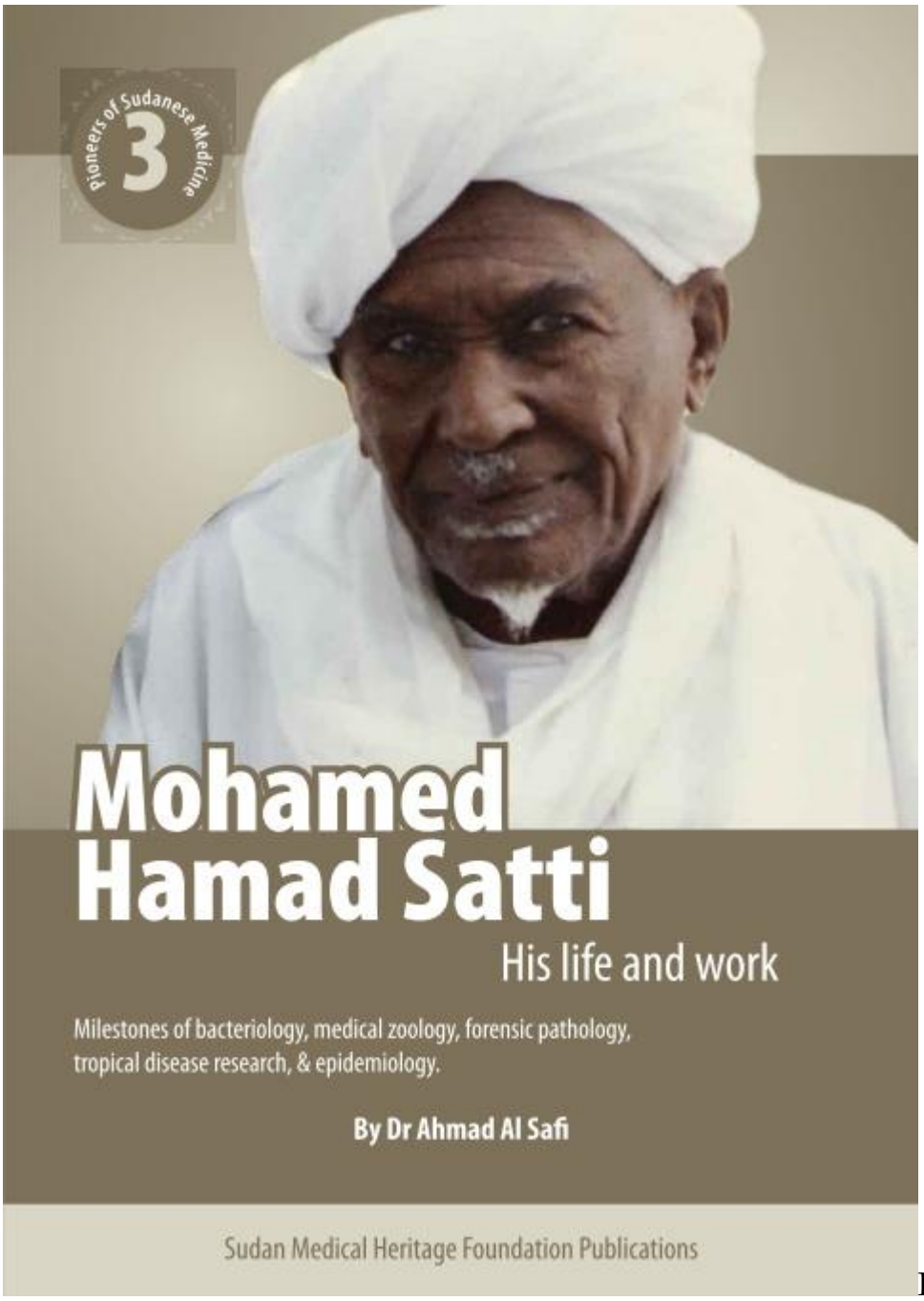

Pioneers of Sudanese Medicine Series (4)

Mohamed Hamad Satti

The Father of Medical Research in Sudan

His life and work
(1913-2005)

Milestones in field research in tropical disease pathology, bacteriology and epidemiology

By

Dr Ahmad Al Safi

Sudan Medical Heritage Foundation Publications

Also by Dr Ahmad Al Safi

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I acknowledge with gratitude the verbal and written contributions of the many friends, associates, co-workers, colleagues, and students of Dr Mohamed Hamad Satti. Their contribution to this work has been invaluable.

I conducted several interviews with the late Dr Satti few years before his death. He helped enormously with dates, facts and information, and gave several documents to substantiate what I had already written based on his verbal narratives. This monograph would never have been written the way it is without his help and guidance. To be truthful, Dr Satti never knew that I was planning to write a monograph on him or write his biography as such. However, he knew that I wrote about his intimate friend and schoolmate, the late Tigani El Mahi, and of course, he knew that I am interested in the history of Sudanese medicine and traditional medicine.

My indebtedness also goes to Dr Maria Satti, Engineer Abdel Rahim Satti, Diplomat Nureldin Satti, Chemist Dr Gwiria Satti for invaluable comments on earlier drafts of this work, and for contributing to the photo gallery annexed to this book.

The data found in this monograph have been produced and processed from sources believed to be reliable, and researched extensively, and most of the information contained in it is obtained from data produced by the late Dr. Satti himself, namely his prima faciae for the Shousha Prize. I made full use of this document and from Dr. Satti's resume, verbal and written contributions.[1]

Although this author strives for accuracy in his publications, any such work may contain inaccuracies or typographical errors. Changes, corrections, and improvements need to be made and will be incorporated in new editions of this work.

Lastly, I am also grateful to Prof. Suad Mohamed Sulaiman for revising the language of the early drafts, and for her constructive comments.

Abbreviations and Acronyms

CSB	Central Sanitary Board
DKSM	Diploma of Kitchener School of Medicine
EAMC	Egyptian Army Medical Corps
EMRO	East Mediterranean Regional Office, WHO
FMOH	Federal Ministry of Health
GM	Graphic Museum in Khartoum
GMC	Gordon Memorial College
IAEA	International Atomic Energy Agency
IED	Institute of Endemic Diseases
IMLT	Institute of Medical Laboratory Technology
ITDR	Institute for Tropical Diseases Research
KSM	Kitchener School of Medicine
MOH	Ministry of Health
MRC	Medical Research Council
NCR	National Council for Research
NHL	National Health Laboratories
SAD	Sudan Archives, University of Durham Library
SMRL	Stack Medical Research Laboratory
SMS	Sudan Medical Service
SNMH	Sudan National Museum of Health
SNRO	Sudan National Records Office
SSTMH	Sudanese Society of Tropical Medicine & Hygiene
TDI	Tropical Diseases Institute
TDR	Research and Training in Tropical Diseases
TMRI	Tropical Medicine Research Institute
WCL	Wellcome Chemical Laboratories
WTRLK	Wellcome Tropical Research Laboratories in Khartoum

Preface

The idea for compiling this series originated after I finished collecting the scattered works of the late Prof. Tigani El-Mahi (1911-1970). In two volumes, I edited and published the articles he wrote in Arabic in 1981[2] and those, which he wrote in English in 1984.[3] The warm reception those two volumes had encouraged me to continue similar work on more pioneers albeit in a different way.

Work started during my fruitful expatriate period in Saudi Arabia (1989-2004), and took fresh momentum after I came back to Sudan, when I realized that this type of work could have more far-reaching value than mere documentation. I realized that allusion to several pioneers of the medical profession is anecdotal and reflected misinformation and superficial impressions at best. Given this dismal situation, health care providers, researchers and students are faced with a dearth of reliable sources on the bookshelves. Resource books are alarmingly few and historical writings notably deficient. Sources rest mainly in grey literature, which by definition is not readily available.

I believe that we are not doing enough in the field of documentation. Although we say that health care providers, researchers, and students should be informed about the history of this profession, sources of information are few. History is not written or taught systematically in all health institutions. The few medical schools that started courses in this field still lack authentic sources to help them in their job.

Personal contributions and outstanding achievements of the pioneers of Sudanese medicine were not documented or highlighted. An approach that is more positive should be taken to correct this deficiency. There are lessons to be learnt by posterity from the legacy of their predecessors, how they lived,

behaved, and worked. In a fresh look at the lives of the pioneers, there will be an opportunity, I presume, for re-enacting the merits of these great men and women, and emulating their successful stories and bringing those stories back to life in one way or another.

Medical history should be documented. This should be a priority, not only because it is something worthy of our immediate attention; but also because it is the one part of our medical culture which has been totally neglected.

Now, after so much work by several generations, so much experience and big sacrifices, it is high time for this profession to substantiate what it has gained thus far and put it on record, for surely one good document is worth a billion spoken words.

The author took this matter seriously by launching a major research project entitled "*Sudan Health Trilogy*" for which he solicited the help of teams of co-workers, co-authors, fieldworkers, and editors. The *Sudan Health Trilogy* as its name implies include:

- *A Biographical Dictionary of Health Care Professionals in Sudan* documenting the lives and work of the men and women who have served in health care institutions or contributed to health and medicine in service and research in Sudan in the period 1903-1978. This work will be a 'Who's Who' of Sudanese health care professionals, Britons, and other expatriate staff.
- *Pioneers of Sudanese Medicine series* documenting the lives and work of the men and women who have shaped health care services in Sudan. This series will profile the individuals whose work has contributed significantly to the establishment and development of the medical profession.

- A *Bibliography of Biomedical Literature in Sudan* (1900-2000) a compilation of medical literature on Sudan by Sudanese scholars and expatriate staff produced during the 20th century.

In addition to performing its chief function, that of recording faithfully the lives and work of the main actors in the medical scene, the *Trilogy* also hopes to provide authentic information. Often we find ourselves uncertain as to whether or not a particular act or technique has been widely accepted or related to a certain person. How can we be sure? This *Trilogy* should help us here. By consulting the appropriate part of this work, we can obtain the information we need on the milestones of different disciplines of Sudanese healthcare delivery. The danger in thinking that history starts with us, that nothing has been said or done before about the issue in question, or lay hands on what is not ours are obvious caveats. This is the *raison d'être* for launching the project of this *Trilogy*.

If the younger generations are to be the natural heirs of the profession, they have to educate themselves better, they have to explore and analyse the medical past thoroughly before setting new norms and standards. They must speak the language of modern medicine and embrace all its goodness.

We cannot bring the past back and we should not try; but we ought to learn from the incidents in its trail. In this instance, the epigrammatic phrase of Sir Winston Churchill 'the longer you can look backward, the further you can see forward' may be appropriate. The young generations should explore the past and learn from it before they take their decisions. They should be tolerant and reverential towards the old generations. This will assure that some wisdom is shared, and harmonious living replaces discord and grumbling. The author thinks that this series of works will salvage lost information, and help to bridge

the gap between generations. Smooth transition and carry on of successful knowledge and experience is assured.

Health services in Sudan faced enormous challenges aggravated by poverty, food scarcity, poor infrastructure, significant geographic and socio-economic disparities in access to and utilization of health services over the last hundred years. No effort was spared by the different generations to cover basic health needs, control infectious and non-communicable diseases, manage the sick, and deliver acceptable health services. There was constant and persistent endeavour to strengthen basic health services not only to address the main causes of morbidity and mortality; but also to maintain a healthy productive workforce. The story of this profession with its difficulties, achievements and failures needs to be recollected and consolidated.

Our past is long gone; but our history continues, it cannot be ignored; it is alive, it is continuous, it is active, and needs to be recorded and preserved. This current work is one chapter in Sudan medical story. It is a reminder of the excellent work that has been done so far to build the health system of the country.

Conservation and development of the medical system and heritage needs to be written down in social history, and as stories of achievements. We need to build a sound health care system, maintain modern medical schools, research laboratories, libraries and museums. These institutions, which were once intact and functioning, are endangered or actually mal-functioning, and some face possible disintegration and disappearance.

We need to record the history of this profession more thoroughly before it is too late. We might wake up soon to find out that we have no recollection of our past. Details of this degenerative process have been listed in an earlier monograph.[4]

This series of monographs, however, is written specifically to raise the awareness of readers in the academic community of the health profession about the milestones and important stations in Sudanese health development, and help them to be better health care providers. Surely, they would be if they were better educated about the contribution of their predecessors.

History of medicine is the history of men and women's lives. It is but the biographies of great men and women. No great man or woman lives in vain. There is probably no history, only biographies, or as 19th-century commentator and historian, Thomas Carlyle put it: "The history of the world is but the biography of great men." This series of monographs, however, is not an endorsement to this thesis. It is simply a story of praise and indebtedness to the notables as well as the regular members in this profession, and a humble attempt towards documenting the lives and work of some notable Sudanese scientists. It aims to provide concise documentation of the lives and work of the men and women who have shaped the healthcare services in Sudan. It focuses on individual contributions and through them sheds light on the milestones of health care services in the country.

The individuals featured in this series, fulfilled the criteria set to identify a pioneer. The pioneers in the context of this work are Sudanese men and women, who have established new institutions, founded new disciplines, researched the field, or made new discoveries and techniques, and those who set new traditions and models of admirable behaviour. They taught, trained, and mentored, and more importantly, provided guidance and encouragement to several generations of young and aspiring physicians and scientists.

They are without exception, meticulous clinicians, arduous teachers, imaginative trainers and hard-working researchers. They maintained unimpeachable professional integrity, upheld

strict medical ethics and consolidated sound medical traditions in a rich service career. They all worked with purpose, with principles, with culture building, and strengthening people. In every situation, they looked for better management, efficiency, perfecting techniques, practices, and processes.

Their contribution as scientists or physicians to science and life has been exemplary. They searched for continuous improvement in their lives and in the institutions in which they worked. They have been constantly involved in the pursuit of fact and truth – about everything in life. That is why they were also notable social workers, sportsmen, poets, musicians, political and social leaders, writers, and efficient administrators.

Studying the lives of these individuals clearly shows that the path to success and distinction requires hard work, confident persistent toil, and professional zeal. For them, nothing happens arbitrarily through luck, or due to quick fixes; but needs to be done perfectly.

This volume profiles the life and work of Dr Mohamed Hamad Satti, the pathologist, epidemiologist, teacher, and researcher. Among these pioneers, Dr Satti has been exemplary. He did his job as expected in terms of quality, and he won the admiration and respect of his peers, colleagues and associates.

The author hopes this series proves to be useful and fulfils the goals intended to achieve. When I started researching for this work, I discovered the magnitude of my ignorance about the basic landmarks of this profession, and in the process, that of many others. This work is an attempt towards understanding what happened, our role in it and what should be done.

Introduction

Sudan is vast; it encompasses different terrain and climatic zones, ranging from arid deserts to tropical forests and equatorial jungles, with a host of disease vectors found in a precarious environment. Consequently, a variety of diseases-epidemic and endemic - are known, and to face them, people have tapped the resources of this environment - plants, minerals and animal products-in the management of their health. In this way, the Sudanese, like many other peoples, have amassed a great corpus of curative methods, techniques, and recipes.

Relevant data concerning Sudan's health has been gathered from the accounts of travellers, explorers, historians and missionaries who have visited the country, and from the writings of medical officers and government officials who worked in the country in the last three centuries.

From these sources and others, it is possible to conclude that the Sudanese were generally healthy. However, their country was swept by several epidemics, many of which were imported from neighbouring countries, and which were frequently connected with famine and drought. The notable epidemics included cerebrospinal meningitis, cholera, smallpox, yellow fever, and other unidentified fevers including typhus.

Fatalities due to these epidemics were massive. Baker, for example, reported that he witnessed a devastating epidemic of smallpox so bad that 'the natives were dying like flies'.[5] Others reported that the pestilence took a fearful toll of the population and sometimes decimated whole villages. Indeed, each wave of an epidemic, reporters agreed, left the population weaker and vulnerable.

Endemic diseases such as malaria, leishmaniasis, onchocerciasis, schistosomiasis, guinea worm infestation,

venereal diseases (syphilis, gonorrhoea, bejel, and yaws), leprosy, and child diseases (measles, chickenpox and diphtheria) were all too common and familiar to most people, and have taken their toll on human lives and resources.[6]

Anthropologists have contributed immensely in recording and studying the traditional systems of medical care among the different groups in the country. Edwards Evans-Pritchard studied the Azande,[7] the Nuer, the Ingassana,[8]the Bongo, the Mberidi and Mbegumba of Bahr Al-Ghazal; RG Lienhardt,[9]the Dinka; Jean Buxton,[10]the Mandari; Charles and Brenda Seligman[11] the tribes of the White Nile and southern Sudan, and Harold MacMichael[12] drew a history of Arabs in Sudan and described their customs and beliefs. In JS Trimingham's studies on *Islam in the Sudan*, we find a perceptive analysis of the magico-religious beliefs and practices associated with affliction and misfortune.[13] Ian Cunnison studied the Humur tribes of southern Kordofan[14] and Harold Barclay Burri Al-Lamab, a suburban village and currently a township in the Khartoum metropolis.[15]

Several studies in healing practices were carried out in partial fulfilment of postgraduate degrees in anthropology, folklore, medicine, pharmacy, veterinary sciences, and agriculture or for other academic pursuits. A representative sample include Ahmed Bayoumi's doctoral thesis (University of Khartoum, 1974), t*he History of Sudan Health Services*, which was revised[16] and published in 1979. This remarkable work traced health services in Sudan through their historical development emphasizing the social, economic and administrative factors. The book no doubt filled a gap in the history of the field of health services and research in Sudan and proved to be invaluable to health care providers, researchers and students.[17]Holy[18] and Abdullahi Osman Al-Tom, studied the Berti of Darfur,[19,20] Nadel, the Nuba of southern Kordofan,[21]Sharaf Al-Din Abd Al-Salam, the saints' cult in

Sudan,[22]Abdullahi Ali Ibrahim,[23]the impact of Rubatab metaphor on social, political and health life of that tribe and their neighbours, and Sayyid Hamid Hurreiz, birth, marriage, death and initiation customs, beliefs[24] and rites of passage[25] in central Sudan. Idris Salim Al-Hassan studied Um Dawan Ban religious institutions and saints cults,[26]Awad Al-Basha, couching techniques in Kordofan,[27]Amira Hasan, the social attributions of female circumcision,[28] Amir Ali Hasan, the *maseed* system in the Gezira.[29,30,] Pamela Constantinidis, sickness and spirits in Northern Sudan,[31] and Samia Al-Nagar, spirit possession and social change in Omdurman.[32] A comprehensive coverage of these dissertations and other early works on traditional Sudanese medicine is given in the *General Bibliography* annexed to Ahmad Al Safi book *Traditional Sudanese Medicine*.[33]

Several other works appeared outside the postgraduate field, namely Ahmad Al-Safi *Native Medicine in Sudan: Sources, Concepts and Methods,*[34]which was prepared for the Salamabi prize competition Sudan Research Unit in 1968 and published in 1970, and the two WHO-sponsored female circumcision surveys that covered almost all Northern Sudan, Hamid Rushwan *Female Circumcision: prevalence, complications, attitudes and change* (1983),[35] and Asma Al-Darir *Woman, why do you weep* (1982).[36]

During the Anglo-Egyptian Condominium (1899-1956), medical army doctors in the Egyptian Medical Corps, scientists, administrators, and officials contributed a lot to our knowledge of the local practices in the various parts of the country. Andrew Balfour[37]solicited and edited pioneering articles on local medical practices and customs in different parts of Sudan in *the Wellcome Tropical Research Laboratories Reports* of 1908, 1911, and 1913.[38] In these reports, four definitive articles were written by Anglo-Egyptian medical army officers, who worked in different parts of the country after the reconquest of Sudan in

1899, and several more articles on relevant subjects. Additional notes were contributed by Sir Rudolf Baron von Slatin Pasha, Inspector General, Sudan Government, which, Balfour said were derived from Slatin's extensive experience of dervish customs and from information furnished by one of the more reputable local *hakims*. Slatin notes included narratives of the traditional treatment of syphilis, gonorrhoea, dysentery, *dabas*, headache, neuralgia, and other diseases.[39]

Bimbashi RG Anderson, while Senior Medical Officer in Kordofan, described the medical practices and superstitions amongst the people of that region.[40]Later, he also described the tribal customs of the Nyam-Nyam[41] and Gour people inhabiting the eastern Bahr Al-Ghazal region of Southern Sudan, and the relation of these customs to the medicine and morals of these tribes.[42]

Bimbashi L Bousfield, an Egyptian Medical Corps Officer and Senior Medical Officer in Kassala in the eastern Sudan, described the local methods of treatment of diseases in that region.[43]

Bimbashi Dr Hasan Effendi Zeki of the Sudan Medical Department and Medical Officer at Gordon Memorial College, described the healing art of the dervishes during the rule of the Mahdi and his *Khalifa* (successor).[44] Dr Zeki had been taken captive to Omdurman by the Mahdi after he had captured the city, and had worked during his captivity as the Mahdi's medical adviser and attended him during his death. It was Dr Zeki who reported that the Mahdi had died of cerebro-spinal meningitis in l885 in the epidemic that hit the country then. Slatin Pasha[45] and Ohrwalder, however, thought it was typhus. Bloss thought both diseases were likely; but the evidence provided by Dr Zeki must not be discredited.[46]

In the first half of the twentieth century, expatriate and Sudanese scientists dedicated a sizable portion of their studies

stringing together information on Sudan's health and tried to understand the prevalent diseases in earlier times.[47]These works provided some information that made it possible to draw a rough picture for the medical scene in Sudan in recent history. The picture they drew could be refined and detailed later.

Earlier to the 19th century, the health of the Sudanese people especially in Northern Sudan was said to be good; but the health conditions of the country in general were precarious. Famine was a constant threat, poverty was rife, and medical services as we know today were nonexistent. There were no hospitals in the country, hardly any doctors were there, and of medications nothing of note known. The health scene throughout the country was influenced by mystique, supernatural beliefs and the empiricism of traditional wisdom. Traditional health practitioners, practices and recipes were the only resources available to the indigenous population to guard against the endemic and epidemic disease, and to explain disability and misfortune.

With the advent of the Turko-Egyptian rule in 1820, Mamluk[48] doctors were the first to practice medicine in Sudan, albeit oriental traditional medicine. Few European doctors were also there in the entourage of the Ottoman rulers. Later, few elements of Western medicine were brought into the country, and rudimentary medical services were started with commissioned army officers first practicing in the field and later running small hospitals built as part of military barracks in the larger garrison towns of Khartoum, Wad Medani, and El Obeid. Some smaller medical units were set up in other strategic locations in the provinces.[49] The little service provided in these facilities was directed towards the troops; the Turko-Egyptian officers and civilians preferred to be treated at home. Practically little health care was available to the indigenous population unless connected with the army.[50]

Epidemics and endemic diseases threatened Mohamed Ali Pasha's ambitious programme to build an army of Sudanese negroes. Though vaccinated and given some medical care, recruits kept dying in thousands before reaching Aswan where his army was stationed. The Pasha thought, and rightly, that better medical care was needed and fast. He launched successfully a scheme of training Egyptians doctors in Cairo and France.[51] Egyptian medical officers were thus available for dispatch to Sudan by 1828. In addition, Italian, German, French and Tuscan medical officers and dispensers were also attracted into the country. All worked in army service and few were spread among civilian hospitals namely in Berber, Dongola and Kassala.

In 1976, Dr. Sobhi Al-Hakiem, a Sudanese obstetrician and gynaecologist, deposited in the Central Records Office in Khartoum, surgical instruments and a medical manuscript that belonged to his grandfather Ahmad Yusuf Al-Siddiq Al-Hahiawi, nicknamed Al-Hakiem.[52] He believed that both items were important historical findings, and indeed they were.

We studied the manuscript, and found that it was an extract of *Al-Rahma fi Al-Tibbb wa Al-Hikma*, a book usually attributed to Galal Al-Din Al-Sioyouti. Nonetheless, we think this finding is interesting, suggesting as it does that the author, a medical graduate and a specialist in surgery with postgraduate training in Paris, retained *Al-Rahma* as a medical manual worthy of being read and extracted. If Al-Hakim was actually referring and making use of this book, then he has helped us in drawing a clear picture of the dominant culture of the type of medicine practised then in Sudan.

Al-Hakiem came to Sudan as a medical officer in the Egyptian Army in 1839. He was appointed Medical Director of Dongola and Berber hospitals, where he practiced medicine and surgery until his death in 1893. In his practice, he performed different

surgical operations, including the removal of stones from the bladder and ureters, the amputation of limbs, the excision of tumours, and tooth extractions.[53]This was probably all the surgery they were doing at the time with the type of anaesthesia available then.

Boss interviewed Bimbashi Hassan Effendi Zeki, a medical officer during the siege of Khartoum, and recorded the following data about the town before its fall.[54] He said that there were several Egyptian doctors in Khartoum, the best known being Nessib Salim, who performed many operations including bladder stones, madura, wounds and abscesses. Chloroform was used as an anaesthetic, though it was viewed with a certain amount of fear at first.[55]

When the Mahdi took the country over in 1885, there was only one hospital in Khartoum operated by the Egyptian Army Medical Corps (EAMC), few Egyptian medical practitioners in town, few chemist shops run by Greek merchants, and some dispensaries belonging to the Austrian Mission. The health care programme was no more than vaccination against smallpox and elementary sanitary measures. Traditional inoculation was still popular and much resorted to in Northern Sudan.

Whatever there was of medical facilities in Khartoum was destroyed and resources consumed during the siege and eventual fall of the town later. In 1896 (1306 AH), the country was hit hard by famine (مجاعة سنة ستة). In that famine, conditions in the country were so bad that people ate food of any and every kind, dogs, cats, rats, leather and gum. Smallpox and measles epidemics played havoc among the vulnerable population.

Up to 1910, the medical arsenal of the country included vaccines similar to those introduced in 1820 by the Turko-Egyptian rule, diphtheria anti-toxin, quinine being tried in different formulations for malaria, arsenical compounds for

syphilis, purges of calomel and magnesium sulphate, emetic syrups, and silver nitrate solution to paint on the eyelids for trachoma, and ample recourse to cupping and blood-letting. Still there was no treatment known for kala-azar, bilharzia, dysenteries, relapsing fever, typhoid fever, liver abscess, yaws, beriberi and cerebro-spinal meningitis. It was only in 1913 that Squires[56] tried emetine hydrochloride in the treatment of acute amoebic dysentery in Port Sudan and demonstrated its beneficial effects, and in 1917, Christopherson tried successfully potassium antimony tartrate in the treatment of bilharzia in Khartoum Civil Hospital.[57]

Public health, hygiene and sanitation were rudimentary, and organized medical service was only found in few hospitals in the main cities, no more medical facilities were found anywhere. Medical care was provided at the dawn of the century by few high-ranking Egyptians army officers, in the Medical Corps of the Egyptian Army, and Syrian doctors, in lower ranks. All doctors were confined to the main cities where the small hospitals in Omdurman, Khartoum, Berber, Dongola, Sawakin, Kassala, and Wadi Halfa were located. British medical officers started trickling in and joining the service from 1901 onwards. There were only seven British doctors up to the outbreak of the First World War, and two nurses, Miss Pye Moore and Miss Jones in Khartoum Hospital. Squires said of these seven that they all had memberships or fellowships of the Royal Colleges of Surgeons of England and Physicians of London. Thus, he said, so far as the British medical staffs were concerned, the service ranked as the most highly qualified in the world.'[58]

Four decades later, vaccines were a little better, and a few chemotherapeutic agents were at hand: Salvarsan for syphilis and yaws, atoxyl, trypansamide and Bayer 205 for sleeping sickness, antimony tartrate for bilharzia, plasmochine for malaria, and the newly discovered sulfonamide drugs, in

addition to anti-mosquito and anti-snail chemicals. Traditional practices were still playing a dominant role in health care throughout the country.

Thus, Dr Satti was born, educated and later worked in a country completely different from the one he left behind when he died. He dedicated his life to a silent war against the killer diseases in the field and in the laboratory. Throughout his active life, he did his daily chores well, carried out his responsibilities efficiently, and laid down for objectivity and rationality.

In addition, Dr Satti made significant contributions and lasting discoveries in the field of health, namely in tropical pathology and epidemiology. He started research with the help of the best in the field then, the pathologist Dr Robert Kirk, the entomologist Dr Lewis, and internist Prof. Morgan, and when he was sent abroad for postgraduate training he landed in the prestigious John Hopkins School of Hygiene and Public Health in Baltimore, USA. He was a typical original researcher looking for authentic data in the field among the local populations, wherever they were in the vast country.

Dr Mohamed Hamad Satti has been a prominent member of the medical profession in Sudan for over half a century. His extensive contributions to medicine in general, and in tropical medicine specifically, deserve respect and admiration.

Dr Satti started research and teaching in the most important tropical diseases soon after his becoming a medical officer in Singa. Ever since, he had been at the forefront of tropical medicine in Sudan and elsewhere in the world. He was a Founder Member of the National Health Laboratories, Institute of Medical Laboratory Technology, School of Laboratory Assistants, and he was the one who supported and engineered advanced training for laboratory technicians in Sudan.

He was a founder member of the School for Tropical Medicine and the Hospital for Tropical Medicine (1966), and the Institute for Tropical Diseases Research. He envisioned and proposed the establishment of the Medical Research Council and the National Council for Research. Due to this early call and to other opportune moves by other scientists, the NCR was established in 1970 with a power to form many specialized councils including the MRC. Dr Satti was senior researcher and consultant in this council throughout his life.

Dr Satti was appointed as Director of Stack Medical Research Laboratories in 1963. He remained a very active researcher in this laboratory right up to his late years. From 1940 to 1999, Dr Satti developed international links in tropical diseases with healthcare professionals across the world, and commanded respect from all his peers and associates.

In 1985, in recognition of his genuine contributions to tropical medicine, the WHO awarded him the Sousha prize and medal, the University of Khartoum awarded him the Honourary Doctor of Science in 1980, and in 1989, the Supreme Council of State in Sudan bestowed upon him Wisam El-Nilain, the highest award in the country.

Dr Satti was greatly respected within his principal specialty of pathology, medical zoology, and microbiology; he was also vice-chairman of the WHO Onchocerciasis Expert Committee in 1986.

Dr Satti played a leading role in promoting both field work as well as laboratory sciences in Sudan. Dr Satti introduced and promoted interest in new disciplines like medical entomology, malacology, and vertebrate ecology. Until few years before his death in 2005, he continued to teach, on a voluntary basis, on tropical diseases in the Faculty of Medicine, University of Khartoum. From 1940 until 1985, Dr Satti authored over 60 most illuminating scientific publications and wrote several

reports on tropical medicine in international refereed journals along with other co-workers.

The name of Dr Satti was familiar to the tropical medicine community worldwide. He accumulated several achievements that affected significantly many disciplines.

Dr Mohamed Hamad Satti

Early years & education

Dr Mohamed Hamad Satti was born in Shendi, Northern Sudan, in 1913 where he had his elementary education. In Atbara, he had his intermediate schooling, and higher secondary education in the Old Gordon Memorial College (the only secondary school then) in Khartoum in 1927. He joined Kitchener School of Medicine (KSM) in Khartoum in 1931, and graduated with DKSM (Diploma of Kitchener School of Medicine) in 1935. It is to be noted here that the initial course of training in KSM was four years; in 1934, it was extended to five years and in 1939 to six years.[59]Prof. Haseeb wrote evaluating KSM then saying, 'competent assessors, including professors from the Cairo Medical School and distinguished members of the profession from London teaching hospitals, were invited to view the examination procedure, to inspect the various departments of the School, and to offer criticism and advice.'[60]

Dr Satti died in Khartoum on Tuesday 15th March 2005 of natural causes, and buried in Faroug cemetery.

Career

Immediately after graduation, Dr Satti joined Sudan Medical Service and worked for ten years (1936-1946) first as house officer in Port Sudan and then in Senga and Gedaref, which happened to be areas endemic with leishmaniasis.

In 1946, he joined the Stack Medical Research Laboratories (SMRL) as an assistant bacteriologist. In 1948, he was posted to Bahr El-Ghazal to study the epidemiology of onchocerciasis and its chemotherapy with suramin. For two years starting 1952, he had postgraduate medical studies in the United Kingdom. In 1955, he rejoined the SMRL and in 1956 was appointed as

Medical Zoologist, a job he started with a study of an outbreak of kala-azar of an unprecedented scale in the Southern Fung.

Later in 1958, he joined the John Hopkins School of Hygiene and Public Health in Baltimore, USA, and in 1959, he acquired a Degree of Master of Public Health (MPH) majoring in Zoology.

In 1962, Dr Satti was elected member of the WHO Advisory Panel on parasitic diseases, and enjoyed this membership until the 1980s.

In 1963, Dr Satti replaced Prof. Mansour Ali Haseeb[61] as Director of Stack Medical Research Laboratories (SMRL) and held that post up to 1968 when he retired work in the Ministry of Health. Dr Satti was succeeded by Dr Mahmoud Abdel Rahman Ziada (DKSM, MRCPath) who held the office up to 1973.

On retirement in 1969, Dr Satti was re-appointed as advisor on medical research, and in 1970, he was assigned as a short-term consultant epidemiologist and public health advisor on the health aspects of Lake Nasser Development Centre, Aswan, UAR as WHO consultant. Later, in 1972 he had two assignments from WHO in the People's Democratic Republic of Yemen, South Yemen. He rendered two reports for the two assignments on Wadi Turab soil conservation and water development-health aspects, and parasitic diseases survey.

In 1973, he joined the Medical Research Council as member and consultant and in 1975 and 1976; he worked as member of the WHO Expert Committee on Onchocerciasis. In 1981, he was appointed Director, Tropical Medicine Research Institute, Sudan.

Throughout his career, Dr Satti occupied several posts in Sudanese Ministry of Health and filled different specialties during his active service. He was the bacteriologist, medical

zoologist, forensic medicine specialist, epidemiologist, pathologist, and researcher.

Character

Dr Satti had been an unassuming man. He was firm in his purpose, humbly believing in himself, uninterested in social success or financial reward and did not have a private clinic throughout his working life.

International presence

- In 1952, Dr Satti and the late Dr Robert Kirk attended the first Italian conference of tropical medicine in East Africa in Asmara (Eritrea). They jointly read a paper on 'Phlebotamus and Disease'.
- In 1958, the 6th International Congress of Tropical Medicine and Malaria in Lisbon, Portugal, invited Dr Satti to read a paper on 'Kala-azar in Sudan and Tropical Africa'. He accepted the offer and read a paper on the subject in the congress. In the same year, he was elected a member of the International Interim Committee organizing the seventh congress to be held in Rio de Janeiro in Brazil in 1963.
- In 1968, he attended the eighth International Congress of Tropical Medicine in Tehran, Iran. He was still enjoying the membership of the International Interim Committee.
- In 1973, he attended the ninth International Congress of Tropical Medicine and Malaria, Athens, Greece. Together with Dr. Osman M. Abdel Nur, he read a paper entitled "Chironomiae".
- In 1980, he attended the 10th International Congress of Tropical Medicine and Malaria, to which he contributed two papers: Changing Epidemiology of

Leishmaniasis in Sudan, and Cutaneous Larva migrans in Northern Kordofan, Sudan. He was still member of the IIC.

- He was chosen Vice-president of the 12th International Congress of Tropical Medicine and Malaria, Calgary, Canada, 1986?.
- In 1986, he attended the WHO Onchocerciasis Expert Committee as Vice-Chairperson.

Teaching

Dr Satti established himself as an all-rounder teacher. He taught pathology, microbiology, practical and theoretical, forensic medicine and post-mortem from 1946 to 1948 in KSM, and was the only teacher and examiner in forensic medicine in the Faculty of Medicine, University of Khartoum from 1963 to 1969. He was part-time teacher then.

Initiatives

During his term of office as Director, SMRL, Dr Satti made several achievements that laid down sound infrastructure for laboratory services and medical research in Sudan. These included the foundation of the National Health Laboratories, the Cancer Institute, School of Laboratory Assistants, and the Institute for Tropical Diseases Research. He also envisioned and proposed the establishment of the Medical Research Council, the National Council of Research, and a school of tropical medicine. He also launched ambitious programmes with the objective of developing human resources to strengthen laboratory technology in Sudan. He introduced new specialties into the country like medical entomology, malacology, medical zoology, and vertebrate ecology; he did so by sending teams of postgraduates to specialize in these fields.

The National Health Laboratories

One of the notable achievements of Dr Satti was his major role in the supervision of the building of the 6-storey building-complex that formed the new National Health Laboratories. The building was planned to accommodate the expansion in health laboratory services. Earlier in 1949, the WCL was hosted in the first floor of the Ministry of Health building. Since then, these laboratories were short of space and in real hazard of fire because of its wooden verandas and roofs. In 1956, MOH applied for the inclusion of the construction of the new WCL building in the 1957/58 Government Building Programme in the area allocated for that purpose between the Faculty of Medicine, University of Khartoum and the present building of the Faculty of Pharmacy on the Palace Avenue. The new building was planned to accommodate beside the WCL the Medical Entomology and the Schistosomiasis Departments, which were in Wad Medani to constitute the proposed Medical Research Institute (MRI) as advocated by Dr Satti. In 1957, that area was reallocated for the immediate expansion of the Faculty of Medicine, University of Khartoum to meet the proposed larger intake of medical students, which was given top priority by the government.

An alternative piece of land was allocated for the new laboratory buildings (where the Continuing Medical Education Department is housed now). Unfortunately, the new area contained six inhabited old government houses and would need many years to evacuate. At the same time, the GM building was condemned and closed pending demolition. Because of the expected difficulties and years of delay needed to remove those houses, Prof. Abdel Hamid Ibrahim Suleiman suggested constructing the proposed combined medical MRI/WCL building in place of the GM and build a new museum in the (now) Continuing Medical Education buildings. The change was immediately approved and Prof. Abdel Hamid

was directed to follow up with the design of the buildings and allocate laboratory space for the listed departments and sections. To expedite design, the Ministry of Works contracted a foreign engineering firm (Peter Muller Engineering Co.) to undertake the architectural and structural design and costing of the proposed building, which were immediately submitted for financial approval in the 1961-1962 budget.

Dr Satti, Dr Sayyid Daoud Hassan, and Prof. Ibrahim, all three earnestly chased financial approvals and supervised the construction and equipment of the new 5-storey National Health Laboratory in Khartoum (NHL). By the end of 1969, the NCL Medical Entomology, Schistosomiasis laboratories, and all (Stack) departments were completely moved to the new NHL. During the seventies, three Regional Health Laboratories (RHL) were constructed in Port Sudan, El-Obied and Juba, and in the nineties, Atbara RHL was completed.

Dr Satti, director of SMRL (1963-1968) was highly convinced of the necessity of building the National Health Laboratories, so much that he fought for it and solicited foreign help to support the project. In 1964, he engineered an invitation to Sir Graham Wilson, ex-director of the Public Health Laboratories of England and Wales to visit Sudan and lend support to this project.[62] Skeptics were many. They were not convinced about the worth of this huge building; they thought that the cost of upkeep of this colossal building far exceeds its usefulness and it is therefore a liability. They discouragingly called it 'Satti's white elephant' in reference to the legendary white elephant in Southeast Asian traditions. This animal was held as sacred and protected by law from labour. Hence, possessing a white elephant is both a blessing and a curse: a blessing because the animal has a scared nature and a curse because it could be put to no practical use. Fortunately, Satti proved to be right; he and his colleagues won. The laboratories were built in the period 1963-1968 with an approximate cost of $ 5 million. In 1969, they

were equipped, staffed and functioned and became a landmark in the city of Khartoum. Tens of researchers were sent for training within the budget of the UNDP project in 1972-77. Probably the NHL building would have never been constructed for the next 25 years if Dr Satti failed in his efforts at that time. The NHL soon proved its worth.

Institute of Medical Laboratory Technology

Dr Satti shared in the efforts and assisted the University of Khartoum in the establishment of the new Institute of Medical Laboratory Technology, and offered a building to accommodate the new institute. This later became known as College of Medical Laboratory Sciences.

He sent several technicians to the United Kingdom to obtain the AIMLT from the Institute of Medical Laboratory Technology. Those trainees formed the core of teachers in the new Institute.

School of Laboratory Assistants

Dr Satti secured approval for the creation of a full-fledged two-year course school of laboratory assistants, who eventually became the backbone of medical diagnostic laboratory services at all levels of health care facilities.

Training of scientific officers & postgraduates

Dr Satti recruited scientific officers and sent them for training abroad on malacology, medical entomology, malariology, parasitology, and onchocerciasis. These officers were recruited from graduates of the Faculty of Science, University of Khartoum who joined the service of MOH.

A post of a vertebrate ecologist was created. Many of those recruits later became leaders in their respective fields, and several of whom attained national and international recognition. He also recruited and sent a team of medically qualified research workers for postgraduate training in the

United Kingdom to specialize in different laboratory disciplines including pathology, bacteriology, haematology, histopathology, parasitology, virology, biochemistry and various other specialized disciplines like vaccine making. These were supposed to fill the posts in the new laboratory to meet the expansion in the health services, which were very much ahead of those of the laboratories that were left to lag behind over the years. The theses for higher degrees by these and other graduates, Prof. Haseeb commented, proved to be useful in research programmes sponsored by Sudan Ministry of Health.[63]

The Cancer Institute

In collaboration with a WHO consultant on radiotherapy in EMRO, Dr Satti supervised the building of the Cancer Institute (later to become the Radiation and Isotope Centre in Khartoum), when the specialist in charge was still under training in the UK during 1959-1962. The specialist in question happened to be Dr El-Sheikh Abdel Rahman (MB BS, DMRT, FRCR) who did his postgraduate studies in UK and came back in 1962 to become the first founding director of the Radiation and Isotope Centre.

The UNDP Project

Even before the various departments were moved to the new NHL building in 1969, Dr Satti, Prof. Ibrahim and Dr Sayyid Daoud anticipated the great need for training of laboratory professionals and technicians abroad. They envisioned the need for the acquisition of up to date laboratory equipment, apparatus, instruments, consumables and vehicles. Therefore, in 1968 the MOH requested EMRO to assign a consultant to prepare a submission on behalf of the Sudan Government to UNDP for funding a 5-year project for the strengthening and expansion of health laboratory services in Sudan. The WHO responded and assigned Dr Hayder from Jordan to carry out this task. The request was made and submitted by the

government to UNDP in 1971, was approved and signed the same year for implementation during the period 1972-1977. UNDP contributed 1,136,200 US$ to the project and Dr Bukhari from Pakistan was appointed project manager. In 1973, and in order to compete with the Universities for getting the best BSc Honours graduates (First or Upper Second), the government approved application of the National Council for Research Cadre (terms of service) on NHL scientists (researchers). By 1977, the UNDP Project and researchers terms of service greatly enhanced the capacity of the NHL, and upgraded and expanded the national health laboratory services in Sudan.

National Council for Research

Though Dr Satti's main contribution was fieldwork and laboratory investigations, yet he had far-reaching efforts in how to organize and direct research in medicine. He believed that Sudan as a developing nation can contribute to the development and advancement of science. He said, 'we should not expect other people to come and solve our problems for us. I should very much hesitate to allow foreign scientists to be let loose to go up and down the country. This is extremely dangerous and a lot of espionage is done through the smoke screen of science. Young developing nations have to be very careful.'[64]

In 1966, Mr. Abdel Hamid Ibrahim Suleiman and other prominent scientists, made major contributions in the efforts to establish the NCR. A 10-page memorandum was submitted to the Prime Minister at the time (Mohamed Ahmed Mahgoub), to establish a body called the National Council for Research and Technology. They regarded it as a contribution to the then ongoing series of meetings sponsored by the Prime Minister and headed by Dr Abdel Halim Mohamed, on ways and means to establish a national council for scientific research as promoted at the time by UNESCO. Prof. Mansour Ali Haseeb

and Prof. Amin El-Karib have shared in the implementation of the UNESCO proposal. Eventually, Dr Abdel Halim Mohamed proposed the idea on 13 June 1966 and the matter discussed in a Council of Ministers meeting then.

Prof. Mustafa Hassan, Dr Gaafar Karrar, Dr Mohamed Abdul Rahman Ziyada, and Mr. Abdel Hamid Ibrahim also supported the issue. This group issued a vindication memo on 16 June 1966 addressing the controversial issues and suggesting solutions.

Coincidentally, Dr Satti proposed in the same year, 1966, the creation of a Medical Research Council and a Higher Scientific Council for Research under which all research disciplines were to be included. The proposal entitled "Memorandum on cooperation in Medical Research in Sudan and the suggestion of the establishment of a school of tropical medicine" appeared in the SMRL Annual Report of 1965/1966. The memo succinctly stated:

> "Having been engaged in research of one form or another with particular reference to our local problems for the last quarter of a century or so, and in view of the fact that I am in continuous contact with and aware of the many urgent public health matters, I am struck and in reality perturbed by the great number of medical problems in this country that shout and press for solutions. This cannot be carried out without intensive research, which necessitates the exploitation of all our available scientific manpower regardless of the differences of the units, institutions or ministries to which they belong."[65]

Later, Mr. Abdel Hamid Ibrahim Suleiman and other personalities including Hussain Idris, Director of the Agricultural Research Corporation, and Mahdi Mustafa El-Hadi of the Minsitry of Foreign Affairs at the time supported

the idea and continued pressing on the idea. The NCR establishment decision was one of the first decisions to be taken by the new May 1969 regime cabinet of Ministers. The NCR was eventually formed by a Presidential Decree in 1970.

The NCR secretariat was accommodated in the 5th floor of the NHL and was headed by Dr El Samani Abdalla Yagoub from Department of Physics, University of Khartoum. The building accommodated as well the Institute of Tropical Medicine Research and the Schistosomiasis Research Unit, which Dr Satti also reactivated.

School of Tropical Medicine

In 1966, Dr Satti proposed the establishment of a school for Tropical Medicine and a hospital. He reckoned that it was high time that some form of a school of tropical medicine with a big team of teachers and research workers in the various fields of tropical medicine with particular emphasis on Sudan's local problems should be started. He suggested that the school should set off under the auspices of the university (then University of Khartoum and the only one in the country) with moral and material support from the Ministry of Health. This setup, he thought, was very essential and urgent in view of the fact that they were then absorbing in the service very many doctors who had been trained in non-tropical countries including Europe. These graduates were never exposed sufficiently to tropical medicine. He thought this was not fair on both patients and doctors, and the situation should be remedied. This institute, he envisioned could be developed later into a proper school. Whatever the entity that Dr Satti proposed, it materialized and proliferated several institutions years later. The proposed institutions he thought should have good relations with other schools of tropical medicine in London, Liverpool, and Calcutta. He rightly thought that the

establishment of such a school would create great interest in studying Sudan's local health problems.[66]

Institute for Tropical Diseases Research

During the period 1972-77, Prof. El-Hassan was Chairperson of the Medical Research Council (MRC) in Sudan. During this period, he and others helped in establishing the Institute for Tropical Diseases Research (ITDR) at the NCR with its two parts: the Hospital for Tropical Diseases in Omdurman and the Laboratory in Khartoum. Several researches were recruited and sent for training in tropical medicine, pathology, epidemiology and parasitology in Britain.

Major Research

In the first half of the twentieth century, expatriate and Sudanese scientists dedicated sizable portion of their time trying to understand the tropical diseases of Sudan. In collaboration with Prof. Robert Kirk, Prof. Haseeb, Prof. Morgan, Dr Lewis, Dr Osman M Abd Al Nour, and Dr Horgan, and with the assistance of several coworkers, Dr Satti carried out extensive field and laboratory studies on leishmaniasis, yellow fever, Weal syndrome, Kakoom paralysis, trichomonadae, bancroftan filariasis, cutaneous larva migrans, onchocerciasis, malaria, infective hepatitis, water-borne diseases, cholera, typhoid fever, cerebro-spinal meningitis, arboviruses, smallpox, and presbycusis (a progressive bilateral symmetrical age-related sensorineural hearing loss), and how less it affects the Mabaan tribes living in the southern and western part of the southern Fung district.

Field expeditions

Dr Satti was best known for his assiduous fieldwork and unwearied scientific studies. The fields Dr Satti chose wholeheartedly for his studies and research were far from the glamorous and lucrative clinical medicine. He interested

himself in epidemiology, medical zoology, malacology, and medical insects, and in the areas of disease vectors, hosts and reservoirs.

Dr Satti spanned the four corners of the country investigating and determining the epidemiology of disease, identifying causative agents, vectors and hosts, and establishing diagnoses, and testing the therapeutic efficacy of drugs for Sudan's major killer diseases where ever they were. He established that *Phlebotomus papatasi* is responsible for leishmaniasis and *P. orientalis* is responsible for Kala-azar, and that Sodium Stibgluconate injection (Pentostam injection GSK-UK) is the drug of choice. He investigated the epidemiology, causative agents, vectors, diagnosis, and treatment of these killer diseases, and left behind a legacy of scientific excellence including more than 60 published papers and solicited reports (see annexed publications).

He surveyed eastern and southeastern Sudan studying leishmaniasis, Bahr El Ghazal region of the southern Sudan in search of onchocerciasis and testing for the efficacy of Suramin Sodium (Antrypol), or spent time identifying a peculiar encephalomyelitis that affected the Nuer tribe of the Zeraf Island in Upper Nile, eventually called 'Weal syndrome'. He established the cause of an unusual polio-like paralysis of hands in Kakoom, a village on the Atbara river, eventually labeled 'Kakoom paralysis'. He unearthed the presence of cutaneous larva migrans in Kordofan, jaundice in Gedaref and typhoid fever in western Sudan. He investigated presbycusis[67] in a remote tribe of Sudan called the Mabaans, a study that revealed that hearing loss is significantly less in the elderly population in that area than in a group of similar age in urban societies. He assessed the environmental effects of Aswan High Damm on Wadi Halfa; or yellow fever in the Nuba Mountains in western Sudan and Kurmuk in southeastern Sudan. He lead an unprecedented expedition investigating the adverse effects

of consumptionof well waters of extremely high nitrate content on inhabitants of two villages in Northern Kordofan, filariasis in Darfur in Geneina in the very far western border of Sudan. He supervised building a field laboratory in the leishmania endemic area of the Blue Nile in Sennar, studied health aspects Rahad Irrigation project, and on-going research on schistosomiasis in the Gezira. The pilot project for the study and control of schistosomiasis in the Gezira, which he started deserves the attention and documentation of those who shared in the foundation.

He was probably the only scientist who could have been solicited to write an authoritative review article, and indeed he did, on practically any major tropical disease: filariasis, leishmaniasis, onchocerciasis, yellow fever, bancroftian filariasis, schistosomiasis or on arbo-viruses or water-borne diseases, and no one could have done the job better.

Leishmaniasis

To establish the epidemiology of kala-azar, a two-member Kala-Azar Commission formed of Captain DSB Thomson and Lieutenant WF Marshall of the Egyptian Army was appointeded by Sudan Government. The Commission left Khartoum in November 3 1909, on board the steamer *Culex*, with which was the Wellcome Tropical Research Floating Laboratory. The Commission was assigned the job of invetigating the cause and prevalence of the disease in eastern Sudan, and establishing whether it was recognized by the natives or not.

The Commission produced two reports and was concluded in 1913. The main endemic area was found to be along the banks of the Blue Nile and its tributaries and the upper reaches of the river Atbara. By questioning the elderly of the villages of Singa, Roseiris, and Qadaref areas, they found out that the symptoms and signs of the disease have been well known for quite some

time. The lay people knew well the clinical picture of the disease, resistant fever, the large abdomen, which is caused by an enlarged spleen, enlarged liver, ascites, generalized lymphadenopathy, anorexia, gradual wasting, weakness and emaciation, and anaemia which is described by saying that the blood becomes yellow (*damm asfar*) (دم أصـــفر). People also knew that the disease could cause epistaxis, diarrhoea, gangrenous mouth (*Cancrum oris*), sudden swellings, cough with blood-stained sputum, difficulty in breathing, and terminal swelling of the face and feet. This picture has been well portrayed in native poetry.

The natives in Blue Nile endemic areas thought that the disease was caused by poor nutrition; drinking water from wells that had been flooded during the rain; eating '*weykab*' (a filtered solution of durra ashes in water that was used as a salt substitute) with food; eating '*mandaki*' (dried, raw, pounded fish), and sleeping on the ground at the beginning of the rains, thus inhaling the vapours from the warm, moist earth. Some natives considered the disease to be highly infectious and would not eat or drink from the same vessels as the patient or even sleep in the same house.

Thomson, one of the two-member Kala-Azar Commission described the type of native treatment for kala-azar in the region:

> "They take the root of a climbing shrub, called *El Lawia*, and that of another shrub called *El Debeigha*, and mix them with (*Khara-El Hadid*)[68] (iron smelter refuse or iron scale), and a handful of red pepper (Shatta). All these are pounded into powder. A young goat is then slain and skinned, and the head, feet, and inside being discarded, the remainder is cut into small pieces and put into a large pot filled with plenty of water. This is mixed with the powder thus prepared; the pot is placed on the

> fire in the evening and caused to boil for some six hours. At daybreak, the patient is first given about half a rotl of Semn (butter) and then about the same quantity of the prepared broth and a few slices of the boiled bitter goat-meat. The effect is that of a very strong purgative, and the same treatment should be repeated for three times in succession (it is advisable to take the broth of this purge a little warm). At the end of three days the patient should consume Semn in large quantities for another three days, and the diet should consist of meat, bread, milk; but no vegetables such as *Weika*, or what Sudanese [in Darfur] call *El Durraba*. Other treatments include drinks of tannin, cupping over the spleen, and/or cautery. These are not specific treatments and were used in all cases of enlarged spleen and fever."[69]

Modern biomedical treatment in the early years of the twentieth century, however, was not a story of glory either. D'Arcy noted and summed up this situation in 1999 saying:

> "No wonder drug has yet arisen for the treatment or prophylaxis of the disease, and the current drug treatment for kala-azar is a classical example of old drugs being used to treat old diseases. With few exceptions, clinicians still must use toxic antimonial or other compounds that were being routinely used some forty to sixty years ago."[70]

Reduction of the swollen abdomen mechanically by tight bandaging is first tried. *Al-qaris* (sour camel's milk) was given to patients to live on exclusively. At the same time, they were required to exercise strenuously. A decoction of several herbs was mixed in camel's milk. The mixture included *janzabil* (ginger, *Zingiber officinalis*), *qurunful* (cloves, *Eugenia caryophyllus*), *qirfa* (cinnamon, *Cinnamomum zeylanicum*), *filfil* (pepper, *Capsicum annuum*), *cammoun aswad* (black pepper,

Nigella sattiva), *kasbara* (coriander, *Coriandrum sativum*), *shamar* (Cumin, *Cuminum cyminum*), *hilba* (fenugreek, *Trigonella foenum-graecum*), *toum* (garlic, *Allium Sattivum*), *basal* (onions, *Allium cepa*), and *harjal (*Argel, *Solenostemma argel)*. All items were incubated for 3 days, and when ready, the patient takes it freely for 12 consecutive days.

Irrespective of the cause, splenic enlargement with ascites is known as *tohal* (literally, spleen), (طوحال) *dobal*, (دوبـــال) *marad al-sa'id*, (مرض الصعيد) *um saloki*, (ام سلوكي) *al-simeih*, (الســـــميح) *abu-safar*, (أبو صفار), *himl al-rujal* (literally man's pregnancy حمل الرجال), *wad al-wirda* (ود الوردة), (*jana al-wirda*) (جنا الوردة) (the outcome of fever), and the sophisticated folk would call it with its classical Arabic name, *istisgha* (استســـــقاء) All these alternatives describe the swollen abdomen in kala-azar in endemic areas in southeastern Sudan.

Dr Satti was aware of this situation when he graduated and started research. In the period 1940-1946, Dr Robert Kirk and Dr Satti collaborated in the study of visceral leishmaniasis (kala-azar) with special reference to its clinical and chemotherapeutic manifestations. They also investigated the reservoir-host aspect. In this respect, Dr Satti found in 1938 that a monkey (*Cercopithecus aethiops*) is naturally infected in Singa in Northern Fung. This area was known to be an endemic focus of visceral leishmaniasis. In the same year and in this same endemic area, Kirk found a fox (Vulpes sp.) infected with leishmania from a sore in the mouth.

Together, Kirk and Satti described the status of the skin and lymph glands in kala-azar, and evolved the gland puncture as a method of diagnosis of this visceral infection in Sudan[71], and they described a punctate rash in treated cases of kala-azar.[72]

Workers in India and Kenya denied the presence of any enlargement of the lymph glands in kala-azar in their countries. However, in the XI Congress of Tropical Medicine and Malaria

held in Calgary, Alberta, Canada in September 1984, Prof. Nandy from the Calcutta School of Tropical Medicine reported on a generalized lymphdenopathy in an epidemic of kala-azar in India. In fact, the case he showed had larger lymph glands than those reported in Sudanese cases. He also obtained L.D. bodies from these glands.

Just before the Second World War, Dr Satti and co-workers received Diamidines-Stilbamidine, Fentamidine and Propamidine from Prof. Warrington Yorke of Liverpool as new drugs for testing on cases of kala-azar. These drugs were tested on hamsters infected with leishmania and on few human cases of kala-azar in September 1938. However, Dr Satti found that Stilbamidine was the most effective; but has very serious side effects. Pentamidine was also effective; but not as good as stillbamidine. Pentamidine had no serious side effects. The results of these chemotherapeutic investigations were published in a series of papers.[73]

In 1942, Dr Satti published his observations on the Antimony treatment of Sudan kala-azar.[74] This described drugs that were available before the war, like neostibosan, solustibosan urea stibamine, and stibamine glucoside or neostam. Certain amounts of combinations either with tar emetic or by itself have been included. In 1949, Satti published a follow-up of cases with stilbamidine before the war and during the war. He found that the drug affected the trigeminal nerve causing trigeminal neuralgia, and by photochemical studies, the drug was found to be retained in the body for about five years. This was found in the urine of treated cases.

In 1945, Horgan and Satti tried the effect of penicillin as a leishmanicidal drug. The result was negative.[75] In 1942, Kirk and Satti received a letter from Dr CM Wenyon, FRS to say that Burroughs Wellcome produced a drug similar or even identical in composition to Bayer Solustibosan and asked whether they

were willing to test it. They accepted the invitation, even though they knew that the drug was not in any way like neostibosan.[76] The drug was delivered in 6 c.c. ampoules with 20 mgms of pentavalent antimony per ml. This compound was tested on about 12 cases and the results were in no way different from those they previously had with solustibosan (Bayer).

However, in the light of the results obtained by Dr LG Goodwin regarding the excretion of the drug in hamsters, in which 85% of it was excreted in 4 hours, it was evident that it was not in any way cumulative like tartar emetic. Therefore, the drug was given in four hourly doses with dramatic results. Later on, Dr Wenyon sent a concentrated solution with 100 mgms/ml. Fourteen cases were treated with this new compound, 13 were discharged as provisionally cured. One patient died; he had M.T. malaria and *cancrum oris*. The compound used is what is now known as Sodium stibogluconate injection (Pentostam). This drug proved to be of extreme importance in saving thousands of lives in out-breaks of visceral leishmaniasis in the fifties and it is still the best we have, in spite of some resistance developed in Sudanese kala-azar. Owing to its safety, Satti and co-workers have treated patients in the bush in 1956-1959.

Previously, there were outbreaks reported in military posts and patrols in uninhabited country. The outbreak of 1956-59 included these areas, which remained silent for almost a quarter of a century. That epidemic affected the local tribes and had decimated the Jum Jum tribe.[77]The number of cases in that epidemic were more than 5,800. The death rate, despite the very difficult conditions under which the cases were dealt with was assessed at 10%.

Certain interesting findings, hitherto, not encountered were the fact that in schoolchildren, there were cases with enlarged

lymph glands; but were otherwise healthy. Some glands when punctured were found to contain leishmania. This occurred mainly in the old endemic foci. In the literature, such cases were found in Cyprus and Malta during the war in both the British and American armies, though in a few cases.[78]

Although Hoogstrall and Hyneman (1969) found infections in an endemic area in Southern Sudan in Nile rats (*Arvicanthus niloticus*), the serval cat and Genetta, this study was later continued by Dr Satti. He embarked on studying the reservoir host, the vector, improved diagnostic methods, immunological studies and characterization of the parasite in the different northern foci as the disease is increasing and covering new areas that were not known to be endemic. New drugs were tested and the clinical manifestations of the disease elucidated in the different new endemic areas.

In one place, visceral infections were found, in others cutaneous manifestations were clinically evident. Some persons go to the same endemic area, they develop the visceral disease; others visit the same area develop cutaneous sores. Only of late, that it was observed that different teams go to the same endemic area, some of whom develop purely cutaneous lesions, while others of the same group living under exactly the same conditions develop the visceral infection.

This situation aroused great interest amongst research workers who were baffled by the presence of purely cutaneous lesions coexisting in the same place and sometimes in the same patient. In some cases, you encounter the muco-cutaneous and the visceral infection occurring in the one and same case, almost at the same time. Is this a question of host-parasite relationship and the difference in reactions of the different hosts or is this an antigenic variation? Do we have different species of leishmania co-existing in the same place?[79]This state of affairs is not in any way unexpected as Dr Satti noted.[80]

Meantime, in search for an experimental animal host that stands the heat of the tropics, Dr Satti found the bush-baby, *Galago senegalensis*.[81]

To solve these urgent questions, Dr Satti built a field laboratory in the leishmania endemic area of the Blue Nile in Sennar under the auspices of Sudan Medical Research Council of the National Council for Research with expected aid from UN Tropical Diseases Research Programme (TDR) and other sources. The aid, it was hoped will be granted and it was being sought from other sources to supplement Sudan's grant. Teams versed in the various aspects of this study were mobilized to study the behaviour of the disease, and unravel its changing epidemiology (WHO, WHEN. They also attempted characterization of the parasite by new techniques and study of the clinical and chemotherapeutic aspect of the disease.

Fevers

The laity sees fever, a manifestation of many infections, as a disease caused by almost any natural or supernatural agent. The 'Evil Eye', however, ranks high among the agents that cause fever in all ages, while *um al-subiyan* (mother of lads) affects only the young and causes other diseases in addition to fever.

In all parts of the country, fevers were diagnosed and managed on similar lines. When fever was accompanied by convulsions, the causative agent in the mind of the laity was surely *um al-subiyan*. In that case, the parents were forbidden from touching the child; the sign of the cross was drawn in soot on the forehead, and the *faki* was asked as well to pray for a cure. Many plants were used for their antipyretic effects, and some were claimed to be specifically anti-malarial, antibiotic, or anti-inflammatory as well.

Awad Al-Karim Muhammad Hindi in his book *Mukhtarat Al-Sayigh* quoted the views of some notable healers of his time on the causes of fever:

> "Basir Mustafa Bati of Omdurman attributes *wirda um barid* (وردة أم برد) to accumulation of internal dirt, walking on hot ground, exertion, or *damm* (دم) [plethora]. *Basira* Fatima bit Talib of Berber, classifies fever as either due to *nugud al-halaq* (نجود الحلق) [syphilis], especially in winter, *khiderat* (خـديرات) [tonsillitis], or '*afanat al-matar* (عفانة المطر) [dampness of rain]. Basira Fatima adds, "If *khiderat* [infected tonsils] are treated, fever subsides."[82]

Al-Tunisi in his narrative of the Darfur kingdoms in the ninteenth cenury, *Tashhidh Al-azhan bi-sirat bilad Al-Arab wal-Sudan*,[83] describes *al-humma al-mutbiqa* (الحمى المطبقة), and likens it to *al-nosha* (النوشـــة) (typhoid fever) of Egypt. However, whether this name was actually known in Darfur was doubtful because Al-Tunisi soon added that, 'all types of fever were called *wirdi* by Sudanese; they do not differentiate between them.'

People also recognize *al-humma al-raj'a* (الحمى الراجعة) (relapsing fever) and *abu-farrar* (أبو فرار) (cerebro-spinal meningitis). For treatment, they cup the back of the neck and rub the skin with *qarad* (*Acacia nilotica*), and vinegar.

Among fevers, malaria has attracted a lot of attention and received much better documentation in classical medical and literary works, as well as the best descriptions in local tongues.

Fever is known under a variety of labels-*humma*, *wirda*, *sahraja* (سهراجة), and is qualified, when it is a malarial fever, as *humma um barid* (fever with rigours), *hummat kharif* (حمة خريف) (rainy season's fever), *gibbiyya* (غبيـــة), *tiltawiyya* (تلتاويـــــة) *and rib'* (ربـــع). *Ghibbiyya* (literally a fever that recurs every other day) is quotidian in Northern Sudan[84], and tertian (recurring every third day) in Darfur.[85] *Wirda*[86] is quotidian fever in Darfur.

Purulent wounds draining in the groin and armpits are known to cause *ashgaddi* (أشـــقدي) (lymphadenitis) and fever. When a child had fever with rigours, the parents were forbidden from touching him or her because the condition was believed to be due to *um al-subiyan*. The *'uqda* (عقـدة) (knot) was blown upon both for prevention and for cure of fever. A patient was fumigated to exorcise evil spirits, and reverse the ill effects of the 'Evil Eye'. The following items were used as fumigants: chameleon's skin, hedgehog skin, tealeaves, common salt, *sheeh* (شـــيح) (*Artemisia absinthium*), and *dofr* (ضـــفر) (dried cartilaginous remains of shellfish).

Because fever was seen mainly as due to supernatural causes, treatment was associated with ritual fumigation, incantation and magico-religious spells including the use of *bakhras*, *mihayas*, and the laying-on of hands. Treatment remained to be generally non-specific directed towards 'fever', large spleen, large abdomen, etc. Physical methods were also resorted to and include massage with coolant herbs and salts, cupping and cautery.

As further treatment for fever, the skin was massaged or rubbed with vinegar, *qarad*, *henna* (*Lawsonia alba*), mixed with common salt and water, oil or liquid butter. The scalp was covered with sheep's tallow, and the patient's bed covered with ground *qarad*. Wet cupping of the nape was practiced both for prevention against various diseases and for treatment. In Darfur, when fever was high, the young patient was cauterized on the forehead. For *wirda um barid*, recipes include *kasbara* (coriander), *kurkum* (turmeric, *Curcuma longa*) *'aradeb* (tamarind), *mistika* (mastic), *jardiqa*, *maqarat*, *qirfa* (cinnamon, *Cinnamomum zeylanicum*), *kholongan* (*Alpinia officinarum*), *mahareb* (*Cymbopogon proximus*), sugar and *samn* (butter oil).

Internal medicines for fever include the following: macerates of *qarad*, *'aradeb*, *turaiba*, and *jardiqa*, the last two are type of earth

taken sometimes with dates; a decoction of *harjal*; a decoction of *murdu* known also as *gulum* (*Capparis tomentosa*) and tysin (the last three are peculiar to Kordofan). To cool the skin, massage with *henna* and *khall* (vinegar) was practiced. The late basir Mahjoub Hamad of Berber used to immerse a febrile patient in Nile water three times to cool down.[87]

Slatin Pasha, among his observations on the practices of the dervishes during the Mahdiyya, in his book *Fire and Sword in the Sudan*, mentions that *senna* (*Cassia acutifolia*) and *'aradeb* (عرديب) were taken as purgatives by the dervishes for the treatment of fever.[88]

Yellow fever

Two major outbreaks of yellow fever occurred in Sudan - the first was in 1940 in the Nuba Mountains. At that time, it was the biggest outbreak in Africa. The second was in 1959, which mainly affected the Southern Fung in the Southern Blue Nile Province. At the end of October 1959, news came to the Ministry of Health in Khartoum that a disease resembling yellow fever, with people vomiting blood and dying after an attack of fever. In fact, a classical description of yellow fever was given. Therefore, Dr Satti was flown to the area to investigate this disease. He found out that an influenza-like disease had occurred in August and September 1959 and had been diagnosed as influenza in patients attending dispensaries and dressing stations. In the places where the influenza—like disease was evident, there were few deaths and no classical cases of yellow fever described.

On his arrival at the village of Doro a woman died of jaundice and black vomit after an attack of fever. The relatives having yielded to persuasion, allowed Dr Satti to take a viscerotome section from her liver. She fell ill on October 28 and died on November 3. Her illness was characterized by severe headache and a temperature of 104˚ F. On the day of admission, she

walked out of the hospital in the evening. On November 1, she was carried in, vomiting blood profusely. Her urine was scanty and loaded with albumin. Then she developed anuria. On November 2, she had definite jaundice of a mild degree before she died. A running nose, general body pains and severe pain in the epigastrium had accompanied the illness. Her temperature when she was brought to hospital the second time was 101° F, while the pulse rate had fallen to 60 per minute, suggesting a positive Faget's sign.

Another death in similar circumstance was recorded in this village. The patient was a male of about 30 years of age. When he was brought in he was vomiting blood, his urine was scanty and loaded with albumin and bile; he was jaundiced and was complaining of excruciating pain over the epigastrium. He continued vomiting blood until his death.

Two more cases were brought in with influenza-like symptoms and both recovered; they were from the same house. Several deaths occurred in Kurmuk Hospital. The symptomatology, the short duration of illness and manner of death, made the medical officer suspect yellow fever. The horrifying black vomit after an unimpressive prodromal stage, and the short duration of the disease from health to death made the people apprehensive.

In that small community (2000 souls), 11 persons died in about two weeks. This had a terrifying effect on the countryside; in many places round Kurmuk and inside the Ethiopian border deaths under similar circumstances were reported. When the plane was preparing to return to Khartoum, a case died in the village after a bout of black vomiting. Viscerotome sections were taken from this case also. The diagnosis was confirmed by histological examination when confirmation was sought from Prof. Robert Kirk then in Singapore, Prof. TF Hewer in Bristol

and from Dr FO MacCallum of the Virus Reference Laboratory at Colindale.

They had no doubt of the diagnosis. Attempts to isolate the virus by intracerebral inoculation of mice failed because the area is on the Ethiopian frontier and very far from the Central Laboratory and Dr Satti and his team had no cryogenic equipment at the time.

However, Ethiopia was alerted. Consequently, a team of two scientists one of whom a French epidemiologist of the Pasteur Institute, Addis Ababa, visited Dr Satti at Kurmuk. After visiting several places on their side of the border, they told Dr Satti that they did encounter cases of influenza; but they did not see yellow fever. Dr Satti, to their astonishment, told them that this influenza-like disease is most probably yellow fever in its mild form. Later, in a meeting in Geneva, 200 of the influenza-like cases seen by the team who visited Dr Satti in Kurmuk were reported as positive for yellow fever.

Dr Satti was also a member of a scientific meeting on yellow fever in WHO Headquarters in Geneva, in which Dr Satti was studying an outbreak of the disease in East Africa in Ethiopia. This group met three times in Geneva under Dr Panthier of the Pasteur Institute, Paris as Chairman. The study continued for three years, 1961—63. There was Dr W. Chas Cockburn as WHO Chief Medical Officer, Virus Diseases and Dr AC Saenz as Medical Officer. The mosquito involved in transmission was *Aedes aegypti* and there was suspicion of *Aedes vittatus*. All investigations were carried out including serology.[89]

Smallpox

Healers and laypersons alike have differentiated between *al-burjum* (البرجم) or *al-burjuk* (البرجك) or al-burjub (البرجب) (chickenpox), and *hisba* (measles). Smallpox, *Judari* had always been difficult to diagnose except during epidemics. The laity have also identified several types of skin rashes, and labelled

the itch as *dam al-tayyir* (دم التاير). The infecting agents in all these diseases were not known; but methods of contagion were suspected, and therefore, many ways of management developed.

We have no evidence that people knew the agent that caused smallpox. Healers infrequently confuse its diagnosis with impetigo, psoriasis and other skin lesions. They refer to the deadly smallpox as *judari al-karufa*, (جدري الكروفة) a phrase indicating the disease is so virulent that it could be contracted through breathing. The native poet coined the current wisdom beautifully in the following verse:

(جابوك للكتل لا كليت ولا مليت يا جدري الكروفة البرزولك بيت)

Smallpox is a highly dreaded and stigmatized disease. It had been known in the Nile valley and neighbouring countries for around a millennium and a half[90]. During recorded history, a number of devastating epidemics had scourged the land, giving rise to appallingly high mortality.[91] Of all diseases, smallpox was unique in lending itself to traditional control measures, and more than one method of variolation, prevention, and treatment were practiced.

The laity knew several methods of contagion, prevention and treatment of smallpox. With the exception of anointing the skin with oil, which is particular to Sudan, other preventive measures were also known in neighbouring Egypt and Ethiopia. People shut themselves indoors, the sick segregated and sometimes the population moved en masse.

Traditional variolation was known for both cattle and man. It was practiced to protect cattle against cowpox and *abu qinniet* (pleuro-pneumonia) (أبو قنيت). In cowpox, a piece of the lung of an infected cow was cut after it died, and sewn in an incision inflicted in the ear of a healthy cow. In cases of pleuro-pneumonia, inoculation was done on the tip of the cow's tail. In *abu lisan* () a piece of cloth is soaked in the saliva and tears of an

infected cow and the contents blown up the nostrils of a healthy animal.

Two main methods of traditional inoculation of man were practiced in Sudan in the early days. Some were perhaps indigenous to Africa, others were probably Arabian,[92] were known and practiced long before the Mahdiyya. The two methods were teshtari al-jadiari and dagg al-jedari. In general, pus was taken from a pustule of an infected person and rubbed into a scarified wound of a healthy one. A highly infected person was preferred as a donor to somebody lightly infected; the disease caught from a heavily infected person was said to have spent itself, and, therefore, would not be severe if caught. Bloss (date?) noted that the mortality among those inoculated was only about two or three percent, which, considering the total mortality, was very small.[93]

Bruce in 1790 described the commoner type of inoculation, *tishteree el jidderee* (buying smallpox). This type, he said, was common among the Shulluk, the Nuba, and Arabs. In Bruce's words 'women, both the blacks and Arabs, those that live in the plains, like the Shulluk or inhabitants of El Aice, those of Nuba and Guba, those that live in the mountains, all the various species of slave that come from Dyre and Tegla have known a species of inoculation which they call …'

During the fairest and driest season of the year, and upon the first appearance of smallpox anywhere, women of Sennar go to an infected person and wrap a fillet of cotton cloth around an infected area. They then start bargaining with the patient's mother over the price of this 'infected charm'. After it was bought, it was taken home and tied round the arm of the person to be inoculated. When the person develops the disease, he was supposed to get no more pustules than have been paid for in the bargain.[94]

The English, WG Browne, travelled from Egypt by Darb Al-Arba'in road to El-Fasher in 1793. He described the less popular[95] method called *dag el jedari* (hitting smallpox). It was also described by Burckhardt[96]. This method, they observed, was neither popular in Northern Sudan nor in southern Egypt. Little benefit was said to be gained from this technique, which consists of rubbing the fluid taken from the pustule of an infected person into an incision inflicted on the leg of a person to be inoculated.

Throughout Sudan, smallpox patients were isolated and put under the care of elderly persons, such as a woman well past her menopause. In Darfur, a patient was isolated in a cottage called *al-kurbaba* (*kurfa* in central Sudan), and nursed by a person who had had the disease before. Patients were fed on a frugal diet, mainly milk and porridge. They lay on beds of ash and when the eyes were inflamed, onion juice was instilled.

Among the Fur, however, Beaton wrote: 'smallpox is treated as an honoured guest and referred to euphemistically as father or grandfather (*abo*); grain and flour are sprinkled outside houses to propitiate it and to avert a fatal visitation'. So far in fact do such propitiatory rites go that sometimes a deputation was sent to an infected village where pustules were punctured and the pus conveyed to the uninfected village for use in a primitive sort of inoculation[97]. When smallpox hit a village, the Acholi tribe generally isolated the affected cases and whole villages were often burnt after an epidemic. Vaccination was practiced, the actual pus of a patient being rubbed into a cut on the forehead of a healthy man.[98]

Very little was done in the way of treatment once the disease was established. General management of the skin lesions was practiced. The most popular remedy here was *ramad* (ash), and death was thought inevitable. Heroes, however, would never like to die that way; nor their beloved ones do. The fatal disease

was hardly treated and the death was never the one worthy of heroes. Banouna, a famous Sudanese poet lamented her brother saying:

(ما دايرالك الميتة أم رماداً شح، دايراك يوم لقا بدماك تتوشح)

In l938, an outbreak of smallpox broke out in Alleona village, 22 miles south of Singa, amongst the Beni Halba tribe. Thirty-two cases occurred before the medical authorities in Khartoum heard about it. Amongst these, there were 12 deaths. Of those cases, Dr Satti detected a few vesicles on the face, fever and general body pains. One patient had pitting of old smallpox lesions, which he previously had over forty years ago. Dr Satti had no doubt that it was a case of smallpox, which could have been missed if it did not occur during that epidemic. It seemed that the patient immunity faded during the long period of time that elapsed since the previous attack. Of course, vaccination against smallpox started almost at once under very difficult conditions. There was at that time the wet lymph vaccine and there was no dry ice and no such sophistication as liquid nitrogen. Moreover, there were no roads to speak of; but dust ones.

As there were many deaths, it was anticipated that many people from the same tribe were expected to come to the village for consolation. The first thing Dr Satti did was to visit these villages at once. Seven other villages were found to have one case each. One village had two cases of which one had already died. Again, here and in all the other villages, vaccination was done and at the same time, mass vaccination of the whole population of the district had been embarked upon. It was gratifying to report here that no more cases occurred and no more deaths. Of course, strict quarantine measures had been effective from the very start in the affected villages and the whole district was isolated from other parts of the country for three weeks from the date of the last case. The disease was

checked in a matter of weeks. The senior MOH officer came to see what the situation was and to his astonishment, everybody he met on the road was vaccinated. Being greatly satisfied, he wrote in an official report that, "The Medical Officer in Singa has handled the epidemic in a masterly fashion."[99] It had to be stressed here that Dr Satti did all that work single-handed and without any assistance from outside. He was the only qualified person in the district, handling both curative and preventative medicine at the time.

Onchocerciasis

In 1940, Dr Satti was sent to Bahr El Ghazal Province in the Southern Sudan, a well—known endemic area for onchocerciasis (Jur blindness, river blindness) as part of a programme proposed by Dr Horgan in 1946 in which Dr Kirk and later Dr Satti were involved. Dr Satti was entrusted with study of the epidemiology, clinical and chemotherapeutic aspects of the disease, and Lewis was to study the vector and its incrimination in transmitting the disease in Sudan. Dr Satti was sent immediately after Van Hoof discovered the efficacy of Suramin (Bayer 205) in 1947 in the treatment of onchocerciasis in Zaire (then the Belgian Congo) to test the efficacy of a British drug of exactly the same chemical composition by the name of Antrypol for this disease. Dr Satti and Dr Kirk working in 1957 found that the drug was effective; but its side effects were at times fatal. The drug, no doubt, killed the adult worm, as the nodules became hot and tender and there was very marked swelling. When the nodule was opened, the worm was found dead and liquefied. The drug was very toxic even in small doses. Dr Satti also tried Pentostam (sodium stibogluconate), concentrated solution. That was done based on the previous work of Culberston in 1947 who found arsenic and antimony useful in treatment of filariasis. The result, however, was good; but only temporarily and in four weeks, the microfilaria reappeared. The effect of these filaricidal drugs with particular

reference to Antrypol, Germanin or Morenyl, whatever you call was very marked on the kidneys.

It was also observed that there were many cases of epilepsy in the endemic area. These were too frequent to be coincidental. That impressed Dr Satti to the extent that he did several lumbar punctures on children; but unfortunately, he failed to find any microfilaria. Later, it was known that microfilariae were found in the cerebro spinal fluid.[100]

At that time, the blindness because of onchocerciasis had been in certain respects questioned. It was thought that it might be at times due to rutin-like substance in certain fish poisons that were frequently used by Southerners to catch fish. Rutin was thought to be the cause of damage to vessels; but ultimately this was discarded. Dr Satti was lucky to have with him at that time, Dr AB McKelvie, an eminent ophthalmologist and with his help and cooperation, the eye manifestations were properly studied and put in their true perspective.[101] In a temporary assignment in the Peoples Democratic Republic of Yemen in 1971, Dr Satti suspected the presence of onchocerciasis in the northern region of this Republic. Some of the patients were from North Yemen. He was a member of the Expert Committee of Onchocerciasis in 1976. He was assigned the task to study the Geographical Distribution of Onchocerciasis in East Africa and the Yemen. This was published in Sudan Medical Journal. Lewis (1948) found infection in *Similium domnosum*.

Bancroftian Filariasis

In search for this disease, Dr Satti asked one of his old colleagues who had moved about in the different parts of the country about the existence of Elephantiasis anywhere in the country. The friend told him that in the thirties, when he was stationed at Geneina hospital, one of the westerly hospitals in Darfur and right on the border with Chad, he operated on a case of massive elephantiasis of the scrotum that the patient

used to sit on it. In 1968, Dr Satti visited the Darfur district enquiring about the presence of any form of filariasis. He was told not to waste his time; there was no filariasis of any form in Darfur. Despite this negative answer, he went to Geneina where the old colleague operated on a case of elephantiasis. He had the same negative answer from the doctors and the laboratory assistant. Again, he decided to go to see for himself and was accompanied by the medical inspector in charge of the district. They stopped l50 miles south of Geneina, where there was a dispensary run by a medical assistant. Dr Satti asked him to bring in all persons with hydroceles. Twenty-five patients were brought in. A little before midnight, Dr Satti started taking blood films from those patients and as there was no electric light, he looked at the fresh blood under a Petromax pressure lamp. To his excitement and more so that of the medical inspector, he could see microfilariae wriggling in 15 blood films out of the 25 cases of hydroceles. It was in fact the microfilariae of a strictly nocturnal periodicity. Thus, they missed reporting the existence of the disease because they never suspected it and therefore, never looked for it. A similar state of affairs happened to Peter Jordan in the fifties, when he encountered negative answers in the area he was searching for *W. bancrofti* in Tanzania. In the survey carried out later in the year many cases of elephantiasis were encountered (Satti and Abdel Nur, 1975).

Cutaneous larva migrans

Cutaneous larva migrans disease that Dr Satti and his colleagues, Dr Osman Mohamed Abdel Nur and Abdalla Ahmed Dafaala, unearthed in Kordofan for the first time in 1975[102, 103]. This disease had existed in that region from time immoral; but because it was a mild disease and patients had spontaneous recovery, nobody bothered to investigate it. Dr Satti and his colleagues came to Kordofan in search for guinea-worm disease and found instead a malady they did not encounter before. This newly discovered disease affected

children who usually go barefooted in wet soil and come in direct contact with *rhabditiform* larvae, *Ancylostoma* sp. and *Strongyloides* from the dung of cattle, sheep and goats. The larvae were recovered from wet loam soil as well as from the intestines of sheep, goats and cattle. Dr Satti put fresh dung from sheep, goats and cattle in a dry loam soil and kept it continuously wet for six days, when he obtained from the dung of these animals *rhabditiform* larvae of hookworm and *strongyloides*.

Kakoom paralysis

In 1960, Dr Satti was called upon to investigate cases of polio-like paralysis of hands in fifteen persons in Kakoom, a village on the Atbara River. The patients were labourers working in that village and were living together and partaking meals. The disease started with gastrointestinal symptoms and then paralysis. Patients' blood was examined for heavy metals with particular reference to lead and no evidence was found. The blood was examined for visual antibodies, none were found to account for the disease. As these workers were eating together in an area, which was occupied by the military of the East African campaign during the Second World War, it was thought that they probably had taken something toxic agent in their meals like tri-orthocresyl phosphate poisoning.

The paralysis looked like Ginger paralysis or certain stages of Morocco-poisoning or Cackie virus A.7 might cause similar paralysis. The serology for arbo-viruses was done, and nothing suggestive as a cause had been found and no testing with Cackie was done. No more cases were detected since 1960.

Weal Syndrome

Weal syndrome was an encephalomyelitis affecting the Nuer tribe of the Zeraf Island in Upper Nile. The word 'weal' in Nuer language means 'turning head and staggering gait'. This

disease was discovered for the first time in 1957 and sporadic cases were reported from time to time.

The aetiology of the disease was unknown. The Medical Officer who reported on these cases diagnosed them as cases of pellagra without satisfying the three Ds i.e. the cases had dementia; but no diarrhoea and showed no dermatitis.

The cases had ataxia, confusion and manic depression. The patients were so demented that one of them, in the attack, killed his mother, another killed his son. The disease was self-limiting but in two cases mania and depression continued. Nicotinic acid was determined in the blood of some of those cases; but it was found to be normal. Both the cerebrospinal fluid and blood were examined in a number of cases. There were certain amounts of eosinophilia in the blood of some. One patient had a positive blood Kahn test; but negative cerebrospinal fluid (CSF). The cells in the CSF and the proteins were normal. Similar conditions occurred during the Second World War in Aden and were found to be due to presence of a fungus in the grain. No fungus was found in the grain of the Sudanese patients. Similar conditions in animals were encountered in Australia and sometimes in England, due to the low level of trace elements in the soil; but none was known to occur where the disease occurred in Sudan. Dr Satti tried to incriminate a virus as a causative agent in this disease; but none was found on intracerebral inoculation of mice and by attempts to find virus antibodies that may be responsible for those cases.

Nitrates in water

In 1968, as a result of a directive from a ministerial committee on water supply and rural development, Dr Satti and Prof. Abdel Hamid Ibrahim organized a large unprecedented multidisciplinary medical expedition to two villages in Northern Kordofan (Um-Gozein and Al-Mazroob) to investigate the health impact of the consumption of water of

extremely high nitrate content (which happened to be the only water available in those villages) on the health of the inhabitants. The team was formed of Dr Nasr El Din Ahmed Mahmoud (Physiologist), Dr Osman Modawi (Obstetrician), Dr Mahmoud Mohamed Hassan (Paediatrician), Dr Omer Imam (Kordofan Province Medical Officer of Health), Dr Abdel Razzag El-Mumbarak (Internist), Dr Mohamed Hamad Satti (Pathologist). Prof. Ibrahim was unable to take part in this mission because of his illness. No ill health effects were detected in men, women and children of all ages in the two villages visited by the team.

We failed to find a copy of the report that Dr Satti prepared as the Team leader. The only information on that important field study we laid our hands on was that on the haematological aspects of the investigation published by Prof. Nasr El Din Ahmed in Sudan Medical Journal.[104]

Recognition

In 1980, the University of Khartoum awarded Dr Satti an Honourary Doctor of Science degree in recognition of his vast contributions to science and medicine.

In 1966, the Nineteenth World Health Assembly, with a view to honouring the memory of the late Dr AT Shousha (1891-1964) one of the World Health Organization founders, as well as one of its most faithful servants and friends, established a foundation bearing his name. The foundation purpose is to award a prize to be known as the Dr AT Shousha Foundation Prize to be given to a person having made the most significant contribution to any health problem in the geographical area in which Dr Shousha served the WHO. Dr Satti won the Shousha Prize and Medal in 1985. In May 15, 1985, he addressed the World Health Assembly for 20 minutes on the occasion. Shortly after this celebration, he donated the prize money to the Palestinian Liberation cause. The late Professor Mansour Ali

Haseeb won the prize in 1973, and later by Professor Ahmed Mohamed El Hassan in 1986, and Professor El Shaikh Mahgoub Gafaar in 1989.

In 1986, Dr Satti was awarded the 'Day of Sudanese Doctor Golden Award.'

In 1989, the Supreme Council of State in Sudan bestowed upon him Wisam El-Nilain, the highest award in the country, in recognition of his excellent service.

On the international level, Dr Satti obtained the 'Certificate of Merit of the Dictionary of International Biography', Cambridge, England as a notable scholar.

Dr Satti was elected President of the Union of Sudanese in UK in 1953, and President of Sudan Doctors' Union replacing Dr Tigani Al Mahi when the latter was chosen member and rotational head of the Supreme Council of the State in Sudan in 1964.

In 1986, Juba University bestowed on Dr Satti 'Doctor of Science (Honoris Causa), and the Ministry of Health and Social Affairs in Wau, Sudan recognized his research in control of onchocerciasis in Sudan.

In 1989, the Pharmacy Students Union, University of Khartoum remembered his vast and genuine contributions.

Perhaps the best tribute and recognition Dr Satti would have acknowledged and loved was the dedicaiton of El-Hassan and Zijlistra of their monumentous supplement of the Transactions of the Royal Society of Tropical Medicine and Hygiene: 'Leishmaniasis in Sudan' to Dr Mohamed Hamad Satti and to the memory of Professor Robert Kirk and Dr DJ Lewis, who pioneered leishmaniasis research in Sudan.[105]

Contemporaries & predecessors

Dr Satti's batch who graduated from KSM in 1935 were nine: Ibrahim Mohamed El Maghrabi, Mohamed Hamad Satti, Mohamed Rashad Farid, Tigani El Mahi, Osman Rahmi, Mohamed Abdella El Awad, Abbas Hamad Nasr, Beshir Mohamed Saleh, and Ali Ibrahim Beshir. Every one of the batch left his fingerprints in Sudan health services (short notes needed).

Dr Satti worked with several notable pathologists and shared their wisdom and experience. The list includes Prof. Mansour Ali Haseeb, Prof. Robert Kirk, Prof. Morgan, Prof. Ahmed Mohamed El-Hassan, and Prof. El-Sayyid Daoud Hassan[106].

His co-workers included Prof. Mutamad Ahmed Amin, Prof Osman M Abdel Nour, Dr Mohamed El-Fatih Babiker, Dr Mirghani Yousuf, Dr Beshir Ibrahim Mukhtar, Dr Abu Bakr Hassan Amin, Dr Mahmoud Abdel Rahman Ziada, Dr Asmim Abdul Rahman, Prof. Suad Mohamed Sulaiman, Dr Saida El Safi, Dr Abdel Rahman El-Dirdiri, Dr Hariedi, Dr Mohamed Abdin who headed the Entomology Section in Wad Medani for a short period. Others included Dr Saad Mohamed Ibrahim who after specialization in biochemistry in UK, joined the Faculty of Medicine, University of Khartoum.

Family

Alongside every great man is a great family. Vital to Dr Satti's success was the tremendous and unfaltering support that he received from his wife and thirteen sons and daughters, Saida, Abdel Moneim, Kamal, Awatif, Mariam, Nureldin, Gwiria, Maria, Abdel Raheem, Abdel Hameed, Naima, Hind and Abdel Azeez.

Every one of them was a successful professional in this or that field of life. Two of the sons are engineers, one a scientist (Chemistry), a diplomat (French), a lawyer and one with a

language diploma. Five are PhD holders and university staff at one time of their careers.

As for the daughters; one is Faculty of Arts graduate (Geography), one is a scientist (chemistry, high school teacher), one is a pharmacist (university staff), one is a medical doctor (University staff), one is a lawyer, one was a teacher in intermediate schools and one chose to stay at home.

Publications

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[48] Belonging or pertaining to the Slave dynasty that ruled Egypt as an independent state from 1250 until 1517, and as subjects to the Ottoman Empire until 1811.

[49] Ahmed Bayoumi. Op. Cit. Page 77.

[50] Ahmed Bayoumi. Op. Cit.Page 77.

[51] Under the instruction of Mohammed Ali Pasha, the first national medical school in Egypt was established due to the efforts of the French Dr Antwan Brtly Clot (Clot Bey), chief doctor and surgeon of the Egyptian army. The school was first attached to the military hospital in Abu Za'bal and later moved to Qasr El Aini, thus named in honour of its owner Ahmed Ibn El Aini who built it in 1466.

[52] Dr. Ahmad Yusuf Al-Siddiq Al-Hahiawi, nicknamed *Al-Hakim* (1802-1893) was born in Hahiya, in Al-Sharqirya, Egypt, and graduated in Abu Za'bal College of Medicine, Cairo, in 1828 in the second group of students to matriculate. He specialized in surgery in France, then joined the Egyptian army in Sudan as a medical officer.

[53] Bloss. Op. Cit. Page 131.

[54] Bloss. Op. Cit. Page 140.

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[78] Bell *et al* 1958 and Angevinc et al 1958.

[79] A paper entitled "Changing epidemiology of leishmaniasis in the Sudan", had been read by Professor Satti in 1980, in the Tenth International Congress of Tropical Medicine and Malaria in the Philippines.

[80] Paper entitled "Cutaneous and muco-cutaneous lesions in kala-azar 1963"meant to be read in the Seventh International Congress of Tropical Medicine in Rio de Janeiro, but unfortunately he could not attend that Congress. The paper has been published in *Sudan Medical Journal*.

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Photo gallery

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Ahmad Al Safi holds a bachelor of Medicine & Surgery of the Faculty of Medicine, University of Khartoum (MB BS, 1971), Diploma of Anaesthetics in London (DA, 1976), Fellowship of the Faculty of Anaesthetists of the Royal College of Surgeons of England (FFARCS, 1977), and Fellowship of the Royal College of Anaesthetists of England (FRCA, 1992). In 1982, he had orthodox training in traditional Chinese medicine and acupuncture as applied to Anaesthesia, analgesia and therapy in Nanjing (China). He is currently Professor of Anesthesiology, Khartoum College of Medical Sciences and Head Department of Anaesthesia, Bashayer Teaching Hospital, Khartoum.

Ahmad Al Safi developed early in life a love for the study of the sociology and anthropology of health, and pioneered institutional research in Sudanese traditional health culture. His current fields of interest include health delivery systems, traditional health culture, and history of medicine.

In thirty-six years of medical career, in addition to hands-on clinical practice, he managed departments of Anaesthesia, intensive care units, and training centres. He has strong foundation and experience in almost all subspecialties of Anaesthesia and intensive care. He has been consultant Anesthesiologist and Intensivist in different hospitals around

the world including the 1200-bed Khartoum Teaching Hospital in Sudan. He has been one of the founding anesthesiologists of open-heart surgery with the late Mr. Ibrahim Mustafa and neurosurgery with Mr. Hussain Sulaiman Abu Salih in Shaab Hospital, Khartoum in 1980 and beyond.

He founded several new organizations – governmental and non-governmental. In 1981, he established the *Traditional Medicine Research Institute* in the National Council for Research, which he managed to be designated a WHO Collaborating Centre in 1984. He was founding director for both institutes up to 1989. In 2005, he founded the *Sudan Medical Heritage Foundation* as a non-governmental organization dedicated to health systems research, development, and conservation of Sudanese health heritage and resources. He also established *Maharat* as a non-governmental, multi-disciplinary, professional development and continuing medical education training & consultation centre.

In the period 1978-88, he carried out important studies for Sudan Medical Council, Sudan Medical Association, and Ministry of Health. In 1982, the Sudan Medical Council asked him to study (Postgraduate Medical Qualifications: Recognition and Equivalence). The study became the preamble for the *Specialist Register Ordinance* of 1985. In 1984, the Sudan Medical Association and Ministry of Health asked him to study (Teaching Hospitals Organization and Management in Sudan). The study became the preamble for the *Teaching Hospitals Organization and Management Ordinance* and the *High Council for Teaching Hospitals Ordinance* in 1985.

Ahmad Al Safi was a member of the WHO EMRO Expert Advisory Panel for traditional medicine (1982 for over ten years). Currently, he sits on important committees in all health institutions in Sudan. He is a member in the Anesthesiology Advisory Board of the Federal Ministry of Health, and the

Board of the Traditional Medicine Research Institute of the National Centre for Research, Ministry of Science and Technology. He is the Chairperson of Sudan Medical Council Traditional and Alternative Medicine Directorate. He is a member of the executive office of the *Sudan National Academy of Sciences*.

He was Editor-in-Chief or member of the editorial boards of several refereed journals inland and abroad. He was Advisory Editor and referee for *Social Science and Medicine*, United Kingdom (1984-1994). In 2004, he launched the *Sudan Editors* service specialized in producing and editing corporate communications and academic and postgraduate manuscripts, and aiming at improving Sudanese academic writing tools.

Ahmad Al Safi wrote and edited over 12 books and several articles in English and Arabic on health systems, history of Sudanese medicine, health culture, and rules of order.

In ten years of work (1970-1980), he collected, edited and published in two volumes in 1981 and 1984 the complete works of the late Professor Tigani El Mahi, the first Sudanese and first African psychiatrist.

His voluminous book *Traditional Sudanese Medicine* (1999) is a pioneering wide-ranging account of traditional Sudanese health culture targeting health care providers, students and researchers.

His book *A Manual on Rules and Procedure of Deliberative Assemblies* (1999, 2006) puts him in the forefront of Sudanese and Arab writers who defined the field of parliamentary procedure in Arabic. Critics have noted that this book is probably the only one of its kind in Arabic, and that it provided an invaluable toolbox for modern organizations in a country undergoing democratic transformation.