

**Forum: Plenary Session V: Vector Biology and Control
Plenary Session VI: Socio-economics
The Fourth MIM Pan-African Malaria Conference
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JOHN GITHURE: The secretary had though it wise to dedicate this session to the late Professor Thomas Odhiambo who died at the age of 72 in May 2003. Professor Odhiambo is a well-known scientist and very well known for founding the International Center of Insect Physiology and Ecology in 1970. This center, which is a site and training center, is based on Nairobi, which has a global mandate of keeping the focus in Africa. Dr. Odhiambo believed that science-led development was the solution to the many problems that cripple Africa. To highlight his achievements and contributions to our solving this problems I am privileged to invite Professor Kiloma [misspelled?], the managing trustee of the Amulet, which as you all know will host the next [inaudible] secretariat for the first time in Africa from Germany next year. Professor Kiloma is also a member of the [inaudible] governing council, and therefore I believe he is the most [inaudible] to highlight Professor Odhiambo's achievements. Professor Kiloma.

PROFESSOR KILOMA: Thank you very much John. On behalf of the governing council of the International Center of Insect Physiology and Ecology and on behalf of African academics I feel greatly honored to present the following tribute on TRO as we fondly remember him. Thomas Odhiambo was one of that first

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generation of African academics to rise from the humble background to open the corridors of the world's finest institutions. Thomas was born in Mombassa Kenya in 1931, the first of 10 children of a telegraph's officer and his mother from [inaudible] province of western Kenya. He excelled at both primary and secondary education and thereafter entered the famous Micro University College in 1950 where he studied biology, particularly entomology, [inaudible] biology and hematology. After a short stint of employment in Uganda he proceeded to Queens College at the University of Cambridge in 1959 where he first enrolled for the natural sciences [inaudible]. Sixty years later and armed with both a Ph.D. in insect physiology (1965) with a specialization on the reproduction physiology of the [inaudible] locusts and an M.A. in natural science. He returned to his mother Kenya in 1965 ready to change his world. His dream was to create a working environment of international standard for African scientists to build the capacity of the indigenous populations to solve their problems and to change the political climate to enable countries to make use of their expertise. After the end of his 40th sun year career he was [inaudible] to the establishment of an excellent [inaudible] institution for scientific [inaudible] and societies and internationally acclaimed for [inaudible] program and the [inaudible] of other finance-related

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organizations and activities. He became an erudite advocate for African medical development and a mentor for the continent's young scientists as well as a catalyst in creating an African scientific renaissance. When he came to Kenya he joined the faculty of the then University of [inaudible] Nairobi an affiliate in those days of the University of London where he soon became acting head and leader in the department of virology in 1969. After the newly constituted University of Nairobi he was appointed the first professor and head of the new department of entomology rising to become the first dean of the new faculty of agriculture in 1970. In his words [inaudible] opportunity presented itself in 1967 when he was asked by the editor of the journal, *Science*, to [inaudible] a review of the status of science in Africa. This article proved to be writing "for attention to be paid to Africa and its development issues." In it he proposed without a scientific sense of excellence be established on the continent. The center would provide a mechanism and focal point for linking the world's leading scientist with the problems facing the small state farmer of the developing world. Odhiambo's plea for the center for excellence in Africa [inaudible] international interest and support and received more than 1000 requests for the article in the space of only a few weeks. Among his many supporters were his former tutor at Cambridge, namely Professor

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Sir Vincent [inaudible] and Carl Wilson of Harvard University. Within three years of the *Science* article the International Center of Insect Physiology and Ecology was created in Nairobi as a [inaudible] disparate institute with the objective "to discover new knowledge that may permit the design and development of species specific non-toxic, non-persistent means of insect control." The budget for the first year was only U.S. \$10,000. It is now \$11 million. Given his own background in entomology it is not surprising that this new center should concentrate on insects and related arthropods. [inaudible] choice as the socialist such agenda to tackle only a few kinds of typical insects that represented different aspects of the new center's concerns. Together with the directors of research he chose the sets of flies, tics, termites and any worm. The first mosquito to be studied at ICIPE was ADZ [inaudible] the vector of yellow fever. This insect was chosen because yellow fever was an important disease in Africa then but perhaps more importantly because it was in his words "probably the best insect to use in studying the practical possibilities of genetic engineering as a technique for species specific pest control and "a tradition of things to come and of the current race to develop a genetically modified mosquito." The intention was to develop a pilot project to control the mosquito in ecologically isolated areas using genetically

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manipulative techniques by "introducing a deleterious mutation or a new gene that would make it ineffective as a vector." In 1978 a program on Anopheles ecology was added with the objective of seeking new methods of control, better definition of breeding sites, including dry season sites and developing "proportion models of predictive power." High on the agenda were [inaudible] ecology, Anopheles [inaudible] species, resting and biting behavior and infection with [inaudible]. In 1979 two extra species were added to the research agenda. ICIPE later concentrated mainly on malaria vectors in its medical vector program, which I think Mr. Co-Chair you now have, which has of course undergone a series of major revisions as to scope and approach since the 1980s. The international committee charged with guarding the new center in its formative years reads like a who is who of prestigious scientific academies with representatives from many societies in the United Kingdom, the Netherlands, Sweden, France, Israel, Japan, the U.S.A., Sweden, Germany and observers from Hungary, Norway and Denmark. To ensure relevance this was mirrored by an African committee of academics from nine countries and a representative of the newly established East African Academy of which Odhiambo was a founding member. ICIPE was granted full international status by the government of Kenya in 1977 and was made an intergovernmental organization in 1986 with a charter

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signed by eleven countries from all parts of the world. The author of over 160 referred publications Odhiambo himself has been honored with numerous awards among them, the Albert Einstein Gold Medal in 1991, the Gold [inaudible] International Award in 1982, the Gold Medal Award from the International Congress of [inaudible] Protection 1983, the African Tribes for Leadership for Sustainable End of Hunger, which is shared with the president [inaudible] from Senegal in 1987, the ISCTRC Silver UB Award of the African Union in the year 2000 and many others. He was awarded the honored PhD from the University of Oslo in 1986, the Doctor of Science from the University of Massachusetts in 1990, a Doctor of Rhodes from Notre Dame University in 1992, a Doctor of Truman Letters from Johns Hopkins University in 1991 and [inaudible] the Doctor of Science from the University of Eastern Africa [inaudible] in 2002 and [inaudible] at the University of Agriculture and Technology in Kenya in 2003. One of his most rewarding achievements at ICIPE was the fulfillment of another cornerstone of the Center's mandate "to build a motivated, highly talented human capital of insect science and its application for Africa." This was achieved by establishment of the African Regional post-graduate program in insect science in 1983. To date the program has changed more than 170 Ph.D. students from around the continent and indeed over 125 at the

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master's level in the collaboration with 32 African universities over immense satisfaction to all who helped found this program the great majority of these graduates have remained to work in Africa. Providing the incentives and the rewards to talented work across scientists to remain in Africa is one part of the solution and this is where Odhiambo recognized the importance of scientific academies. This was one of the rationales for the establishment of the African Academy of Science, which he served as founder president from 1986 to 1999. Odhiambo had earlier co-founded the East African Academy of Science in 1963, the Kenyan National Academy of Sciences which he served as founder chairman in 1982 to 1994 and the African Association of Insect Scientists he served as vice president of the Third World of Academy of Sciences from 1986 to 1997 and was a member of the 12 other learned societies around the world. Thank you very much Mr. Chairman.

[Applause]

JOHN GITHURE: I'm aware of the constraint that we have in terms of time but I would wish that we stand and observe one minute's silence in honor and memory of the late Professor Odhiambo. Thank you, you may be seated. I would now like to hand over the chair to Dr. Etienne Fondjo. Dr. Etienne Fondjo is the executive family and secretary in the National Malaria Control Program in Cameroon. He will introduce the keynote

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lecturer.

ETIENNE FONDJO: Thank you very much and good morning to everybody. In [inaudible] we were supposed to receive [inaudible] from George Geopolous that for some [inaudible] he cannot be here and Dr. Fotis Kafatos going to be attached to us and Dr. Fotis Kafatos has studied the physiology and molecular biology of insects for almost 40 years. In 1993 he became the director general of the European Molecular Biology Laboratory and during this period he has worked on Anopheles entomology. This year he became the founding member of the Independent Insect Consortium and is now its chairman. [inaudible] to keep on schedule with us many years of [inaudible] that's supposed to give now and the [inaudible] our first official response laboratory modalities versus [inaudible] malaria transmission systems. Dr. Fotis Kafatos you have the floor please.

FOTIS KAFATOS, Ph.D.: Thank you chair, it's a great pleasure for me to be here to be back in Africa and in particular it's a moving experience to be talking in a session devoted to the memory of Thomas Odhiambo since I was a member of the board for a number of years.

Dominic [inaudible] said yesterday that for new approaches to malaria control we should look to the three genomes that are implicated in this disease, the plasmodium, the human and Anopheles. Today I will focus on this third

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genome and I will present some highlights of the work that my laboratory and other colleagues have done in recent years in this major vector, *Anopheles gambiae*. But first I wanted to present an advertisement on behalf of Biomalpar, the biology and pathology of malaria parasite. This is a European network of excellence. As a matter of fact there is a special symposium going on [inaudible] at the same time and I would like to point out that Biomalpar has a call for reintegration of African scientists willing to work in an African institution or African school already in Africa but no more than three years at the time of the deadline which is the end of January. The award is substantial as you can see and further information will be posted soon on the website, which is here www.biomalpar.org. I encourage young scientists who are prepared to stay in Africa or come back to Africa to consider this major award.

I'll tell you about *Anopheles gambiae* in particular the combination of genomics and the study of the innate immune response as it affects malaria transmission. As we all know malaria transmission involves interaction between three organisms, the parasite plasmodium, the human host and the mosquito vector. Indeed it's important to point out that malaria is a disease of few organisms and that the parasite has two quite independent life cycles, which it follows in succession. In the human or in the mouse, which is the modeling

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system that many of us use you have the asexual cycle of malaria in which the spozoites go into the circulation by the infected bite, the home to the liver and there they multiply in an immunologically protected environment and then from the liver they go back into the circulation and they stay in the peripheral circulation for many cycles hiding in the red blood cells, lizing the cell and emerging from it in a synchronous manner giving life to the periodic fevers. The second cycle is the sexual cycle that begins with a low percentage of the parasites in the red cell stages, the gametocytes. These are male and female cells which are precursors of the gametes which remain inactive so long as the parasite is in the human, however, with the next bite of a mosquito the gametocytes go into the mosquito and there in the mid-gut there is some very rapid and spectacular developmental process where the gametocytes transform into active gametes male and female, essentially sperm neck, which cross-fertilize produce then the alchanid [misspelled?], which is a motile stage, and the alchanid undergoes a very perilous but essential travel. It has to go from the inside of the mid-gut across the epidemial layer to the basil side. If it succeeds in doing so on the basil side it forms a cyst, the o-cyst in which it multiplies and you can get actually thousands of sperzoytes within an oasis from a single parasite that made it through.

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The phenomenon that many of us have studied in recent years is the phenomenon of refractoriness or resistance of the mosquito to the parasite. This is graphically illustrated here on your left. You see a mid-gut from a strain, which is susceptible and this strain has allowed the formation of 100s of o-cysts, which are the brown circles that you see. The same or similar [inaudible] fed to a resistant strain of mosquito which is solidic in other words, which is able to lize the parasite as you see in the middle panel does not produce any o-cysts. Finally the melanizing resistant strain as you see at the extreme right also kills the parasite but melanizes them rather than lizing them. The phenomenon of refractoriness is only the tip of the iceberg because even in the susceptible mosquitoes there are huge losses of parasites that take place. This shows you a single plasmodium alchanid going through the epithelial cell and emerging and you see the top part turning into a black portion which is the melanization. This shows the major losses of parasites that occur during the transmission cycle. The numbers may not be very visible in yellow. We get something of the order of 10^3 gametocytes which enter with blood meal and over a few days you actually get massive losses reducing by about 300 [inaudible] to produce brave new o-cysts but even again if an o-cysts is formed that will survive because it's immunologically protected and in it there will be

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an application and there will be thousands of sporozites produced increasing the numbers again making the next bite of the mosquito infective.

What do we set out in 1990 when I entered the field to do is to understand the control of plasmodium through studying mosquito and resistance or refractoriness in particular. After studies on innate immunity, which we did in the 90s, we shifted the effort to the study of the genome and an international consortium was formed, which included [inaudible] genomics, the French National Sequencing Center Genoscope, the ENPL, Notre Dame University, [inaudible] Institute, etc., Tiger these two molecular biology and [inaudible] in Greece, fly-based in the United States and the ONCA network in Brazil. With the support of the WHO and especially the National Institute of Health and the French Ministry of Research we made progress in record time and in 1992 there was a wonderful occasion when on the same day *Science* and *Nature* published the genome of the mosquito and the parasite at the same time on the same day. Getting so many scientists and institutions to work together was a big challenge by itself and especially since at that time the genome centers in the public sector and the private sector were fighting each other but we did make a very strong international effort because of the importance of malaria. Even getting *Science* and *Nature* to publish on the same day was quite an

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achievement. With that information we turned to the question what does the genome tell us about the genes that we might be interested in? We first asked the question whether we could recognize genes that we knew about in order [inaudible] the model system for all insects. We looked at a live set of genes of 350 genes which controlled the development of [inaudible] elegantly studied for many, many years by excellent scientists and we asked if these genes are also recognized in the mosquito and the answer is by and large yes. Almost 95 percent of the genes which are present in [inaudible] and control and development are also present in the mosquito presumably having similar kind of function in development, which is a highly conserved and very carefully constrained process. This you can use as a baseline because now we will turn our attention to another class of genes the innate immunity genes or potential genes, which are participating in the interactions between the mosquito and the parasite. We studied in a comparatively genomics analysis led by genus [inaudible]. We studied a number of her families and obtained a very interesting pattern in which we could recognize certain genes as being the same in [inaudible] and Anopheles. These are genes that we will call [inaudible] because these are really recognizably the same and have been the same since the last common ancestor of the fly and the mosquito 250 million years ago. But in addition to the

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[inaudible] we discovered that many of these new genes in these new families were not [inaudible] but represented expansion of the gene families that took place here in the mosquito or the [inaudible] but not in both. This one for example down at the bottom of the slide you see a whole set of the genes, near the bottom you see several blue branches. They represent the genes which are only found in the [inaudible]. The red branches represent the genes in Anopheles and you see that this set of blue genes at the bottom are specific to [inaudible]. So these genes are [inaudible] specific, whereas these genes are only found in the mosquito. They are not in the fly. Similarly here you see genes which are only present in the mosquito. We also find orthologs which you see here. These are recognizable by the fact that you have short branches connecting a mosquito gene in red and a [inaudible] gene in blue and we have marked them with a black dot. So you see a number of [inaudible] orthologs of pairs but you also find specific expansions in the mosquito.

By thematic analysis and with the wealth of information about the [inaudible] behind us we were able actually to take a look at the genome and begin to make hypotheses as to the function of the large number of genes. Essentially what I show you here is a diagram of how you might consider many of these genes to be implicated in immune reactions. Here for example

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are genes that we thought might be implicated in the [inaudible] response based on what we know about bio-chemically from other insects. Here is a set of genes, which are forming the famous toll pathway, which has been studied primarily in working immunity by Hugh Hoffman and his collaborators in Strasburg and led to the study of [inaudible] receptors in mammals as well. Here's another pathway, the IMD, or immune deficiency pathway, which are implicated again in immune responses. But of course bioinformatics tell you what is possible it doesn't tell what actually is there. For that you need experimental studies and the next slide shows you one approach that we took. This was led by George Kastofidos in the lab. We created micro rays, George Kastofidos and George Thermopolis together produced this and these DNA micro rays were used to determine whether there are genes which are stimulated, up-regulated or orders which are down-regulated by the presence of the parasite or by any other challenge that we wanted them to do.

This summarizes just a small part of the experiments that were done. Let me just focus on this last set of experiments, which are magnified here, which represent infection of the parasite with malaria. The infection started here within three hours after the blood meal and goes down to about four days after. If we just look at this set of three

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genes [inaudible] they're an example of how within the same gene families you can have individual genes, which have very different behavior. [inaudible] by having red color denotes the fact that this gene is very strongly up-regulated over a long period of time after malaria infection. [inaudible] on the other hand is stimulated as well but only for a very short period at the very beginning and then this up-regulation stops. [Inaudible] on the other hand is down-regulated and that's demonstrated by the green color. What I'm telling you then is that the immune families consist of multiple genes each of which has its own control and we needed to understand which ones are actually involved in the immune response. I'll just show you as an example how the micro rays studies can lead us to functional understanding. Here's a particularly distant gene. It's a serpent, serpent 10. Serpents are inhibitors of [inaudible] and serpent 10 shows a very interesting expression pattern where you get strong up-regulation but very specifically at about 24 hours and that is interesting because that's when the parasite is going through the epithelial layer from the contents of the mid-gut to the basil site. This led us then to see if serpent 10 is involved in the invasion process. The next slide shows you actually a dramatic picture. These are [inaudible] microscopic pictures in which we have sustained the nuclei in blue and the presence of serpent 10 is shown by red

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by antibody staining and you can see that a single cell here is very, very strongly expressed in serpent 10 and remarkably that is a cell that has been invaded. You can see that actually because the parasite is just emerging from it there. This is an example of the many genes, which are stimulated by the invasion process of the parasite in the middle. I'll have more to say about that later.

Let me turn from the approach that we have been taking in the early years, which was a gene-by-gene approach to the approach that we are now taking looking at the immune system as a system. We would like to understand how it operates as a whole and I'll show you the diagram in which we diagrammed the tissues that are involved but also the set of cells that are involved and eventually the groups of genes which are implicated in specific immune reactions. [Inaudible] biologists for a long time have recognized that the fat body, which is essentially the insect analog of liver is an important immune organ and so it is. But too we have discovered that the additional important immune organs are the hemosites immune tissues or the hemosites, which you see here circulating in the [inaudible] system of the mosquito. Furthermore as the previous slide indicated the mid-gut at the helium itself reacts to immune challenges and I'll show you that it is an immune organ as well. I should take the opportunity here to remind you that

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this is the lumen of the gut. It is separated from the [inaudible] by a single of epithelial cells, which are bonded by a lining on the lumen side and a layer of basil lamina on the basil side and the parasite to go from the blood meal to the hemoleaf has to cross this lamina, the epical lamina and the basil lamina, and go right into the epithelial cell, cross through the cytoplasm and emerge on the other side. During this process many parasites will be killed and lized. Others will be melanized as they emerge out of the epithelial cells and others will make it through and will form the o-cysts.

Carrying this diagram further here I summarize what we have learned in just the last few years about the sets of genes the modules, the molecular modules as we say, which are implicated in specific types of immune responses. I'll guide you through those. Here's the [inaudible] transduction pathway which is a typical type of regulation whereby the presence of an invading microorganism is recognized by some kind of molecular recognition, which you would not understand and it is this molecular binding, which gives the initial signal, which then must be modulated to determine if the signal is strong enough that yes, the immune system should be activated and if it is to be activated this takes place through a single transduction series of reactions, which ultimate result in the expression of a set of genes that produce effector molecules.

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This is one module of the immune response and this is again what has been studied very well with the toll pathway and the IMD pathway. Additional modules that you see here relate to melanization for example, parasite lyses and local epithelial responses.

I'm told that we need to speed up since we got a late start but let me simply say that [inaudible] who was a PhD student working with [inaudible] at that time in the lab now also in Strasburg developed a method of detecting the function of genes by double standard RNA injection into the mosquito. You can actually do bioassays of a function after you inactivate specific genes. I don't have time to go into details but let me go ahead to the study of what we have learned about genes implicated in malaria transmission.

Leonard and Stephanie have studied a very interesting gene called Typ1 which you see as a model of a three-dimensional structure. It belongs to a family of proteins which are recognizable in mammals as the complement system which is a very well-known component of the immune response. Typ1 has turned out to be very strongly implicated in malaria control and the next slide shows you the formation that led us to this realization. In this case again we have a [inaudible] microscope of the middle epithelial. Again you can see the nuclei in blue. Here we have labeled plasmodium radii the model

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system we're using with GFP, the green fluorescent protein and as a result the live alchanids are shown in green because the fluorescent green. We also stained this sample with antibody against plasmodium [inaudible] protein to [inaudible] a protein that is well known to be at the surface of the parasite and sure enough you see red surroundings of the parasite itself. But now you see certain parasites, which are not looking very good unlike the banana shape of the green parasites. These parasites we believe have been lized and they have lost the GFP and indeed they have been killed. When we go to a different channel and look at the presence of Typel by antibody staining you see a very interesting look. The parasites which are alive are green but not red whereas the parasites that are killed are red and not green so the parasites that have bounded type on them are the ones that are killed.

If that is correct genetically we would expect that if this is a certain number of parasites that develop in the wild type mosquito if we could inactivate Typel, which we think of as antagonistic parasite, we should increase the number of the parasites and indeed that's what happens about fivefold whereas if we manage to under produce or eliminate Typel we should get very few parasites and indeed that's what we see. So indeed this validates Typel as a major gene involved in the control of the parasite.

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There are additional genes, quite a number of genes actually and you see here a gene that we call [inaudible], which is also an antagonist and which if inactivated gives rise to many [inaudible] more parasites as shown by the black bars. In addition to the antagonists exemplified by Type1 and [inaudible] we also detected a class of genes which you call antagonists and this protects the parasite. That's a very interesting phenomenon. This is work that Mike Costa in collaboration with George [inaudible] has done and you see here what happens. If you do a control [inaudible] GFP that does not affect the number of parasites. That's the baseline. If we knock out the [inaudible] the antagonist we get a substantial increase in the numbers but if we knock out CTL4 one kind of antagonist this is electing you actually kill all the parasites. The parasites are not at all visible here. If you go to light microscope you see them as being melanized parasites.

Actually you can do double knock downs and here you see what happens when you knockout both [inaudible] and CTL4 and this leads to the second type [inaudible] increasing parasite numbers but no melanization. This then leads us to the next slide which is a model saying that parasites that have been generated alchanids in the lumen of the gut go through the epithelial and in that process many of them as many as 80 percent are going to be killed and lized or melanized but

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actually that can also happen and that will also happen by the action of antagonists like [inaudible] or Type1 which will also lead to melanization in the appropriate genetic background. That's where the agonist protective molecules are intervening. CTL4 and other members of that class now are known to protect from melanization the parasites, which have made it through to the basil space.

Let me simply say very briefly without going into details to have combined sub-biology and functional genomics we have shown that as much as 7 percent of the genome is activated during the invasion process. Here you see actually a living epithelial cell with the membranes vitally stained and here's the parasite going through the epithelial cell. During this invasion process there's a huge amount of verging induction.

There are a very large number of induced genes and it turns out that these belong to certain classes, which are diminutive. The classes reduce potential classes and in particular interestingly we have many genes, which are implicated in the control of the cytoskeleton in the skeleton of the cell. I believe I have to close now but let me simply say that this is just the start of a long process of trying to understand and through that understanding to develop methods to control the parasite in the mosquito. If you push several slides ahead I'll tell you I wanted to just end with two slides

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at the end. Our agenda for the ten coming years is to do how do you put functional genomics and the systems biology of the interactions between plasmodium and Anopheles to understand the entire set of implicated molecules and to move from plasmodium radii, the model which is very convenient to [inaudible], which is the human malaria. We also are determined to move part of the work to the study of the parasite falsiperum in the field and that will entail the study of population genomics to understand the population biology and diversification of these vectors and to examine the potential of co-evolution of host vectors and parasites. This will require and will entail science partnerships and capacity building in functional genomics and work in the field.

Actually [inaudible] this afternoon in section I believe 227 in which he will tell you some initial results there. So we are going to follow that up with [inaudible] biology because I believe that it is important to understand that the ethical [inaudible] of malaria control will not accept silver bullets. What we need is an integrated approach, which is both low and high tech and it will take a sustained effort over many years. The last slide will show you the talented people who contributed to this work and with that I'll close my door. Thank you.

[Applause]

ETIENNE FONDJO: Thank you very much. I suggest that the [inaudible] my right to the left to take simple questions and then [inaudible]. On my right please.

FOTIS KAFATOS, Ph.D.: Any questions on this side?

ETIENNE FONDJO: [inaudible] On my left.

FOTIS KAFATOS, Ph.D.: Okay.

ETIENNE FONDJO: [inaudible] more Dr. Paris

[Applause]

RAPHAEL OKALLA: And his current share of the [inaudible]. Dr. Halima you have the floor.

HALIMA MWENESI, Ph.D.: Thank you very much, the chair person, distinguished guests, colleagues, ladies and gentlemen. Just over 20 years ago if and when a social scientist got a chance to speak about social sciences at a gather such as this there would inevitably be pleading to make a case for the integration of social sciences in medicine general and into biomedical research in particular. I was privileged as a young sociology graduate student to attend the first social sciences and medicine meeting organized in Africa by TDR that's the special program for research and training in tropical diseases of WHO in 1982 where for the first time African biomedical scientists and a small number of social scientists sat in the same room to explore ways of working together to tackle six tropical diseases of interest to TDR at the time including

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malaria, [inaudible] leprosy and [inaudible] disease. Needless to say the social scientists who were in the minority in that meeting and many of the biomedical scientists who were not convinced that social sciences had a role in the prevention management and control of tropical diseases today are not here to make a plea or a case for social sciences in malaria prevention, management and control. I am elated to have a chance to share with you some contributions of social sciences to malaria efforts in Africa since that meeting in 1982.

This is just a brief presentation outline of my presentation which we will begin with a brief review of malaria prevention, management and control in Africa. Then we'll look at what social science's contributions have been to that. We will look at a few lessons learned, gaps and issues, opportunities and prospects, and then there will be a proposal made for the way forward.

This is a brief overview on malaria prevention, management and control in Africa. The slide looks a little busy but we will explain most of the points as we go along. We all know those of us who have looked at malaria in Africa that the eradication era actually did not include Africa. Africa was not included because of various reasons but basically during that period the eradication era heavily relied on mechanical, technical and military-like solutions to malaria control which

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basically dealt with the vector and the parasite. With DDT coming into the picture there were dramatic gains in the Americas, Europe and parts of Asia but there were variable successes even in those areas. In the late 50s and early 60s chloropine comes into the picture and we seem to have tamed the disease. We seemed to have tamed the parasite at that point and there is [inaudible] going on all over the place in certain pockets in Africa in Mozambique, in Sara Leon, in parts of Tanzania and we see a combination of vector control including IRS or insecticide residual, indoor residual spraying with DDT in most of the homes. Unfortunately there was half-hearted introduction of these technologies into sub-Sahara and Africa and there was little effect especially when we started to see the setting in of resistance both to the insecticide and to the drug of choice. There was then a need to pay attention to social sciences or social and economic issues pertaining to malaria control. In the late 70s and early 80s the World Health Organization special program for research and training in tropical diseases started to earnestly research all socio-economic aspects of malaria very comprehensively but at that time there was no link to public health action. In the late 80s and early 90s there was a new emphasis on multi-disciplinary research and integrated combination of multiple strategies and tools with really good attention to social economic parameters

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for malaria prevention, management and control.

Today insights from all these disciplines which we see here actually permeate all aspects of malaria control. These disciplines although different and grounded in different theoretical frameworks share an emphasis on understanding human behavior in its socio-economic, cultural, geographical, ecological and political and other contextual factors. The disciplines ask different questions and use similar or different methodologies to answer them but essentially contribute to an holistic perspective on our response to malaria.

How have social sciences made a difference in terms of malaria control? First of all now we do know who to target and how to reach them. We also understand what behavioral, economic, social and other contextual barriers to overcome for the efficacy of the drugs, insecticides, policies and strategies that we have. We understand which policies and strategies will most effectively deploy all the suitable interventions that we are coming up with. [inaudible] And we have a better understanding of socio-economic, ecological health systems and political processes that mediate viable and sustainable malaria prevention management and control at all levels but we also know where the gaps are.

In terms of specific contributions of social sciences

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to malaria control we have a good knowledge of the psycho-social aspects of malaria in the communities. We understand how communities and individuals make a distinction between disease which is what they see at the situation that has to be dealt with in health facilities and illness which is the situation where the individuals and communities feel they can deal with at the community and household level. We also have a better understanding of health beliefs and perceptions on fibril illness or fever, which has resulted in more and better effective behavior communication change. This has allowed for better management of mild malaria at household and community levels however we know that in most of the places where we go and in scores of studies that have been done that there is awareness. There is new knowledge. That there isn't a real change of behavior or acting on the new knowledge therefore efforts must be intensified to encourage individuals and populations to act on the new knowledge acquired.

This is an example of trying to understand people's perceptions of their malaria because we all know those of us who work in social sciences that there is malaria that belongs to researchers and the biomedical scientists and there is malaria that belongs to the individuals and people in the communities and populations. For example the first picture there is just a community education program on promotional

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preventive tools. The other one at the bottom is a session where a group of individuals who are being taught how to retreat nests.

With regard to malaria prevention we understand what people do to prevent their malaria at the household level. We understand their behaviors, what they use at the household level, how they use it and why they use it and all the reasons behind that. We understand their solutions, which then help us to come up with interventions that really address their behaviors at that level. We understand malaria effectiveness trials are very different when we come to the field. In controlled situations it is very easy to insure that all parameters of an intervention happen but when we move from controlled trials or from project situations to the field then we realize that there are a number of parameters that we have to pay attention to and the social sciences have been able to open that area up for us. We also know and understand what the enabling environment is where there will be an uptake of the interventions and policies that the social scientists and other scientists come up with. We understand what the enhancers for behavior change are or uptake of new technologies and tools. We also understand what the barriers to use those tools and strategies are. This is not just for the users because there are times when we actually forget that when we are in the field

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we are not just looking at the utilizers of the technologies and tools but we are also looking at the providers of the same. We understand quite a little about prophylaxis which is not a preventative tool that has been used so much in Africa since the early days of the eradication era but now we know that there is an increase in the promotion of intermittent preventive therapy for pregnant women and also for infants. We have a good understanding of acceptability, appearance and barriers to the uptake of those behaviors or those interventions. With regard to ITNs and LLINs we understand the issues about availability and what that means in terms of utilization. We understand about affordability and cost of the same whether it is the cost of getting the nets to the people or whether it's the cost of people getting the nets for themselves for use at the household level. We understand the issues about acceptability. What do people feel about sleeping under a net? Is it hot? Is it not hot? Do you want it white? Do you want it black? Issues like that and we also understand the barriers and difficulties that people face when they have to use a net for example. Is it so easy to hang? Is it square or is it round? Is it conical, the shapes of these tools? What implications do they have in terms of acceptability? With regard to residual into spring we don't have much information on this area at this point and this is simply because it is not

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an intervention that has been used extensively in Africa in the recent past but we know that there is a huge call now or [inaudible] call for the use of residual indoor sprays with DDT or whatever other insecticide it may be. We will have to try and understand issues about acceptability. What we know from past studies which were done in the early 50s and mid 50s both in [inaudible], Kenya and also in some areas in India is that a lot of people didn't like DDT being sprayed into their homes because what it did was to color their walls and they probably have smeared it nice and clean. Then you have all this white sprays all over the place that really was not aesthetically acceptable to the people. So the sprayers would come in. they would spray and as soon as they left the household would actually go wash it off or clean it up or re-plaster their walls just to make them clean. So those are things that we want to try to understand. Of course we know that the chemicals have improved and maybe what was happening in the early 50s won't happen now but still we do need to understand as we go into IRS and as the IRS starts to take hold as an intervention. There are other areas of environment and social reduction. Window and door screening and that is acceptability and practicability of the same in different areas and the other tools that we all know of repellent sprays, protective clothing, et cetera.

In trying to understand prevention we also try to

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understand the people who do not use the prevention and that helps us to understand what is going on on the other side. With regard to treatment this is just a slide that is asking a question. Where is most malaria treated? Scores of studies have indicated to us that most malaria or malaria-like illness is treated at home and at the community level and that is about 70 percent of the time. Only 30 percent of malaria or malaria-like illness actually finds its way to the health systems.

Again here we now understand where and when and why people seek care or do not seek care, why they utilize certain health systems whether it is the private sector or public sector or they utilize traditional medicine. We understand at what point they seek care. We understand reasons for delay in care seeking and its consequences. Some of these are based on cultural, structural and system issues.

We have a good understanding of drug use, self-treatment, why people treat themselves. We know whether they treat themselves rationally or irrationally and all the related consequences such as what we have been hearing about drug pressure and therefore selection of strains for resistance. The timing of treatment and the [inaudible] and compliance to drug regimens and dosages and its implications is also another area that has been of importance to social scientists. This is becoming even more critical now that we are going to see an

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introduction of [inaudible] in combination therapies, which are different from the past drugs that people were using, which was one dose maybe a couple of days. Now we have combination drugs where it's multi-dosage, multi-day, the works so we need to understand that. Although we have a good understanding of what has been happening with the drugs that we have had in the past. We also have a fairly good understanding of acceptable modes of treatment delivery. We know that in the earlier days when we were going around asking, asking populations about their preference in terms of treatment especially for malaria the answer was always that mostly if you go to the hospital and you have an injection then that was preferable. In fact there were lots of quacks in many communities that were giving injections of all sorts where some of them were just really water based but people believed that they were going to affect some cure. Whether it is to take tablets or syrups and now with the coming of rectal cups and suppositories for severe management at least home level management of severe malaria at household level there were questions that needed to be understood about acceptability of using rectal administration of medicine. We have a fairly good understanding maybe not a lot has been done on this but we have a good understanding of the acceptance levels of this mode of administration.

Further knowledge has culminated in informed IMCI

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algorithms and even as we understand that we don't have good standards for symptoms of malaria but at least we do have algorithms, which we have all agreed upon to say this I use for when we are teaching community health workers or drug vendors and others we have a set that we have agreed are useful and those can be used. That has also led to the innovative home management of malaria and other malaria strategies. This has led to training of caregivers, shop keepers, vendors and other subgroups. Thus we have been able to generally bring treatment closer to the people to insure that treatment within 24 hours of onset of illness is feasible.

From the economics and policy side we know that the economic status of malaria have informed policies and positions on what interventions to deploy and strategies for delivering them. We have a good understanding of the cost and cost effectiveness and efficiency of different interventions and delivery systems be they public, private, community all and integrated. We know how to target and reach the most vulnerable households, subgroups and entire communities. Do we distribute tools and products for free? Do we have vouchers? How do we go about it? What is the cost of that et cetera? We also have a good understanding really of the household expenditure on malaria, ability and willingness to pay, what years of fees can do in terms of utilization of services and also a good

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understanding of social and health systems factors that impinge on or enhance utilization. Economic and social burden of malaria on households, communities and regional productivity has been studied extensively by various economists and so we know what the burden of malaria is for all these sectors. We know that it determines clearly, health and wealth in most of our communities. These studies allow for prudent use of scarce resources and a better understanding of inequities and inequalities in health care. I have a put epidemiology here. Some people might find it a little awkward to see epidemiology in a social science presentation but I believe a comprehensive epidemiology really does entail social sciences and now we know that cultural epidemiology is a discipline that has come up and a lot of people are starting to study it. We can talk about that later on but we understand better the socio-economic, ecological and behavioral determinants of malaria transmission in specific settings and this has informed [inaudible] us on how to better tailor effective control strategies. Do we use ITNs in Area Y? If the transmission rates are very intense do we use IRS? Do we use IRS only for areas where there is focalized malaria transmission, etcetera, etcetera? Epidemiology has also elucidated to us the gender differences in access to information on malaria prevention, management and control and the need for gender sensitive interventions.

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Basically epidemiology informs us on the context of risk and also tells us about risk in context.

I just have a few examples of research to development here where we have drugs and insecticides. Social sciences have really contributed much to the studies of bio-prospecting and discovery which is based on traditional medicines and vector controlled products. When we're trying to understand what people use to treat themselves or what they use to control vectors it is if they are plants and if they [inaudible] traditional plants we then have people who are working in pharmacology and in traditional medicines to bio-prospect for new candidates and compounds for drug discovery and insecticide discovery. Then of course talking to consumers or users we have been able to come up with user friendly products which increase the likelihood of utilization. For example there are now prepackaged color-coded unit doses of anti-malarials. We have ITNs and LLINs that people like because of the shape, the size the color. We have single dose re-treatment kits because we realized in the past that the communal dipping was not working for people and they were not really being encouraged to retreat their necks. The single dose re-treatment kits came up as a result of social science research. As I said earlier IRS we don't much but we will get to understand what is going on there too.

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Hopefully there will be a meaningful contribution towards vaccine development. This is an area where social sciences have not started to make a contribution for whatever reasons but I think there is a lot that social sciences can offer not only in the preparation of the sites but also in trying to understand how well the other vaccines have been used in the past and what might happen when we have a new vaccine that comes into the picture.

Of course there has been cross cutting contributions from social sciences and if we go back to the beginning where we had a cycle where we had a real key concentration at looking at the vector and the parasite and not paying attention to man we've gone full circle now. We understand about disease which is where the biomedical scientists are really doing lots of work. And then we now know quite a bit about people but where we still have a gap is in the systems. We really don't understand health systems, not very well. A lot is going on but we are yet to really crystallize what the real issues of health systems are, the weaknesses, the strengths, and I'm not just talking here about health systems, the hospitals and the facilities. I'm talking about community health systems also. I'm talking about traditional health systems, the works. All those systems need to really be understood so that we can have a better understanding of how best to deal with malaria. At the

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bottom there we have examples of where cross cutting contributions have come and this is in the area of ethics. We understand better how to protect communities in terms of exploitation. We understand better about behavior change communication, M&E monitoring and evaluation, tools and methodologies and of course health systems research. Of course there are many others but those are the ones I could come up at this point in time.

What are the key lessons from integration of social sciences into malaria prevention, management and control? The key lessons are that integrated tools and strategies, multi-disciplinary and adaptive malaria programs are key to effective malaria prevention, management and control. We also know that tailoring interventions to settings, people, systems, the environment is very important. What does tailoring mean? It means engendering the interventions that we are looking at, really looking at gender issues and being very sensitive. We know there are different ways that different genders access information to health, access health. We know that men sometimes are the ones that make decisions about various health related issues at the household level and that is very important. Again tailoring means empowering people getting them to understand that this is their problem. They have to feel ownership of whatever interventions and programs that are going

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on in their environments. Also we have to respect issues and principles of equity. When we pay attention to all those key lessons we stimulate attention to sustainability because there isn't any need and use to do all these things without thinking about the long term.

A couple of gaps have been identified here and one of them is that there is a lack of comprehensive utilization of the vast knowledge accumulated through social sciences over the years but really most of the contributions that social sciences have to make are not with the implementers and beneficiaries but with are mostly in journals and institutions and in close circles of scientists. We tend to talk to ourselves. We come here we talk. Sometimes we don't pay attention to the implementers to those practitioners who really have to make our interventions or our findings useful for [inaudible] decreasing the burden of malaria amongst our people. The information that is out there is not always in the form that practitioners or implementers or program personnel can utilize. It is in scientific jargon or it is in jargon that only we ourselves can understand. There is still too very little effective communication between scientists, practitioners and decision policy makers. Health systems constraints are yet to be fully understood.

The other key problem that we have or the other gap

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that there is is really the non-harnessing of meaningful community participation in malaria prevention, management and control. There is always a very good thing. In fact this morning when the minister was speaking he did allude to the fact that we have to bring in the communities. We have to make sure that communities are involved but when we think of how we started talking about community participation and primary health care they were ideal thoughts and maybe I want to call them slogans that came into the picture. We were told that to bring in communities into interventions we have to include them in planning, in execution of interventions, etcetera, but maybe I beg to differ with regard to malaria. There is with malaria and the nature of malaria and the complexities involved I do think that there will be and there is a need to have the scientists who have to do the biomedical work and all that stuff do what they have to do. They bring in this information to the communities but in the best way possible so that they can use it but to say that we should be able to include them in every aspect of what we are doing might not be as practical as maybe it had been thought on. Maybe that is why we haven't seen a real good community participation happening in malaria control.

But we have good opportunities and prospects.

Currently we have a wonderful crop of social scientists working

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in malaria in Africa. This are dedicated, well trained, grounded in theory and methodology. This was not the case about 20 years ago. I want to emphasize this because social scientists can work in any area. They don't have to be stuck working in malaria which doesn't seem to be glamorous or have lots of money. They can jump ship and they can work in AIDS. They can work in all sorts of areas. There are good opportunities for consultancies of every type and nature but they choose to work on malaria and they are there. So this is a resource that we need to utilize. We also have social scientists now an integral part of teams defining the research and prevention management and control agendas for malaria. Again 20 years ago social scientists were brought into malaria control as an afterthought. Some biomedical scientists would begin to do something. Then they would think we need somebody to come and tell us why people are not coming to the clinic. We need to understand why we should be seeing a lot more malaria at the outpatient clinic but we are not seeing these people. Bring in someone who can quickly come and do a rapid assessment and tell us what is going on. That is not the case. They are now part and parcel of really setting the malaria research agenda. We have an increasingly effective communication between social scientists and biomedical scientists so it's not a closed shop anymore. Malaria programs which are the other key

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thing are retaining their staff longer. This of course entails long term gains and stronger approaches at individual and program level, which contribute to sustainability.

What is the way forward? The way forward I think is to really try and better understand what integrated tailored interventions entail and what they are especially the role of communities. We are talking about scaling up. We are talking about taking interventions from projects and programs to really nationwide scaling up. How are we going to do that? The communities have to be our partners but how we bring them into the picture is very critical and I'm appealing to the social scientists here to start thinking about it so that we can be part and parcel of really enhancing that scaling up process. The next one is that we have to reduce I am suggesting we have to reduce new knowledge and analogy production. I sit here and I think we have enough information to help us scale up because that is where we are going, scaling up. We have done lots of pilots. We don't want to continue doing pilots and pilots. We don't want to keep doing little studies here and there to give us this more information of what we already know. We know a lot. Can we utilize what we know? Can we reduce that generation of new knowledge?

Can we also synthesize, validate and generalize the available knowledge that we have and translate this into policy

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and strategic action information, information that can be easily utilizable by the practitioners at the program level and at the policy making level? Maybe the one controversial thing I'm going to say here is that I think we need to rethink the current focus on capacity building for social sciences and malaria within MIM. We have concentrated over the last couple of years since MIM started on really training [inaudible] scientists, Ph.D.'s, etcetera. I am not saying we should stop doing that. All I am saying is that maybe we should start to rethink that and probably decide that we will have a 50/50 approach where we will have the embassies and Ph.D.'s but at the same time focus on training a caliber of people who are actually implementing and operationalizing the strategies and policies that we are contributing to. Before I finish, there is a statement that is being made over and over and I'm sure it's been made every day since we started this meeting that we have effective tools to combat malaria here and now but somehow or for some reason we are not doing it. In the past peculiar reasons were top on the list but today this is not true. I'm now making a plea. [Inaudible] make a plea. I'm now making a plea to fellow social scientists and all who are that way inclined, while biomedical scientists continue to grapple with vaccine discovery and the genomics that we were earlier looking at and of course the pathogenesis of malaria let us earnestly

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talk to practitioners implementers and wherever possible decision makers to make even more sustainable contributions to malaria prevention, management and control. Let communication specialists come up with effective generic messages for users and providers that are sustained over the long term through all media in endemic areas. Even as we communicate amongst ourselves let us share the knowledge with those who really need it, sufferers, decision makers and implementers of malaria interventions. Let us insure that our contribution is real so that we can contribute to denting the burden of malaria in Africa and I thank you for your time.

[Applause]

RAPHAEL OKALLA: Thank you very much Halima. Does anyone have some question in the back? [Inaudible].

MALE SPEAKER 1: Thank you. Thank you very much Dr. Mwenesi for a most enlightening talk even if for those of us who are not yet enlightened to really understand. I have one of three questions to raise [inaudible]. Now you were talking of [inaudible] and these ideas have been around and useful social scientists have helped us [inaudible] in the understanding and in their use. Now one area that I feel may need quite a little of attention is the cost effectiveness of ITNs versus environmental management in other areas. You were talking of pyramid interventions to particular areas. We find although the

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research is done in rural areas and ITNs but the [inaudible] preliminary use is usually in towns where you have [inaudible] mosquitoes, which are not so susceptible to [inaudible] etcetera, etcetera. Is there any research really going in this area to see really is it what is more cost effectiveness [Inaudible] areas? Is it ITNs? Is it environmental management? The second question is the area you brought up of bio-prospecting where people of your kind have undertaken [inaudible] botanical studies and this has led not to but to bio-prospecting and bio-piracy. What are you doing in this area to promote packaging all your knowledge as social scientists? Lastly the ITNs that [inaudible] discovered during the days of [inaudible] and [inaudible] where market forces where really in the front where we were saying let not the government do what the people can do better. Now my worry is I mean I don't know what you social scientists have done in this area. Don't you think that ITNs caught on because of the [inaudible] of [inaudible] of [inaudible] and they both have postponed if we had governments that had social responsibility at heart? Thank you.

RAPHAEL OKALLA: Any other questions? Yeah.

MALE SPEAKER 2: Just a [inaudible] question about house staff attitude of the house staff because these are people that actually enter the community. It's very common

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throughout [inaudible] health centers and interactive with the community. Is there any research looking at how these influence the impetus of social intervention?

RAPHAEL OKALLA: Thank you. Can we take a third question? Yeah.

MALE SPEAKER 3: Thank you Halima for a lovely talk. I was really encouraged by two points you touched on that I would agree with. I would ask you for some more examples. One was the problem we've had I guess with propaganda or slogans with a lot of the material that's been going out. I know there's been a lot of the information that we're putting out in the community. We're putting it out for the sake of putting out information but some of it is impractical or weak and in some occasions just plain wrong. I would give the example [inaudible], which we see in many instances even in school textbooks etcetera. The other one is the need to train people below the M.Sc. and Ph.D. level because there's never going to be M.Sc.'s and Ph.D.'s to cover all of sub-Sahara and Africa so if you could expand on that I'd be very grateful. Thank you.

RAPHAEL OKALLA: Thank you. Halima.

HALIMA MWENESI Ph.D.: I will attempt to respond to professor's questions. When we got to whether there are any cost effectiveness studies looking at IRS versus ITN all I can tell you Prof is that this is a new research agenda coming up.

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This is because whether it was patriotism that took us to ITNs I want to believe that it was the efficacy studies and the science that took us to ITNs when it did because there was science that was done in various parts of Africa that showed that they were working but whether at that point that it was important that we should look at two of the interventions, IRS and ITNs is not for me to answer. I have absolutely no idea why we decided to go that way with ITNs but I guess it's because there was a lot of information from various countries that were really showing that ITNs were efficacious and all that needed to be done then was to really have large scale trials, randomized controlled trials in different parts of Africa with different entomological inoculation rates to see how that work. Basically that is all I can say. I am not very politically inclined but we can discuss that later. In terms of patenting of ethical botanical knowledge and whether or not we are encouraging bio-prospecting or bio-piracy in terms of discovery of drugs and insecticides again that is debatable. I guess it would be in the hands of the institutions that are doing these activities to ensure that this doesn't happen because that is what ethics of it really is about. But unfortunately you and I know that that is not the case and it really depends on who is manning these institutions. If they really pay attention to that then it will happen but otherwise it's neither here nor

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there.

There was a question about health staff and their morale and depending on where they are. Just before I concluded my talk I said the area where we really have a shortage of good information is health systems. It is in the area of health systems research and that is where we should be encouraging lots of new work to be done because we really don't know much. We have pockets of research that has been done here and there and that is what needs to be synthesized so that next time someone gets up here they can really tell exactly what is going on in that area but it's still very wooly as of now.

Jerry thank you. About these issues of impractical messages that go out to communities you gave the example of bush clearing for malaria control and we know that since 1947 someone had written a paper to show that it's really a waste of time. Also when we know for example that the Anopheles Gambia is everywhere in the rural areas. Where are these people going to clear? What bush are they going to clear? Which bit are they going to clear and which one will they not clear? How many animal hooves are they going to cover and all that stuff? That is an area that really needs attention and again it is one of the areas that I said we need to look at. This is the area of communication. We haven't been as good as other workers in other disease for example in HIV/AIDS where you see

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communication, serious communication that is sustainable, that is running almost all year round and is everywhere. We only have pockets of information only in the project areas that we are working but I am hoping that this is going to change when we start looking at nationwide, country-wide programs or region-wide programs for that matter.

And there was the last one, the need to reduce. That is why I said 50/50. I didn't say we must stop the training of Ph.D.'s and MSEs altogether. All I am saying is that we probably need to pay more attention to the training of those [inaudible] of personnel that actually implement and operationalize the processes or the policies that we have. The reason I'm saying this is that in most of the national program offices you have one or two people who are high up on the hierarchy but really they are not the ones that are implementing these activities in the field. The training might take different forms. It could be a social scientist who is [inaudible] or a consultant who is [inaudible] to a national malaria control program within a region or in a country to really support them, understand all this information and integrate all this information that is coming in from all sorts of directions so that then they can be able to implement their programs better. But it's a balance and it's a balance that we have to try and find and I don't think there will be a chance

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for anyone else to do that if we within MIM do not take that challenge.

RAPHAEL OKALLA: Well I think we are going to stop here and I think that it is important for us to look at the information and from all the sharing that is followed up I will not summarize but I think I will resume with ideas which I believe are important particularly in the resolution that we must carry on in the fight against malaria and put them in the relationship with social sciences. Now I think that it is obvious that social sciences have now produced come up with so much information, so much research results that are available. The problem that arises is that this information, which is available among researchers is not as much with people who are planning programs that may have to be implemented and the result is that at the political level we do not find the use of this information. I also believe that for as much as health systems must make further efforts to adapt themselves to using these results or conclusions in the same way social science and its researchers should organize research such that from this that they be included in [inaudible]. In research projects that are drummed up and which are implemented. The second thing I would underscore is that this fight the abundant overflow of information and results which we have there are still some pockets of areas which [inaudible] social sciences

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still need to enlist. I am hereby referring or thinking to health systems to service providers, the motivation and the real knowledge and I would like to share but you can not come back on all these issues but we realize very often that service providers are unused in programs not particularly [inaudible] they have some information. They come from some families. They come from regions and these cultures in which training has been improved training as [inaudible] nurses contradicts you to what has been done and so they are all partners in information that is given particularly the information that is given to patients and then it's still only information of medical sciences organizing scientific information which is given back to patients but also we are [inaudible] convictions and knowledge of the people that they have before them and that is going beyond the message. Now the third thing I would like to mention here is in the area of research we all still have areas. We have some gaps and in the area of funding it is important that social sciences be considered in programs, which are implemented as research on its own right. Even if you have a lot of knowledge I think there is an operational area locally within each institution where you would have to implement a project to study the amount of knowledge that is already there, the various projects that have unfolded in those areas, the various slogans that have been drummed up there because these

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are not village idiots who need to include this information to come up with new form planning and new message with regards to the fight that we want to carry on. I will therefore conclude by thanking Halima for all this information, thanking the participants on the sharing which we just had, by wishing that more and more social sciences be involved much more in research and planning and that the results of research or the outcomes be built to effectively influence actual plans and be beneficial to the people and the different communities. Thank you.

[Applause]

[END RECORDING]