	3 years	1-Mar-14	21st December 2016
25.	Preserving African Food Microorganisms Green Growth	4 years	May, 2014	

26.	Cashew Fruits- Adding Value for Food Security	2 years	May, 2015	June, 2017
27.	Developing Low cost nutrient dense fish products	6 Months	2015	2015
28.	The cassava integrated enterprise development (EDIF) PROJECT	1 year	January, 2016	
29.	Developing biomass-based value chain of plantain and reduce post-harvest losses of plantain through the development of value added products for small scale farmers and processors in two regions in Ghana.	1 year	Oct, 2016	December, 2017
30.	Research on the possibility of sea-freighting bio sugar loaf pineapples	3 months	May, 2017	
31.	Sawdust for mushroom cultivation in ayum forest area, Brong-Ahafo region [Australian direct aid Mushroom Project (AUS-DAMP)]	8 months	15th May 2017	Jul-18
32.	Aflatoxin in fish feed: it's implication on growth and nutritive value of farmed fish (Oreochromis Niloticus) in Ghana.	1 year	: 1st September, 2017	Sept, 2018
33.	Up-scaling millet grain sourdough technology and extruded snacks for sustainable livelihood in West Africa (MBOSS)	2 years, 6 months	January, 2018	November, 2019

34.	Small Fish and Food Security (SmallFishFood): Towards innovative integration of fish in African food systems to improve nutrition	3 years	1st September, 2018	31st August, 2021
35.	Development of bacteriophage cocktails as disease biocontrol agents for improved aquaculture productivity, food and nutrition safety in Ghana and Uganda – Safe Fish	3 years (36 months)	22nd December 2018	
36.	Building Climate-resilience into basin water management - CREAM	5 years	March, 2019	
37.	Ghana Cassava Industrialisation Partnership Project (GCIPP)	2 years	April, 2019	
38.	Food Fortification Research Portfolio Development And Management (2fas): Integrated Strategies For Micronutrient Deficiency Reduction	2 years , 8 months	January, 2020	
39.	Improving Nutrition in Africa by strengthening the diversity, sustainability, resilience and connectivity of food systems (HEALTHYFOODAFRICA)	4years, 5 months		
40.	Modernization of Agriculture in Ghana (MAG)	2017		

### **3.1 Project Outputs**

1. A document on food composition which gave the nutrient content of important foods in Ghana was written.
2. Another project output which is now very popular in West Africa was the improved artisanal technology for hot-smoking and preservation of fish.
3. There was the construction of a pilot plant. This activity was delayed so the plant could not be as fully equipped as was originally planned.
4. Ghanaian counterpart scientist and a technician were given postgraduate training abroad. In all, 16 scientists were trained. Sponsorship of the training programme was by UNDP, the commonwealth Fund for Technical Co-operation, the British Technical Assistance Fund as well as the government of Ghana.
5. Sponsored by the British Council, Mr. K.K. Eyeson went to the Tropical Products Institute, London, for a practical attachment course in food chemistry. This course lasted from 29th August 1973 to 26<sup>th</sup> February 1974.
6. Mr. St. John A. Clotey was offered an FAO/DANIDA fellowship to pursue a post-graduate course in food Hygiene and Veterinary Public Health in Copenhagen, Denmark. The course lasted from 1<sup>st</sup> September 1973 to 30<sup>th</sup> June 1974.
7. Provision of advisory services to food processing factories under the Ghana Industrial Holding Corporation (GIHOC) was an expected output which was fully achieved. Relevant scientists paid periodic visit to observe their operations and to give advice on how to maintain product quality and safety.

The following factories were visited by scientist with relevant specialization:

- GIHOC Corned Beef Factory at Bolgatanga

At a point in time, this factory decided to come out with big sizes of canned corned beef (about 6-8 times the regular size). This size was meant for parties, boarding

schools, hotels and hostels. Unfortunately, this pack size of corned beef had very poor shelf-life and posed a threat to the health and safety of the consumers.

The meat processing specialist on the project spent some months with them to identify the cause of the problem. It was due to insufficient heating during the sterilization of the canned product. After a number of trials, the appropriate length of time in the autoclave was determined and the problem was solved.

- Esiama Oil Mills (in the Western Region)

The Fats and Oils specialist on the project assisted the enterprise to come out with a new product called Makola Cooking Oil. This was a refined and deodorized oil developed from coconut oil.

- Nsawam Cannery produced canned pineapple slices, canned okro, canned garden eggs and canned tomatoes.
- The State Fishing Corporation received advisory services from the refrigeration engineer on the project. The scientists who played those advisory roles also served on the Management Boards of these enterprises. All these services continued after the project ended, until the factories and the fishing enterprise stopped functioning.

A major set-back was the inability of the project to construct permanent buildings for laboratories and offices as originally planned.

### **3.2 The fish section of the CSIR- Food Research Institute**

Under the broad umbrella of the Food Processing Division of the Food Research Institute, the Fish Section started as part of FAO/UNDP Project.

At the time Mr. B. Kagan, an FAO Fish Expert was assigned to the Institute to give effect to the establishment of the Section in 1968 with the assistance of a Local Counterpart in the person of Miss Gladys A. Okraku-Offei later known as Mrs Gladys A. Nerquaye-Tetteh.

Notable amongst the activities of the Section was the development and introduction of the Chorkor Smoker to the fishing community at Chorkor a suburb in Accra.

Following the significant success, the technology was extended through a United Nations Children's emergency fund (UNICEF) Fish Smoking Extension Project of the National Council on Women and Development (NCWD) with the assistance of the Food Research Institute along coastal Ghana specifically Ada and Keta from June 1983 to January 1984. In the process a Practical Guide to Improved Fish Smoking in West Africa was prepared.

As a sequel to this activity, a Ghana/Netherlands Regional Training and Applied Research in Artisanal Fish Processing which was funded by the Netherlands Government was started and operated for a ten (10) year period from 1986 to 1996.

The training programme for Extension Officers attracted participants from West and East Africa including Ghana. It was residential and lasted six weeks at each instance. It entailed both theory and field practical in the construction of Chorkor smokers in the selected fishing communities. At the end of each of the training sessions, the Chorkor smokers constructed by the participants were donated to the fish smokers in the communities involved in the exercise.

As a result of the prolonged and sustained nature of the programme, Ghana through the Food Research Institute benefitted immensely both in terms of financial and non-financial assets as it was able to acquire assets including the present Fishery Resource Centre as well as fleet of vehicles used for the project.

Additionally, the programme made it possible for the technology to be replicated in African countries like Kenya, Ethiopia, Nigeria, Sierra-Leona, Liberia and the Gambia through their respective participants who attended the training over the period.



Figure 1: Fishery Resource centre sponsored by the Dutch Government and built by Mrs. Gladys Neequaye Tetteh

**3.3 DANIDA PROJECT**

**Building capability for research into indigenous African fermented foods**

The pivotal role played by Prof. Mogens Jakobsen since 1992. Mogens had an African dream in 1992. He spearheaded the Inception of 'Capability building for research into traditional food fermentation processing in Ghana (later, West Africa). Funded by DANIDA (1991-2011) with CSIR-FRI and Burkina Faso.



Prof Mogens Jakobsen

Moses Mengu, Danish Technological Institute

Alfred Jorgensen Lab. Denmark



Dr. Mary Halm  
CSIR-FRI, Ghana

Figure 2: Key contributors to DANIDA project

19 years on

- Several collaborative projects on indigenous African fermented foods have been carried out by a network of food microbiologists from LIFE, several African research institutions including university departments and also Institute of Hygiene and Toxicology, Germany



Figure 3: Prof. Dr Wilhelm Holzapfel, former Director of Institute of Hygiene and Toxicology, Federal Research Centre for Nutrition and Food, Karlsruhe, Germany. Key partner and co-leader in most of the collaborative projects on indigenous African fermented foods





**19 years on - products which have been studied extensively in the series of projects**

**Maize**

- ✓ Kenkey
- ✓ Mutwiwa
- ✓ Soy-ogi

**Cassava**

- ✓ Agbelima
- ✓ Akyeke
- ✓ Kivunde
- ✓ Gari
- ✓ Palm sap
- ✓ Palm wine

**African locust beans**

- ✓ Soumbala
- ✓ Afitin
- ✓ Iru
- ✓ Sonru

**Cocoa**

- ✓ Cocoa beans

**Coffee**

- ✓ Coffee beans

**Roselle seeds**

- ✓ Bikalga

**Sorghum**

- ✓ Dolo
- ✓ Pito
- ✓ Gowe

**Soybeans**

- ✓ Soydawadawa

**Milk**

- ✓ Kweniorik
- ✓ Rob
- ✓ Ergo
- ✓ Nyamire

**Millet**

- ✓ Koko sour water
- ✓ Koko
- ✓ Maasa
- ✓ Fura

**Kapok seeds**

- ✓ Kantong

**Baobab seeds**

- ✓ Maari

**African institutions which have been involved in the series of projects on indigenous African fermented foods initiated by Prof. Mogens Jakobsen**

**WEST AFRICA**

**Ghana**

- ✓ CSIR-Food Research Institute, Ghana.
- ✓ University of Development Studies, Tamale, Ghana.
- ✓ Cocoa Research Institute of Ghana
- ✓ University of Ghana, Dept of nutrition and Food Science

**Burkina faso**

- ✓ Departement de Technologie Alimentaire, Burkina Faso.
- ✓ University of Ouagadougou

**Benin**

- ✓ University of Abomey-Calavi
- ✓ DNSA

Nigeria

- ✓ Federal Institute of Industrial Research, Oshodi, Nigeria.
- ✓ Cocoa Research Institute of Nigeria

Ivory Coast

- ✓ Centre National de Recherche Agronomique,.

Mali

- ✓ Institute of Rural Economy (IER)

### **EAST AFRICA**

Kenya

- ✓ Kenya Industrial Research and Development Institute.
- ✓ University of Nairobi

Uganda

- ✓ Ugandan Industrial Research Institute.

Tanzania

- ✓ Tanzania Industrial Research and Development Organisation

Ethiopia

- ✓ Ethiopian Health and Nutrition Research Institute.

### **CENTRAL AFRICA**

Sudan

- ✓ Food Research centre for Agricultural Research Corporation, Sudan.

### **SOUTHERN AFRICA**

Zimbabwe

- ✓ Scientific and Industrial Research and Development Centre, Zimbabwe.

South Africa

- ✓ Stellenbosch University, South Africa.

**Projects on indigenous African fermented foods (mostly initiated by Prof Mogens Jakobsen)**

1. Capability building for research into traditional food fermentation processing in West Africa. Project 1 (1992-2004). DANIDA funded project
2. Capability building for research into traditional food fermentation processing in West Africa. Project 2 (2004 to 2011). DANIDA funded project
3. Capability building for research and development in quality assurance and fermentation technology for traditional African fermented foods (1995-1998). EU project.
4. Capability building for research and development in traditional fermented African dairy products (1996-1999). EU project
5. Degradation of aflatoxins in fermented African foods (1999-2004). EU project
6. Development of biochemical and molecular markers for determining quality assurance in the primary processing of cocoa in West Africa (2002-2007). EU project.
7. An integrated approach to prevent ochratoxin A contamination in post-harvest processing of coffee in East Africa
8. Implementing new method for cocoa fermentation in Ghana.
9. The Influence of fermentation method of cocoa beans and processing parameters on chocolate quality
10. Value-added processing of underutilised savanna tree seeds for improved food security and income generation in West Africa.
11. Improving the quality and nutritional status of "GARI" through the use of starter cultures and fortification with soybean, palm oil and coconut milk (2004-2008)

**Approach to capacity building in African research institutions/university departments**

- Training of scientists (Mainly sandwiched PhD programmes)
- Training of laboratory technicians (In Africa by European and African scientists and technicians; Visits to European labs)
- Renovation of laboratories

- Acquisition of more advanced analytical equipment eg High Performance Liquid Chromatography, Gas Chromatography-Mass Spectrometry, Polymerase Chain Reaction, Denaturing Gradient Gel Electrophoresis (DGGE).
- Introduction of more advanced analytical techniques.
  - e.g molecular characterisation of microorganisms, aroma analysis, mycotoxin analysis
- Postgraduate projects supervised out in African partners' laboratories
- Establishment of pilot plant.
- Training in Quality Management Systems (Good Manufacturing Practices, Good hygienic Practices) GHP, Hazard Analysis Critical Control point (HACCP), ISO 22000
- Accreditation of laboratory to ISO 17025

**Laboratories: Renovations and new labs (all funded by DANIDA)**

Two major laboratory renovations

- Food Research Institute, Accra, Ghana
  - Food Microbiology Laboratory
  - Food Chemistry Laboratories

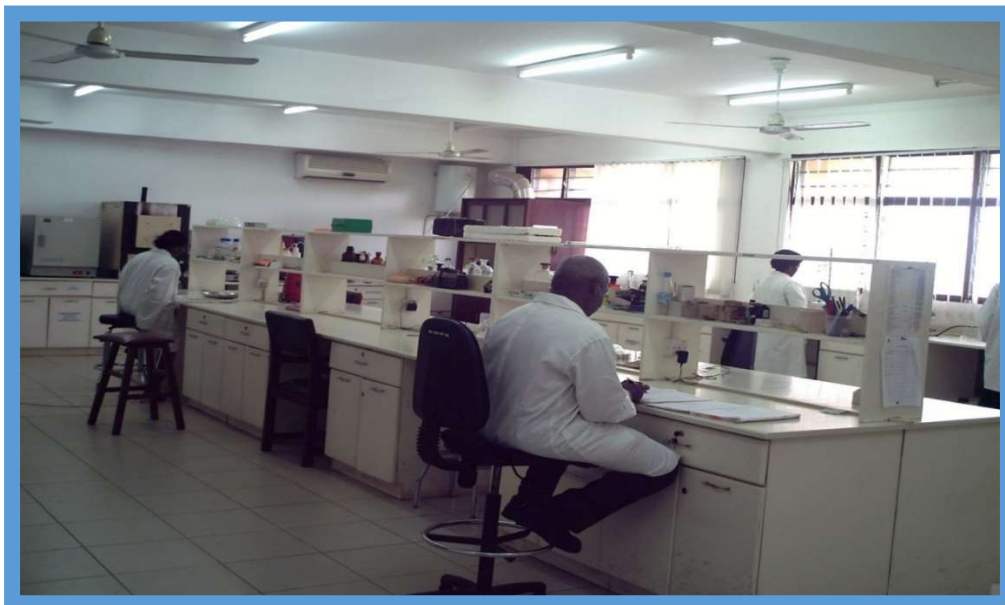
Establishment of new laboratories including complete reconstruction of building

- University for Development Studies, Ghana
  - Tamale campus
  - Navrongo campus respectively.

**Mogens aimed at replicating Alfred Jorgensen Laboratories at the Food Research Institute in Accra**



**Figure 4: Food microbiology laboratory, CSIR-FRI**



**Figure 5: Food Chemistry laboratory, CSIR- FRI**



Figure 6: Aroma analysis by Gas Chromatography-Mass Spectrometry



Figure 7: Extraction of aflatoxins



Figure 8: Detection of aflatoxins by HPLC



Figure 9: Refurbished Microbiology Laboratory



### **3.4 Accreditation of CSIR-Food Research Laboratories to ISO 17025**

The Danish International Development Agency (DANIDA) supported development research for many years and this includes support to research projects that are developed in collaboration between Danish and Ghanaian researchers. They have also supported with institutional capacity building of universities and research institutions like the CSIR-FRI in Ghana, in collaboration with Danish universities.

The CSIR-FRI's journey to accreditation started in 2005 under the sponsorship of DANIDA. During this period, DANIDA provided training for staff, equipment and other needed support to implement a Quality Management System. DANIDA also recommended that a regional accreditation body be selected for accreditation services hence, the South African National Accreditation System (SANAS) was selected.

SANAS provides 15 accreditation services to testing, calibration, forensic, verification and veterinary laboratories, proficiency testing schemes, blood transfusion facilities to mention a few. SANAS has also accredited testing laboratories mainly in the following areas: chemical and microbiological, civil engineering, performance, electrical, environmental and physical, safety as well as mechanical.

After 2 years of hard work and preparation, the ISO/IEC 17025:2005 was fully implemented. This ISO standard enables laboratories to demonstrate that they operate competently and generate valid results as such promoting confidence in their work nationally and internationally.

The Microbiology and Chemistry Laboratories of the CSIR-FRI were assessed and recognized as Accredited.

Fourteen years on, the Institute has maintained its accreditation status and is now accredited to the ISO/IEC 17025:2017 with seven microbiology and five chemistry test methods accredited.

Prof. Plahar facilitated the accreditation of analytical laboratory methods.

## Competence of testing laboratories: Accreditation to ISO 17025

- ISO 17025 fully implemented and accredited at CSIR-FRI, Accra, Ghana in May, 2007.
- CSIR- FRI, Accra, became the first laboratory in West Africa to obtain accreditation to ISO 17025



## Generation of scientific information on indigenous African fermented foods in the international literature

In-depth scientific information on indigenous African fermented foods in the international literature

- Traditional products from 8 commodities (maize, cassava, African locust beans, soybeans, palm sap, millet, milk, sorghum)
- Non-traditional products from 2 commodities (cocoa, coffee)

- Indigenous products covered: 13, maize (kenkey), cassava (agbelime, akyeke, kivunde), African locust beans (soumbala), soybeans (soydawadawa), millet (koko), sorghum (dolo/pito), milk (ergo, rob), palm sap (palmwine), gowe, sonru.

**Table 2: Capacity building by DANIDA projects: Training/Graduate and postgraduate studies on indigenous African fermented foods**

Studies	Africans	Europeans	Total
Ph.D	10	3	13
MSc	11	3	14
BSc	1	5	6



Figure 10: KVL students at CSIR-FRI to carry out their MSc mini projects (5 points & 2 x 3 points projects)

## Publications on indigenous African fermented foods from the collaborative projects

- Thesis
  - Ph.D thesis: 13 (Africans 10, Europeans 3)
  - MSc thesis: 14 (Africans 11, Europeans 3)
  - BSc: 6 (Africans 1, Europeans 5)
- Journal publications
  - Publications in international journals with double referee system: 60
  - Publications in journals with Africans as first authors 45
- Quality Manuals: 10

### Quality manuals developed for Micro Small and Medium Enterprises

1. Development of HACCP system for the A strong network of African food Scientists has been created through the projects and biennial series of African Regional Seminars on fermented foods initiated and held since 1992. The level of attendance has been in the order of 50 participants from close to 15 African countries.
2. Development of HACCP system for the production of *dawadawa/soumbala* (1998).
3. Development of HACCP system for the production of soy-ogi in Nigeria (1998).  
Development of HACCP system for dehydration of mango slices in Burkina Faso (2000).
4. Development of HACCP system for production of yoghurt, butter and cheese in Burkina Faso (2000).
5. Development of HACCP system for production of fermented milk 'rob' in Sudan (2001).
6. Development of HACCP system for production of *ergo* a naturally fermented milk product in Ethiopia (2001).
7. Development of HACCP system for production of *kwerionik* a fermented milk product in Uganda (2001).
8. Development of HACCP system for the production of high quality cassava flour (2006).
9. Development of a GMP and HACCP system for the production of *gari* (2007).

10. Development of a food safety management system for primary processing of cocoa based on ISO 22000:2005 (2007).

### **Networking**

A strong network of African food scientists has been created through the projects and biennial series of African Regional Seminars on fermented foods initiated and held since 1992. The level of attendance has been in the order of 50 participants from close to 15 African countries.

Moses Mengu of Danish Technological Institute, Denmark has been responsible for networking and has coordinated nearly all the project



**Biennial seminars on indigenous African Fermented Foods**

1. First Regional Seminar on Traditional Fermented Food Processing in Africa, Social Security and National Insurance Trust (SSNIT) Guest House, Accra, July 4-5, 1992.
2. Second Regional Seminar on Traditional Fermented Food Processing in Africa, SSNIT Guest House, Accra, July 11-12, 1994.

3. Third Regional Seminar on Traditional Fermented Food Processing in Africa, Secaps Hotel, Accra, July 3-4, 1996.
4. Fourth Biennial Seminar on Traditional African Fermented Foods, Secaps Hotel, Accra. July 2-3, 1998.
5. Fifth Biennial Seminar on Traditional African Fermented Foods, Villa Cisneros Resort, Sogakope, Ghana. July 3-4, 2000.
6. Sixth Biennial Seminar on Traditional African Fermented Foods, Miklin Hotel, Accra. July 2-5, 2002.
7. International workshop on fermentation and quality of traditional African food products, 17th to 19th May 2006, Cotonou - Bénin
8. Seminar on Quality assurance for the primary processing of cocoa, Dutch hotel, Accra, February 14, 2007.
9. Value-added processing of traditional African fermented foods for improved quality and food safety. Hotel Independence, Ouagadougou, Burkina Faso. Feb 16-19 2009



## **Training of Trainers**

- Application of HACCP to Traditional Fermentation of Food in Africa. June 22-26, 1998, Accra.
- Application of ISO 22,000 to primary processing of cocoa, Accra. Fifty Agricultural extension officers from Ghana, Nigeria and Cote d'Ivoire were trained on the application of ISO 22000:2005 to the primary processing of cocoa. February 15-16, 2007, Accra.

## **Technology Transfer: Establishment of pilot/demonstration plants**

- Kenkey processing plant, Osu
- Kenkey pilot plant, CSIR-FRI, Accra
- Tecal, Burkina Faso
- Gari pilot plant, Benin
- Gari pilot plant, Kenya

## **Other key achievements of the DANIDA Project**

- Training conducted at all levels and for all partners in HACCP, GMP and GLP
- Starter cultures developed for fermentation of *kenkey*, *soumbala*, soybean *dawadawa*, *kwerionik*, etc
- A good collection of cultures from various African fermented food with a strong potential for biotechnological exploitation has been established.
- In both Ghana and Burkina Faso issues of food safety have gained national significance and been discussed in the public media with reference to the results of the project e.g. aflatoxin contamination of maize.

## Reasons for success and impact of the collaborative projects on African fermented foods

- Key persons in European institutions committed to research into African indigenous foods and collaborating with African scientists (Prof Mogens Jakobsen, Prof Wilhelm Holzapfel, Moses Mengu).
- Key persons in African institutions committed to collaborating with the European partners.
- African partners identifying critical needs and taking advantage of 'potential' opportunities available.
- Cordial relationships amongst all partners



- Appropriateness of knowledge and technology transfer from European to African partners
  - Exchange visits of scientists.
  - Attachment training of lab technicians to European labs (laboratory culture).
  - Training in use of state of art equipment and maintenance before purchase and installation in African labs.
  - Regional seminars as basis for networking and initially roping in other African scientists doing good work in the subject area (Prof Houinighan, Prof. Odunfa, Prof. Mbugua).
- Emphasis on international publications & postgraduate programmes led to generation of in-depth scientific knowledge on indigenous African fermented foods





Mogens, Africa is grateful!

### **3.5 Cassava Processing Demonstration Unit**

#### **Project Objectives**

To set an integrated pilot scale cassava processing unit as a sub-regional demonstration and training centre for traditional *gari* processors and technicians, and thereby accelerate dissemination of the improved processing technology.

#### **Inter-Institutional Collaboration**

The Food Research Institute managed the construction of the building, the drying unit, site works and the coordination of project activities. The Industrial Research Institute implemented the design, construction and testing of plant equipment units, workshop and putting the biogas plant into operation. The Animal Research Institute designated a livestock pen close to the Centre for supply of manure.

## **Livestock Farm**

The Animal Research Institute placed its livestock farm (400 metres away) consisting of 72 cows and 116 sheep, at the disposal of the centre to provide manure for the biogas plant.

### **3.5.1 ROOTS AND TUBER PRODUCTS DEVELOPMENT UNIT**

#### ***Brief History and Objectives***

The Root and Tuber Products Development Unit [RTPDU] was established by the African Regional Center for Technology (ARCT) in 1990 through funding from the International Research Development Centre, Canada (IDRC), under the original name 'The Cassava Processing and Demonstration Unit (CPDU)'. The IDRC funding supported the provision of all the processing equipment as well as the construction of a biogas plant whilst the Government of Ghana fund was obtained to support the construction of buildings to house the equipment. The purpose of the Unit was to demonstrate improved processing of cassava into various traditional products and disseminate these technologies to appropriate end-users through training programmes and workshops. Part of the IDRC funding was used to organize training workshops and training programmes in which more than 50 traditional Ghanaian processors, 10 industrial entrepreneurs and one research scientist from Benin were trained in the production of various cassava products.



Over the years through different donor-funded projects, other agencies have contributed in one way or the other to improve the facilities at the Unit. The United Nations Industrial Development Organisation (UNIDO) provided a diesel-engine-operated *gari* roaster for the Unit whilst the UK Department for International Development (DFID) through the Crop Post-Harvest Programme of the Natural Resources International (NRInt.), UK, provided a 10 KVA generator and various laboratory equipment to improve the services of the Unit. A DANIDA-funded project also supported the conversion of one of the processing areas into a standard *kenkey* production facility. Through the DFID-funded project, 12 entrepreneurs and individuals were trained in the production of various cassava products. Such as High Quality Cassava Flour and Cassava-based Glucose Syrup, three of whom had taken up the technology and are receiving technical support from the project team at the RTPDU.

Emphasis was shifting from traditional food products to cassava-based industrial raw materials. Quality issues have become even more important now than before, as more industries began targeting the export market in addition to the local market. Over the years the services provided by the Unit as a demonstration centre had led to a lot of processing enterprises adopting the technologies promoted by the Unit with some even introducing new technologies which the Unit could not boast of. Cassava-based industries now require more than ever before analytical and technical support services as well staff training in order to meet quality specifications. As competition in the global market increases, entrepreneurs need to diversify as well as improve upon current production techniques.

### ***Mission and Vision***

The Roots and Tuber Products Development Unit [RTPDU] was a business-oriented research and development unit of the CSIR-FRI, that focused on providing good quality market driven research, product development and training services as well as the sale of various root and tuber research by-products, to the Ghanaian Food industry. Through our shared values of putting people and principles before profit, customer friendliness and purposeful sacrifice inspired by motivation. The project pursued the vision of attaining the status of a centre of excellence for competitive research, training, product development and marketing of root and tuber based products in the West African sub-region.

## **Buildings and physical infrastructure**



**Unit comprising the main Processing Hall, Storeroom and Changing Rooms**



**An inside view of a section of the Quality Control and Research Laboratory of the  
Root and Tuber Products Development Unit.**

### **3.6 Kenkey pilot plant**

#### **Plant layout**

The pilot plant was sited on the premises of the Food Processing Demonstration Unit of the Food Research Institute at Pokuase about 15km from Accra. The plant occupied a processing hall measuring 12.8m by 7.6m and had walls reaching up to the roof. The food Processing Demonstration Unit had store rooms, male and female changing rooms and toilets.

The key elements which were taken into consideration in designing the plant layout were good housekeeping, prevention of physical and microbiological contamination of maize, dough or *kenkey* during processing, ease and convenience of material handling and smooth product flow through the plant. The objective of the design was to permit an orderly flow of material through the plant during processing and cleaning of equipment and prevent cross contamination of maize which was fermented or the final product.

The processing hall was divided into the main hall, the milling room, the fermentation room and the cooking section. This layout reduced the noise pollution of the plate mill by its seclusion in a milling room. The partitioning also reduced the possibility of cross contamination of the fermentation of dough.

Within the restrictions of available space equipment had been located in the plant to provide ease and convenience of material handling, occupational safety of processing staff and prevention of cross contamination of processing materials. Equipment were placed to permit adequate maintenance and cleaning and facilitate good hygienic practices.

#### **Food Composition Tables**

The year saw the compilation by the CSIR-FRI of interim Food Composition Tables for a total of 250 Ghanaian foods (raw, processed or cooked). The analysis covered proximate principles, mineral content, riboflavin content of fermented foods and vitamin C content of leafy vegetables. The tables, when published, would meet a long-felt need and provide a basis for a scientifically-planned food and nutrition programme for the mass of the population.

### **Instant foods**

In the absence of a pilot plant for the CSIR-FRI, leads were given to private food manufacturing enterprises in the development of a number of products, particularly dehydrated 'instant' preparations. These included instant *fufu* granules from cassava, yam and plantain, and instant dehydrated *tatale* or *kaklo* mix from pureed ripe plantain and fermented maize dough. Some of the manufactured products are now available on the market.

### **Shea butter as a substitute for margarine**

Shea butter, a hard fat produced in appreciable quantities by traditional methods in Ghana. The CSIR-FRI refined and deodorized this product. The refined butter proved to be an excellent substitute for margarine in the making of cakes. This important project deserved to be given every encouragement to make it possible to achieve commercial levels of production.

In the field of refining and deodorizing of oils, the help given to the Ghana Industrial Holding Corporation (GIHOC) by the CSIR-FRI to enable it to produce high-quality, well-deodorised oil should be mentioned. The Institute undertook plant and laboratory tests at the factory in Esiama and chemical analyses and storage tests in the Institute's laboratory in Accra. The Managing Director then of GIHOC expressed high appreciation for the Institute's assistance during the commissioning of the new oil-deodorizing plant at Esiama in the Western Region.

A highly significant piece of research work was done during the year by M. Caurie, Research Officer (Microbiology), at the CSIR-FRI, and published in the *Journal of Food Technology* (1970) 5,301-307, under the title "A new model equation for predicting safe storage moisture levels for optimum stability of dehydrated foods".

### **Industrial consultancy and technical assistance**

Under this function of the Institute fell the various requests and enquiries from Government, private establishments and individuals for advice for immediate application or for exploratory purposes. The more important services rendered under this heading during the reporting period briefly described;

One subject which caught the sustained interest of the Government during the period was the feasibility of manufacturing corn bread locally. This arose out of the general shortage in the world supply of wheat, with its attendant increase in the price of wheat-flour. Quite apart from the pressure from domestic consumption on local supplies, the world market outlook appeared grim. The FAO Commodity Review for 1972-73 reported a depletion in 1972/73 of carry-over stocks owing to a sharp rise in wheat shipments. It at the same time forecast that at the opening of the 1973/74 season, aggregate carry-over stocks of wheat in the main exporting countries would be at their lowest level for over 20 years.

The interest in wheat-flour substitutes was not confined to the government but extended to the bakery industry. Through the efforts of some bakers' samples of casava bread, corn bread and rice bread were submitted to the Institute for testing. The Chop Bars and Bakers Association were instrumental in stimulating this interest and the Saltpond Yamoransa Bakers Association called at the Institute to learn about the techniques for producing corn bread.

The Institute on its part intensified its work on the production of bread from composite flours with special attention being paid to corn bread. Consumer tests demonstrated the general acceptability of corn bread to the extent of substituting for all-wheat bread. The main obstacle to commercialization of the product was the high price of corn. Also, the available equipment for processing the corn could only produce corn meal instead of the corn flour which provided a longer storage life of the finished bread.



### **Oil from *neem tree* seeds**

Another request which came from government was to evaluate the oil obtainable from seeds of the *nim tree*.

It was reported that the leaves, the flowers and the ripe fruits of this tree were used as food in India in times of emergency. In the same country the oil was known to be used as an anthelmintic (worm treatment) and for the treatment of wound and skin diseases.

A laboratory extraction of the oil by Soxhlet continuous extraction for 10h was done using seeds with 2.3% moisture content. The oil content from the results was 19.1%; it had a dark brown colour with a disagreeable taste and the smell of garlic.

With an oil content of 19.1% in the laboratory, industrial extraction would yield about 13%. In comparison, groundnut oil content is 44% and soya bean, 18-20%. Besides, the other laboratory analytical values showed a marked difference from those of conventional edible oils.

### **Softening of locally manufactured chocolate in storage**

The then Tema chocolate factory encountered the problem of the softening of locally manufactured chocolate in storage. Analysis of samples showed that the melting point of the cocoa butter component fell between 27°C-29°C, the fat content being 55.7%. Since this melting point was close to that of the ambient temperature, the chocolate was bound to melt.

The factory was advised to hydrogenate part of the cocoa butter (20-25%) to raise the melting point to about 34°C.

### **The prospects for industrial production of pectin**

The then Ministry of Industries was disturbed by the local shortage of pectin for the preparation of marmalades and jams and sought the advice of the Institute on the matter.

It was revealed to the Ministry that pectin is normally produced on a large scale with a very high capital investment and specialized and sophisticated production systems that were completely integrated. Private communication with the Tropical Products Institute, London, further revealed that even in South Africa where the commercial production of citrus products was extensive, the latter still found it cheaper to import the pectin. Consequently, with the very small local demand for it, it might be over ambitious to consider this type of production. The Institute would however, undertake the investigation of producing the unrefined pectin from local materials as soon as suitable equipment had been procured.

### **The possibilities of local production of soya milk**

The Development Finance Department of the Bank of Ghana expressed interest in the possibility of large-scale local production of milk from soya beans for human consumption. As a result of consultations between the Bank, the CSIR Secretariat, the Faculty of Agriculture, University of Ghana, and the CSIR-Food Research Institute, laboratory analysis and the organoleptic tests on the soya bean milk produced by the Faculty of Agriculture were undertaken by the Institute. The results of this work were published later.

### **Ginger**

Other minor requests included the supply of powdered ginger to the Tema Steel Works in their attempt to develop equipment for the processing of the local variety of ginger.

### **The private sector**

Request from private establishments and individuals were limited in scale and scope. These invariably arose out of basic technical problems encountered in attempts to convert local raw materials into marketable products. These requests included the preservation of soups, the use of vanilla in the development of flavour for alcoholic drinks, the technique of manufacturing soap using sub-grade cocoa beans, and the control of microbial load in skippers

The Institute's services were made available to the Nkulenu Industries Ltd, by training a member of the company's staff for 3 months in chemical and microbiological control methods and techniques. The company was anticipating setting up its own control laboratory.

Under Government sources, the period coincided with the commissioning of the canning unit of the Tema Food Complex. Consequently, quality control tests had to be conducted on the whole range of canned products that the factory intended to put on the market. The canned Horse Mackerel was unpopular owing to its rubbery texture. Trial canning at the Institute showed that successful canning could be done at 10.1b pressure for 80 minutes.

The Pioneer Food Cannery Ltd., a subsidiary of Mankoadze Fisheries Ltd, submitted a total of 30 samples for quality control tests as a check on its canning line. This accounted for the majority of samples received from the private (established) sources. The Crystal Oil Mill Co., at far less frequency, also utilized the Institute's services in checking on the efficiency of their oil extractors.

The Ghana Standards Board was given full support in the monitoring of the quality of a wide range of food and allied products. It was the only servicing agency that used the Institute's facilities during the period.

### **Technical co-operation**

#### Consumer preference network study on cowpeas

With a view to documenting and eventually promoting cowpea consumption in West Africa, the Institute, representing Ghana, joined the sister countries in this study under the auspices of the International Development Research Centre (IDRC), Ottawa, Canada. With financial assistance from IDRC the Institute commenced a programme of research into the economic importance of the cowpea and its place in the diet in Ghana.

Tropical products Institute

Miss P.J. Sutcliffe from the Tropical Products Institute arrived in the country to conduct a joint research programme with Mrs. L.A. Bonsu, Research Officer (Processing and Financing). The programme of work concentrated on ice storage trials on two commercially important species of fish – the bream (*Dentex canalicus*) and mackerel (*Scomber colias*).

### **Research work in summary**

Food composition tables

Analysis of foods for quality control and establishment of standards

### **Food Microbiology**

Fermentation of maize mash and dough

Preliminary trials in wine fermentation

Preservation of palm wine

Identification of bacilli isolated from canned foods

Temperature and microbiological quality of locally manufactured foods

Microbiological quality of locally-pasteurized filled, milk

Fermentation of cassava tuber pulp

Diluent for the estimation of bacterial numbers on common salt

A new model equation for predicting safe storage moisture levels for optimum stability of dehydrated foods

New method for the determination of microbiological quality of meat and meat products

### **Food Economics and Marketing**

Food processing establishment statistics

Copra supply at Nzema Oil Mills

Tomato supplies from the Upper and Northern regions

Costing of farm unit

## **Food Consumption Surveys**

Ghanaian recipes

Local beliefs about food

## **Food Processing**

Fruits and vegetables

Oils and oil seeds

Meat and meat products

Fish and fish products

## **Food Engineering**

Design and construction of cabinet dryers

Traditional food packaging materials

## **Food Refrigeration**

Cold storage of fruits

Problems of commercial production of ice

Other activities

Apart from the routine analytical services carried out by the chemical laboratory for internal purposes, 171 samples of various food products were analysed during the period for inside agencies. 71 of these samples were tomato varieties sent by the Faculty of Agriculture, University of Ghana, Legon. The Animal Husbandry Division of the Ministry of Agriculture and Agricare Limited, a private company in Kumasi, sent respectively 42 and 24 samples of animal feeds for analysis.

Concern about curds in imported evaporated milk led to a bacteriological examination of samples of this material. Results excluded bacterial causes but suspicion was cast on conditions of processing.

Similar tests on locally-produced milk showed the system of distribution to be satisfactory provided the prescribed temperature was maintained.

Most of the fish caught in Ghana is smoked in traditional ovens that are poorly equipped for full utilization of fuel and for minimizing products losses. Framed wire nets suitable for the rectangular ovens were introduced to the smokers. They were very much accepted because they increased oven capacity by 25-30% and were more efficient in heat conservation and smoke utilization.

#### **4.0 Prominent Achievements of Directors and other officials of the Institute towards making the Institute what it is today**

- Mrs. Juliana Maud Kordylas was nominated as an Associate Research Fellow of the Ghana Institute of Clinical Genetics and an Honorary Consultant to this Institute. Her initial work at the Institute focused on Vitamin A levels in haemoglobinopathic women taking oral contraceptives (1973-74).
- Mrs. Florence Dolvo- Structuring of the Food Consumption table (1975)
- Mrs. Agnes Osei-Yaw- Structuring of the Sensory Laboratory (1987)
- Mr. Sawyerr and Prof. Mary Obodai- Mushroom Projects (Mushroom Project: 1990-1996)
- Prof. Wisdom Amoa-Awua- Pokuase ARCT Cassava Processing and Training Centre Site-Building (1990).
- Dr. Nanam Dziedoave - Cassava Processing Plant at Pokuase- Continued Building and Fitting of offices and processing halls (1991-1992)
- Dr. Mary Halm and Prof. Wisdom Amoa-Awua were responsible for the DANIDA Project that brought in vehicles and equipment as well as research funds for the Microbiology Division of the Institute (1992-1996).
- Dr. John Tawiah Manful -FAO. NRI- Rice Project and GTZ Initial contract with CSIR-FRI (1992).
- Mrs. Gladys Nerquaye-Tetteh – Attracted funding for and led a ten (10)-year multi-institutional project: The Ghana-Netherlands Artisanal Fish Processing Project. The Chorkor-Smoker was developed and transferred to several fishing communities in Ghana

through this project. Equipment and a fish processing resource centre were acquired. Mrs. Gladys Nerquaye-Tetteh, Leader of Ghana Netherlands Fish Project that led to the Building of the Fishery Resource Centre. The conference room of the centre was named after her (Apesiwa conference room (1995-1997).

- Dr. John Dei-Tutu- Setting up of the Pilot Plant (1995-1996).
- Dr.(Mrs.) Kafui Kpodo- Mycotoxin Laboratory and facilities in Chemistry Division (Through DANIDA Project)- (1996-1997)
- Prof Wisdom Annorsey Plahar and Dr.(Mrs.) Naana T. Annan- developed and promoted well-formulated cereal legume blends that helped to drastically reduce protein-energy malnutrition in Ghana. In addition, they attracted research funds through collaborative project proposals that helped in the acquisition of much needed research equipment like the Gas Chromatography -MS, Kjeldahl, apparatus, Likens-Nickerson apparatus – (1996-1999)
- St. John Clotley- Setting up of the meat Processing Laboratory (before 1997)
- Mrs. Abigail Andah and Prof. Wisdom Annorsey Plahar were instrumental in building the Administrative office complex for the institute at Okponglo behind Ghana Standards Authority. Mrs. Andah started the building and Prof. Wisdom Annorsey Plahar facilitated the relocation of the institute (1998-2000).
- Mrs. Abigail Andah-She helped in the coordination of the National Agricultural Research Project at Deputy Director General office (1998)
- Dr. John Tawiah Manful- Setting up of Cereal Control Laboratory (1998)
- Prof. Paa-Nii Torgbor Johnson- National Coordinator Sorghum Project (1998-2002). Leader NRI Street Food (1998-2005).
- Prof. Wisdom Amoa-Awua- Root and Tuber Improvement Projects (RTIP) Led in several EU Projects – 1999-2001
- Prof. Paa-Nii Torgbor Johnson- Project Leader: Cassava SMEs Project (1999- 2003),
- Mr. Otto Darko- Sorghum Laboratory- UNIDO Sorghum Brewing Project- (1999)
- Dr. Mary Halm. Setting up of Microbiology Laboratory, SANAS Accreditation Systems for CSIR-FRI Microbiology and Chemistry. First Quality Manageress- 2005.

- Dr. Nanam. Dziedzaove- NRI Cassava Project, C:AVA Project (2008-2011)
- Prof. Paa-Nii Torgbor Johnson- (Built the Incubation Centre for drying of Fruits - financed by the German Government through GTZ (2009-2011)
- Prof. Paa-Nii Torgbor Johnson -Cereal Control Laboratory (2009-2011)
- Dr. Nanam Dziedoave – refurbishment of the processing hall, Agribusiness centre established at Pokuase (2013-2014),
- Dr. (Mrs.) Kafui Kpodo and Dr. Margaret Atikpo (Traque Project-Equipment for the laboratories)- (2015)
- Prof. Mary Obodai – Building of CSIR-FRI shop, Expansion of the mushroom facility, solar facility for the Administration block (2017-2018).

### **Honouring Staff who stood out**

Some of the achievements of the staff of CSIR-FRI were recognized by naming buildings of the Institute after them. Prof. Paa-Nii Torgbor Johnson was instrumental in honouring or recognizing staff who stood out when he was Director of CSIR-FRI follows:

The fish processing resource conference room had been named “Apesiwa” after Mrs. Gladys Apesiwa Nerquaye-Tetteh.

A laboratory in the Microbiology section has been named after Ms. Mary Halm

### **5.0 Funding Agencies/ Collaborators/ development partners of the Institute**

- The Netherlands Government
- United States Agency for International Development (USAID)
- United Kingdom Department for International Development (DFID)
- United Nations Industrial Development Organisation (UNIDO)
- European Union (EU)
- World Bank
- Bill and Melinda Gates Foundation
- African Union (AU)



- Food and Agricultural Organisation (FAO)
- Danish Government
- International Fund for International Development (IFAD)
- German Government
- Common Funds for Commodities/ United Nations Industrial Development Organisation (CFC/UNIDO)
- Central African Council for Agricultural Research and Development (CORAF)
- World Food Programme (WFP)
- Natural Resources Institute of University of Greenwich (NRI)
- Alliance for a Green Revolution in Africa (AGRA)
- German Development Cooperation (GIZ)
- Ghana Export Promotion Council
- Government of Ghana

Government Funding were in-direct government counterpart funding through payment of salaries and some overheads. There has been no significant improvement in direct Government funding for research it keeps changing and difficult was to assess.

## **6.0 Infrastructural constraints**

The UNDP-funded project lasted for five years and established CSIR-FRI as a research institution by the end of 1970. However, the problem of inadequate infrastructural facilities was a major constraint over the years after the project. To alleviate some of these constraints, one of the bungalows was used as a Microbiology Division. A wooden structure was put up to serve as the Engineering Workshop for fabrication work. In the Food Processing Division, research scientists and technicians had to use their laboratories as their offices in a cramped space.

It was not until 1998, when a building was completed at Okponglo with government funds, that the Engineering, Food Processing and Microbiology Division moved into this facility. It had a section for an Engineering Workshop. Under the Dutch government funded project on training of fisheries extension officers from across Africa, a Fisheries Resource Centre was constructed at

Okponglo and commissioned on 4<sup>th</sup> April 1997. This facility has 4 offices, a laboratory and a conference room.

At this stage in the history of CSIR- FRI, it was operating at two locations that is Broz, Tito Avenue, behind the Police Headquarters and at Okponglo, behind the Ghana Standards Authority.

In 1997, the institute engaged the services of an architect who designed new building to accommodate all other Divisions operating at Broz Tito. This included the Directorate. The Building and Road Research Institute was employed as the consultant who put together the necessary mix of people to start the construction of these buildings. Financing was from internally generated funds. Financial support was received from the government in the next three years for the construction before it was taken over by the World Bank project dubbed “Agricultural Services Sub-Sector Investment Project” that is CSIR AgSSIP which lasted from 2001-2007.

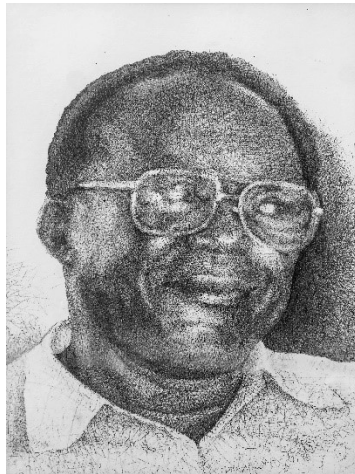
All research activities moved to Okponglo behind the Ghana Standards Authority in 2004 when construction of permanent building was completed.

## **7.0 DIRECTORS**

**List of Directors over the period with pictures**



**Mr. F.W.K Christian  
1964-1970**



**Mr. J.E.M Bartels  
1971-1976**



**Mrs. Juliana Maud Kordylas  
1977-1982**



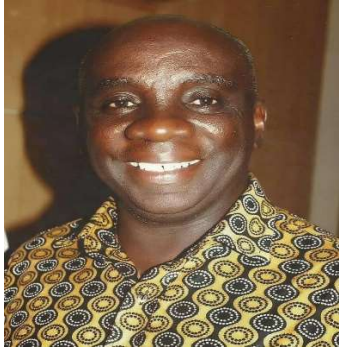
**Mr. K.K. Eyeson  
1982-1993**



**Mrs. Abigail Andah  
1993-2000**



**Prof. Wisdom Annorse Plahar  
2000-2009**



Prof. Paa Nii Johnson  
(Ag. Director) 2009-2011



Dr. Nanam Dziedoave  
2012-2016



Prof. Mary Obodai  
2016-2020



Prof. Charles Tortoe  
(Ag, Director) 2021

## PICTURE GALLERY



New Administration block built by Mrs. Abigail Andah sponsored by AgSSIP project



New FRI shop at the frontage built by Dr. Nanam Dzedoave and Prof. Mary Obodai



Mushroom expansion works established by Prof. Mary Obodai



Microbiology Division



Pilot and sorghum plants and fruit drying unit



Processing Laboratories





Engineering Unit



Former CSIR-FRI office at Josef Brox Tito Avenue, Cantonment

### The Evolution of Chorkor Smoker

