Schistosomiasis and soil-transmitted helminthiasis cause chronic illness and severe morbidity. Professor Louis-Albert Tchuem Tchuenté discusses his efforts to understand, control and eliminate these diseases.

Can you briefly outline the causes and effects of schistosomiasis and soil-transmitted helminthiasis?

Schistosomiasis (bilharzia) infection is acquired when humans come into contact with freshwater infested with the larval forms of parasitic blood flukes, known as schistosomes. There are two main types: urinary and intestinal. Most eggs are trapped in tissues and the body’s reaction to them can cause significant damage.

Soil-transmitted helminths (geohelminths) are transmitted by eggs present in human faeces, which in turn contaminate soil. Humans become infected when they ingest the eggs from unwashed food, or when parasite larvae penetrate the skin.

These diseases are particularly damaging to children. A child with schistosomiasis and/or intestinal worms will often be affected by stunted growth, anaemia, weakness and learning difficulties – and will be more susceptible to other infections.

What is your background as a researcher, and how has this led you to your present roles?

I am currently Professor of Parasitology at the University of Yaoundé, Cameroon. I have over 20 years of experience in various aspects of research, with a special focus on schistosomiasis and geohelminthiasis. During my postdoctoral research I participated in a number of international and multidisciplinary research projects on these diseases, and was responsible for bench and field research conducted in several African countries. When I returned to Cameroon, the challenge was how to continue high-level research and remain scientifically productive. To this end, I set up the Centre for Schistosomiasis and Parasitology (CSP). Over the years, the CSP has become a reference centre for research on schistosomiasis and geohelminthiasis in Cameroon. It has put its expertise into action to promote disease control in order to improve the health of people in endemic areas. Taking advantage of the renewed momentum for the control of schistosomiasis in early 2000, I played a central role in the creation of the National Programme for the Control of Schistosomiasis and Intestinal Helminthiasis (NPCSIH) in Cameroon and was appointed National Coordinator in 2003.

The CSP is a crucial component in the fight against these parasitic diseases. Can you explain the Centre’s overall goals?

The CSP has a threefold mission: research, disease control and training. It integrates research and control in order to improve health and contributes to the understanding of disease epidemiology, transmission dynamics and treatment efficacy, as well as the optimisation of control strategies. The Centre also assists the NPCSIH in the implementation of control activities and operational research.

What is the significance of your work mapping the large-scale dynamic distribution of worm infections? Are there challenges with coordinating efforts across different African countries?

Mapping of schistosomiasis and intestinal helminthiasis (and other neglected tropical diseases) is therefore a crucial step to scale-up interventions in countries and areas of need, in order to achieve targets for control and elimination.

The mapping status is very different between countries in Africa and several challenges arise in coordinating efforts across the continent. These include: coordination of partners and resources for mapping (there are several partners supporting mapping activities in different countries and each partner has an individual vision, interest and mapping approach); harmonisation of tools and method/protocol; and insufficient government leadership.

Can you explain your work on co-parasitic infections, as well as interactions between and within species?

My work showed that polyparasitism is frequent in many parts of Cameroon where most children are co-infected by at least two species of parasite. It is likely that people harbouring multiple species infections are subject to heavy infections and will have exacerbated morbidity. Knowing the type of co-infections is essential to developing adequate drug co-administrations. Interestingly, my work demonstrated that interspecific interactions in schistosomes have significant impacts on parasite epidemiology, species location in humans, genetic heterogeneity, transmission dynamics of schistosomiasis and control strategies.
SCHISTOSOMIASIS AND SOIL-TRANSMITTED helminthiasis (STH) are among the most common parasitic diseases in the world. Schistosomiasis is a group of infections caused by parasitic worms of the genus Schistosoma. Larval forms of the parasites are released by freshwater snails and penetrate the skin. The larvae develop into adult schistosomes in the blood vessels and the females then release eggs. Some of these pass out of the body, but others remain trapped in tissues and cause urinary or intestinal symptoms, and severe morbidity. Schistosomiasis is most prevalent in tropical areas of poverty that lack safe drinking water and adequate sanitation – at least 90 per cent of those who require treatment live in Africa.

STH is a group of parasitic diseases caused by intestinal worms; parasites that live in the human intestine for food and survival. Similarly to schistosomiasis, STH occurs with poor sanitation and a tropical environment. The main signs and symptoms are abdominal pains, loss of energy and frequent diarrhoea. STH is thought to affect over 2 billion people worldwide, with the largest numbers in sub-Saharan Africa.

Schistosomiasis and STH have devastating health and socioeconomic impacts. Chronic forms of the diseases can affect people’s ability to work and may even result in death. In light of their serious implications, these diseases constitute an important public health issue in developing countries. As Director of the Centre for Schistosomiasis and Parasitology (CSP), and National Coordinator of the National Programme for the Control of Schistosomiasis and Intestinal Helminthiasis (NPCSIH), Professor Louis-Albert Tchuem Tchuenté is addressing this desperate situation in Cameroon.

THE CENTRE FOR SCHISTOSOMIASIS AND PARASITOLOGY

Although the parasites responsible for these diseases have been studied extensively, the epidemiology of infections and many aspects of their biology remain poorly understood. To address these knowledge gaps, Tchuem Tchuenté launched the CSP to establish a dynamic framework for high-level research in these areas. The CSP plays a seminal role in research for schistosomiasis and STH in Cameroon, translating its unique expertise into action to improve the health of those who need it most.

A robust knowledge of the distribution of parasites is essential to successfully confronting them. However, data on schistosomiasis are outdated and do not reflect recent large-scale treatment campaigns. Tchuem Tchuenté aims to update this information which, in turn, will enable efficient planning, coordination and evaluation of control activities.

Using geostatistical modelling, Tchuem Tchuenté and colleagues were able to show that in West Africa over 50 million people aged 20 or under are infected with schistosomiasis. Data specific to Cameroon were last collected over 25 years ago – Tchuem Tchuenté updated this by conducting epidemiological surveys in all 10 regions. The results are testament to the success of deworming campaigns, as Tchuem Tchuenté explains: "The number of children treated annually has increased significantly from 150,000 in 2006 to over 7 million in 2012. Mapping showed a significant decrease..."
in worm infection in all 10 regions of Cameroon – by up to 95 per cent in some areas”.

CONTtemplating RESISTANCE
At present, the fight against schistosomiasis and STH is largely comprised of mass treatment with anthelmintics (drugs that expel parasitic worms). It is well established that the repeated and large-scale use of drugs can lead to the development of resistant parasite strains. Therefore, studying the effectiveness of these medications is crucially important, as Tchuen Tchuem elaborates: “Fortunately, no drug resistance has been demonstrated for current drugs. However, the risk remains and there is a need for the regular monitoring of the efficacy of anthelmintics and continuing the search for alternative drugs”.

Tchuen Tchuem has studied the efficacy of three anthelmintics: Praziquantel, the most commonly used medication for schistosomiasis, and Albendazole and Mebendazole, the drugs of choice for intestinal helminths. Praziquantel showed high cure rates among children infected with *Schistosoma haematobium* and/or *S. mansoni*, and this drug efficacy has been confirmed in animal models. Based on these findings, Tchuen Tchuem and colleagues were able to recommend that endemic countries continue to use Praziquantel on a large-scale basis. Although the results for Albendazole and Mebendazole were less clear – multicentre studies across seven countries showed variable cure rates – they remain effective and recommended medications for STH.

Taking a precautionary approach, the CSP team has also begun looking for alternative medicines. It tested the anti-schistosomal activity of plant extracts commonly used in traditional medicine, the results of which were particularly promising for *Sida pilosa* and *Calyptridium umbellatum*.

KEY ACHIEVEMENTS

**CSP**
- Updating the schistosomiasis and soil-transmitted helminthisis distribution map in Cameroon
- Demonstrating frequent polyparasitic infections
- Publishing over 100 papers in highly-regarded international scientific journals
- Genetically characterising parasite strains
- Showing the decline of *Schistosoma intercalatum*, an endangered species in Cameroon
- Demonstrating genetic predisposition to polyparasitism and heavy infections
- Increasing community awareness through health education
- Monitoring the efficacy of anthelmintic drugs and treatment impacts

**NPCSIH**
- The annual deworming of over 7 million children in Cameroon
- The selection of Cameroon as the first country for donation of Mebendazole
- Successful negotiation of a pioneering collaboration between the Ministry of Public Health, Ministry of Basic Education and Union of United Councils and Cities for the control of worms in Cameroon, an essential factor for local ownership and sustainability

IMPROVING DIAGNOSTICS
Comparing recent mapping results with old data clearly shows the positive impact of annual deworming campaigns in Cameroon, and the overall success in the battle against schistosomiasis and STH. However, concern is very much ongoing, and the control of these diseases is a long-term process, fraught with challenges. In fact, the improved treatment of schistosomiasis brings with it new and different challenges, including the sensitivity of diagnostic tools.

The Kato-Katz technique is the standard for intestinal schistosomiasis diagnosis. However, it is less sensitive in low transmission areas with low parasite incidence. Increased mass treatment with Praziquantel and successful control programmes have resulted in an increase in the number of low transmission areas, generating a need for more sensitive diagnostic methods. In fact, the CSP has evaluated the accuracy of screening tests. In fact, studies of cathodic circulating antigen (CCA) urine tests for the diagnosis of schistosomiasis caused by *S. mansoni* showed this method to be more sensitive and easier to conduct than the Kato-Katz test. As a result of this work, the urine CCA test is now strongly recommended for large-scale use for the rapid identification of intestinal schistosomiasis.

PATHWAY TO ELIMINATION
Tchuen Tchuem has advanced understanding of the reproductive biology of schistosomes, the epidemiology of schistosomiasis and the link between the two.

The fight against schistosomiasis and STH has seen great progress in recent times. With the help of new funding opportunities, and the donation of medicines, Tchuen Tchuem is contributing to a paradigm shift in schistosomiasis – from control to elimination. His success is a reflection of his passion for capacity building in research and control, and investment in science in developing countries.