

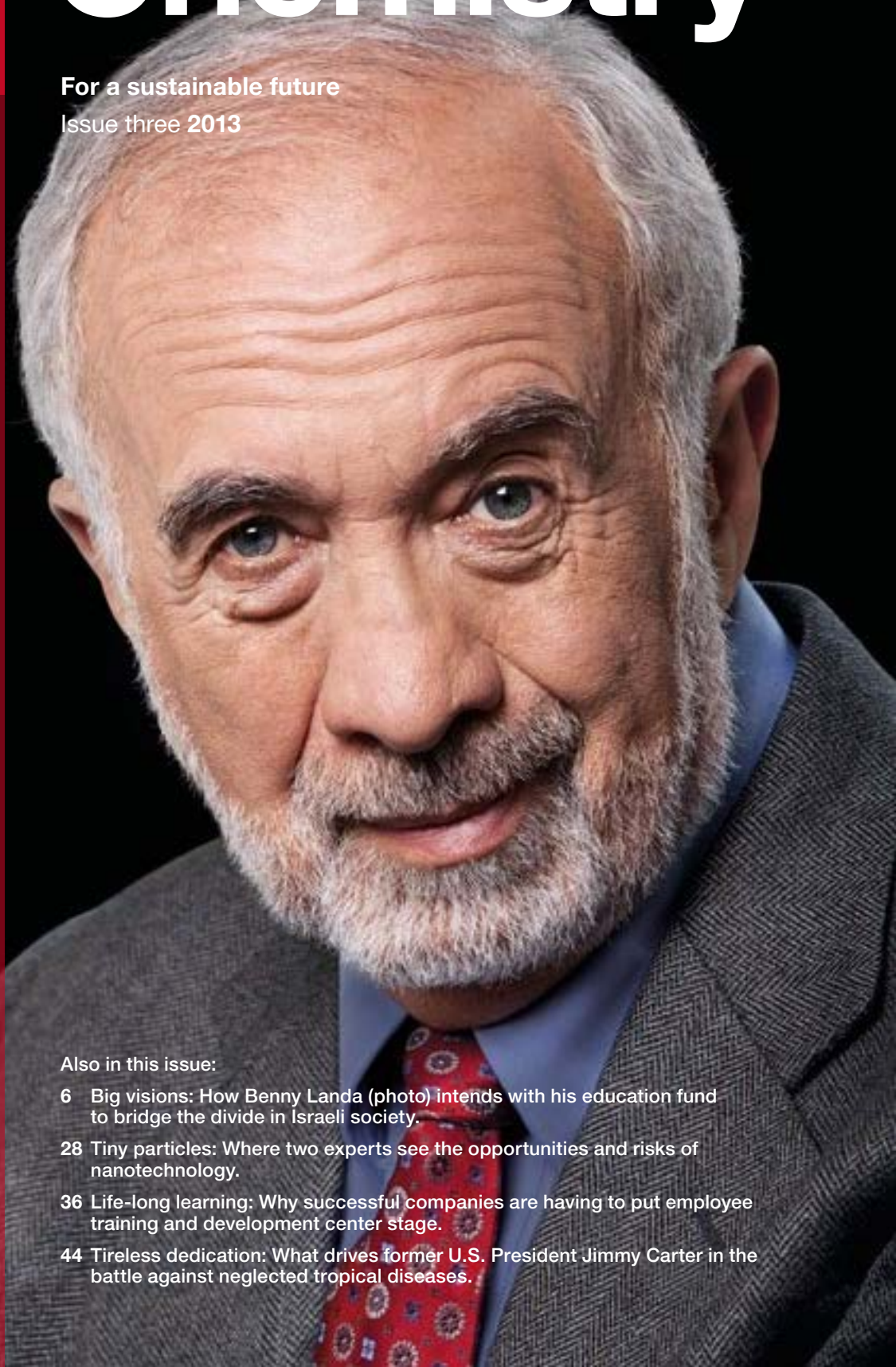


The Chemical Company

Creating Chemistry

For a sustainable future

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The thirst of cities


More and more cities are running dry. How can we meet the challenges of urban water management?

Cover story from page 8

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Young goat herders in South Sudan drink dam water through a filtration pipe that protects them from Guinea worm. The pipe was provided by The Carter Center as part of its efforts to eradicate Guinea worm disease.

Shining a light on hidden diseases

There is a group of diseases that have plagued humanity for centuries and which today blight the lives of a billion people in 149 countries worldwide. The impact on individuals and communities is immense and yet, until recently, they attracted little attention – and little was done to combat them. That has changed over the past few decades. Efforts are now beginning to show results. But the battle is not yet won.

The Guinea worm is a parasite that has tormented human beings since ancient times. One has even been found, calcified, in an Egyptian mummy. Today, people continue to catch the disease by drinking straight from ponds or other water sources that are infested with minuscule fleas. These fleas have eaten Guinea worm larvae which can penetrate the human intestinal wall. A female larva, having mated with the male, grows in the human body into a meter-long worm that mines through the subcutaneous tissue. Usually heading down to the person's feet, the worm exudes acid to form a blister and breaks through the skin. Its emergence is excruciatingly slow.

Winding the worm round a stick, daily, is all that can be done to hasten recovery. A patient can be incapacitated for weeks. Children miss school. Adults cannot farm their crops. Worse, to soothe the burning pain, sufferers are drawn to bathe in the local water source, whereupon the worm immediately releases thousands of larvae, perpetuating the cycle.

Largely hidden

Guinea worm disease is one of a group of diverse diseases known as neglected tropical diseases (NTDs). NTDs flourish mainly in impoverished environments, particularly in tropical areas. Although they do not cause the same numbers of deaths as tuberculosis or malaria, for example, they not only devastate individual lives, but also damage whole communities and, indeed, national economies by locking so many citizens in the poverty trap.

Previously more widespread, NTDs have gradually disappeared from places where living conditions and hygiene have improved. Today the populations most blighted are the desperately poor, in rural areas and urban slums in Africa, Asia and the Americas, where whole communities still lack adequate access to clean water, good nutrition, sanitation or quality-assured healthcare.

Those who suffer from NTDs are largely disenfranchised. They were described by World Health Organization (WHO) Director-General Dr. Margaret Chan, in the first ever WHO report on NTDs in 2010, as “largely hidden” and “largely silent.”

Controlling diseases

WHO itself helped raise the profile of these diseases a decade ago when the organization's then Director-General, Dr. Lee Jong-wook, instigated a key “branding exercise” to bring them to the world's attention. A WHO department nebulously dealing with “Other Communicable Diseases” was scrapped and the “Neglected Tropical Diseases” banner was adopted as a more focused target. There are now 17 diseases classified by WHO as NTDs.

But this was not the first attempt to tackle these diseases. In some cases, efforts had been going on for decades. The global Guinea Worm Eradication Program got rolling in the 1980s at the United States' federal Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia. In 1982, the former U.S. President Jimmy Carter and his wife Rosalynn founded The Carter Center as a not-for-profit NGO dedicated to human rights and the alleviation of suffering. It has spearheaded the Guinea Worm Eradication Program since 1986, with Dr. Donald R. Hopkins from CDC becoming The Carter Center's Vice President for Health Programs. Hopkins brought with him the experience of overseeing the smallpox eradication program in Sierra Leone.

The Carter Center helped to develop cost-effective strategies to tackle Guinea worm disease such as providing at-risk communities with fine-mesh cloths to enable them to sieve out the fleas, and pipes with filters that can be used like drinking straws. Health education for the local communities is a vital accompaniment, for example, using a magnifying glass to show people the fleas in the water and explaining the transmission process. The aim is to spark behavior changes. If sufferers stop entering the water source, the cycle can be broken. >>

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Many developed countries haven't addressed the issue of day-biting vectors at all. This is a time bomb if we don't do something.

Dr. Lorenzo Savioli,
Director of WHO's Department of Control
of Neglected Tropical Diseases

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Below Students distribute pamphlets in Lahore, Pakistan, during an awareness campaign on Dengue fever.



Engaging at the local level

“It's not about just telling people what to do. Immediately challenging traditional beliefs is a non-starter,” Hopkins stresses. Some African villagers, for instance, regard their water source as sacred. “But,” says Hopkins, “if you genuinely discuss, engage and convince them that it's in their interests, they'll take the necessary action.”

Working in partnership with the ministries of health, teams of village volunteers are trained to check that their neighbors understand the transmission cycle, take in hand anyone who becomes infected, administer basic health care, call in more expert assistance to stem any burgeoning problem and report all new cases so that progress – and any aberrations – are closely monitored and analyzed.

Another important factor is that standing water sources can be sprayed with a larvicide, such as BASF's Abate®, to interrupt the cycle. The active ingredient in Abate®, *Temephos*, is recommended by WHO for use in drinking-water sources at concentrations not exceeding one milligram per liter. BASF has made a long-term commitment to The Carter Center, and Abate® has been supplied, free of charge, for the Guinea Worm Eradication Program for more than 20 years.

Personal commitment

Meanwhile, President Carter has used his status around the world to galvanize political leaders. In 1995, he even brokered a truce in the midst of the Sudanese civil war, so that health workers could reach remote areas. This became known as the “Guinea worm cease-fire.”

Even now, in his late 80s, President Carter continues to visit remote African communities with his wife. As he explains: “There were over 26,000 villages with Guinea worm disease when we started out, and only about 3% of the men could write their name, and very few of the women. So we've taught them to change their behavior without written language, primarily using cartoons and pictures.”

The program's tactics have proved highly effective. In 1986, Guinea worm disease afflicted approximately 3.5 million people a year in 21 nations. In 2012, there were just 542 cases reported – a reduction of over 99% – and they occurred only in isolated areas of Chad, Ethiopia, Mali and South Sudan. It looks as if Guinea worm disease will be eradicated soon, which will be no small feat. The only other human

illness ever to be wiped out was smallpox, back in the 1970s, following a major global effort. Unlike smallpox, Guinea worm disease is being wiped out without a vaccine or medicine.

Dr. Lorenzo Savioli, Director of WHO's Department of Control of Neglected Tropical Diseases, is grateful. “We'd never be where we are today if it weren't for President Carter. If we had, for each of the 17 NTDs, an ambassador of that level, life would be much easier.”

Savioli believes that we have come a long way. In January 2012, WHO published its NTD Roadmap, a document that expressed mounting confidence and called for scaled-up interventions against Guinea worm and other NTDs, setting ambitious goals to be achieved by 2015 and 2020. Inspired by the Roadmap, government officials, NGOs and pharmaceutical companies swiftly launched the London Declaration, a vow to cooperate even more actively to help eradicate Guinea worm, and to control or regionally eliminate at least nine other NTDs by 2020.

Ending preventable blindness

Another NTD where progress is beginning to be made is river blindness, or *onchocerciasis*. It is one of the world's largest causes of preventable blindness and is among the diseases flagged in the Roadmap and Declaration. The Carter Center is also targeting it.

Another parasitic worm infection, river blindness can cause terrible itching and disfiguring “leopard” skin, together with eye lesions that can lead to blindness. This worm breeds inside people who have been bitten many times by infected black flies.

Insecticide can be of assistance again, hampering this cycle of contamination. BASF has expanded its long-standing collaboration with The Carter Center to contribute an extra 4,670 liters of Abate® to the Center's river blindness program in Uganda by 2020.

Medicines also enter the equation with this NTD. Although there is no available vaccine, the 1990s saw mass drug administration schemes treating the infected. With its Onchocerciasis Elimination Program for the Americas, and working in cooperation with the African Program for Onchocerciasis Control, The Carter Center has been active in combating this disease in ten countries to date. “We're very close to finishing with river blindness in the Americas,” says Hopkins. Only two small endemic zones remain, in Brazil and Venezuela's cross-border jungle. The assumption has always

Dengue fever – facts and figures

How is it spread?

It is spread primarily by *Aedes aegypti* mosquitoes, which – unlike most mosquitoes – are active during the daytime. Infected humans serve as a carrier, transmitting the virus to mosquitoes that bite them and thus perpetuating the cycle.

Where is it found?

It is typically found in tropical and sub-tropical regions, especially in Africa, Asia and Latin America, but recently also in parts of Europe (Croatia, France, Madeira).

What are the symptoms?

Symptoms are fever, headaches and bone, muscle and joint pain.

How do you treat it?

There is no specific medication, but symptoms can be managed by taking acetaminophen, drinking plenty of fluids and resting.

How serious is it?

It usually clears up within two weeks. There are four different strains of the infection and recovery provides life-long immunity against that particular strain. But subsequent infections from other strains increase the risk of developing severe dengue, which can be very dangerous.

Can it be prevented?

There is no vaccine. To prevent catching it, in high risk areas wear protective clothing and use mosquito repellent day and night.

Dengue ranks as the fastest spreading vector*-borne viral disease in the world.



There has been a 30-fold increase in incidence over the past 50 years.

x30/
50 years

Numbers of countries reporting cases of dengue:

1955: 3

1969: 9

2012: 125

It is estimated that more than 2.5 billion people – over 40% of the world's population – are now at risk from dengue.



* A vector is an organism that carries pathogens which are transferable to humans.

Source: World Health Organization (WHO)

been that river blindness in Africa is too pervasive to eliminate. Yet with concentrated efforts, Sudan recently stopped transmission in the Abu Hamad region north of the capital Khartoum. "And the government of Uganda," Hopkins points out, "is determined to end transmission by 2020, nationwide."

Hygiene and education

Progress in combating some other NTDs has been more difficult. Chagas disease is potentially life-threatening. It is caused by a protozoan parasite spread by insects known as "assassin bugs" or "kissing bugs." Up to 8 million people are infected, most in Latin America, where the kissing bugs infest the cracks of poorly-constructed homes and can contaminate food and drink. The bugs feed on blood and their feces infect the bite wound. Furthermore, there is also a risk that mothers will transmit this illness to their babies during pregnancy or childbirth, or that it can be spread by blood transfusions.

"The problem is that, in relation to treatment, we have seen no improvement for decades," says Professor Simon Croft, Ph.D., of the London School of Hygiene & Tropical

Medicine. He has also worked for the Drugs for Neglected Diseases Initiative and has carried out research on the drug *miltefosine* as a potential treatment for another NTD. His tests suggest that it might combat the Chagas disease parasite as well. At present, though, no vaccine exists and diagnosing Chagas is tricky. The drugs currently used for treatment work best during the disease's early phase. However, it is a long time before most people realize they are infected. Patients suffer enlargement of the esophagus or colon, which causes malnutrition, and they can also suffer heart failure.

"The most impressive effects so far have been with vector* control," says Croft. That means employing mosquito nets and insecticidal wall sprays such as BASF's Fendona® for indoor use.

But a large part of the solution comes down to improved hygiene. This involves educating people about the disease and helping them to prevent infection. A project run by BASF in Argentina aims to do just that. "Vamos por nuestro país" (Let's go for our country) is a community-development program, working with villagers in Chaco province to tackle Chagas (see box on page 49).

"Chagas is much more than a simple infectious disease," says Dr. Héctor Freilij, medical advisor to the National Chagas Program in Argentina. "It is linked to the economic, social and educational conditions of the population."

The fastest spreading NTD

Because of global travel, cases of Chagas disease have been increasingly cropping up in North America and Europe. A greater cause of rapidly escalating alarm worldwide, though, is dengue fever, which is demanding urgent attention (see box above). Thought to be as widespread as malaria, the mosquito-borne virus' incidence has soared 30-fold in 50 years. Each year, 50 million infections occur in more than 100 countries. A frequent cause of hospitalization and death among children, it produces flu-like symptoms which can intensify into severe dengue, with hemorrhagic complications.

Insecticides can be used, but no medical cure has been found and the primary vector, the yellow fever mosquito, is a daytime bloodsucker so bed nets will not help. A secondary vector, the tiger mosquito, has spread the disease to North America

and Europe. International cargos of bamboo and tires provide a breeding habitat, and tiger mosquitoes can survive even freezing conditions.

In 2012, dengue was declared the fastest spreading, vector-borne, viral disease with epidemic potential. Local transmission had been reported in France and Croatia in 2010. Then in 2012, the Portuguese Madeira islands startlingly saw 1,800 infected, with imported instances detected in further European countries. By January 2013, WHO's second NTD Report did not mince its words. "The world needs to change its reactive approach," it stated. Savioli underlines: "Many developed countries haven't addressed the issue of day-biting vectors at all. This is a time bomb if we don't do something." ■



To learn more about the NTDs prioritized by WHO, see: www.who.int/neglected_diseases/diseases/en/



Above Former U.S. President Jimmy Carter tries to comfort a 6-year-old girl at a hospital in Ghana as a Carter Center volunteer dresses her extremely painful Guinea worm wound.

Decades of dedication to fighting disease

Founded by former U.S. President Jimmy Carter and his wife, Rosalynn, The Carter Center has led the Guinea Worm Eradication Program since the 1980s. With Guinea worm disease poised to be the second-ever human disease to be eradicated, Jimmy Carter and Dr. Donald R. Hopkins – the Center’s Vice President for Health Programs – talk about the fight against neglected tropical diseases.

Creating Chemistry: What have been the biggest challenges in combating Guinea worm disease?

President Jimmy Carter: The lack of attention from the rich world. The first thing is for the rich world to be generous. The second challenge is that the people who have these diseases, living in the most isolated communities, have very little communication with their central governments, or access to the media.

Dr. Donald R. Hopkins: Early on – internationally and in the endemic countries – we had to contend with a lack of knowledge about Guinea worm disease and with apathy. Now, I’d say, the biggest challenges are the insecurity situations. We’ve got insecurity in four of the endemic countries, meaning helpers cannot safely travel to these areas: in Mali and some parts of Ethiopia, Chad and South Sudan.

Are there any moments that have been marker points for you?

Hopkins: Absolutely. One of the most striking, looking back, was in February 2007 when I went with President Carter to Ghana, to the northern

town of Savelugu where they had an explosion of cases of Guinea worm disease. So we went up to this epicenter and there were at least 200 kids there crying, including infants, having their worms extracted – rolled up out of their bodies. It was just terrible to see. That was the worst moment that I recall in the Guinea worm fight. Some of the good moments have just been going into villages and seeing how people, in all of their material poverty, are so spiritually rich and so caring. I draw energy from that.

Carter: We’ve had very difficult problems in some countries. For instance in Ghana, we had Guinea worm down to just a few hundred cases. Then the government changed from Jerry Rawlings’ administration, which had addressed the disease as a top priority. The new government didn’t want to address it, which prevented their making progress for five or six years. But eventually they did, then we very quickly did away with the disease there. We have been happy every time we have done away with the disease in one village or in one entire country. We’ve also been very fortunate, not only in getting help from companies like BASF and

charitable organizations like the Bill & Melinda Gates Foundation. Some countries – Great Britain and the United Arab Emirates among them – have been very generous to The Carter Center. And President Barack Obama recently made a speech promising to give more to neglected tropical diseases.

How important are contributions by the private sector?

Hopkins: Beside cash donations, the early contributions of the filter material and insecticides weren’t only important for their epidemiological impact. It also gave a kind of legitimacy, the fact that the private sector was willing to come forward. It gave encouragement to the endemic countries that these companies cared. And it made international agencies, ministries of health and others sit up and take notice. That was the political impact.

What more needs to be done to control neglected tropical diseases?

Hopkins: A lot of these diseases could be better controlled, particularly now that we have drugs – even donated drugs – to combat river blindness, various intestinal parasites and other neglected

tropical diseases. So we have those drugs and we need to apply the lessons we've learned about the importance of health education and the value of village volunteers doing regular surveillance.

Are there lessons you have learned from the Guinea Worm Eradication Program?

Carter: What I've learned is that as soon as these people in the villages are given the necessary help, the opportunity and the knowledge, they will do the work that's required themselves. They are remarkably hardworking and enthusiastic.

Hopkins: I would also underscore the value of marshalling data in a way that motivates people. Let them see the impact of what they've done so far and – if you can – compare that to adjacent countries or districts to really get the competitive juices flowing.

You have achieved a great deal over the past years – what have been the main driving factors?

Hopkins: We owe a lot to President Carter – he is driven, very detail-oriented and focused, and just inspiring. He has taken this cause on and he's very, very tenacious. In the beginning, people weren't paying attention to Guinea worm disease, either in the international community or the endemic countries themselves. President Carter got very important publicity about what we were doing. He was also very active in helping to raise money and in-kind donations, with the insecticide Abate® being the first big contribution in 1989. And he has been able to mobilize people, not just leaders at the international agencies and donor agencies. He visits countries, meets heads of state and ministers of health, as well as calling or writing them, and he goes out to villages. Mrs. Carter has also been very active, visiting the villages. Since President Carter is 17 years older than me, I have no basis for complaining of being tired or anything like that! He's constantly saying, 'Why don't you call on me more?'

What are your key goals for the coming years?

Hopkins: First, finish up with Guinea worm globally. Second, finish up with river blindness in the Americas and help promote the idea of eradicating it in Africa – which is now appearing more and more possible. So, there's plenty to do.

How long do you think it will be before Guinea worm disease is eradicated and how will you rank that among your life's achievements?

Carter: We think within two years we will be through with Guinea worm. Its eradication would be one of the most gratifying things in my life, because it has affected so many people. It's been one of the most challenging and long-lasting efforts I've ever made. I'd say it would even be equal to the Egypt-Israel Peace Treaty of 1979. ■



To find out more, visit:

www.cartercenter.org

www.publichealth.basf.com

Rooting out the kissing bug

How BASF is helping to control the insect that spreads Chagas disease

The "kissing bug" sounds harmless enough, but it is an insect whose bite can be dangerous, if not deadly. That is because it carries with it the parasite that causes Chagas, a disease that starts with swelling of the eyelids, fever and fatigue, but can lead to malnutrition, cardiac disorders and even heart failure. It is considered primarily to be a disease of poverty, but there have also been significant numbers of cases in Europe and the United States, caused by travel and blood transfusion.

Triatoma infestans – to give the insect its scientific name – is endemic in many areas in Latin America, where it is also known as *Vinchuca*. WHO estimates that 8 million people are affected by it here. One example is Chaco, a province in the remote north east of Argentina. Here, the small town of Concepción del Bermejo is home to around 10,000 people, many of whom live in extreme poverty with inadequate access to clean water, healthcare, education and decent housing. The incidence of Chagas has been high among adults and children, with many of the roughly 170 rural dwellings and a large number of the 1,900 urban homes infested by the blood-sucking insects.

Since 2010, BASF Argentina has been committed to the community-based project "Vamos por nuestro país" (Let's go for our country) in this area. In cooperation with the National Chagas Disease Program of the Argentinian Ministry of Health, the project utilizes BASF's existing knowledge and state-of-the-art technology to help control, monitor and treat the disease. "'Vamos por nuestro país' is different from other programs because it is sensitive to the needs of the people affected by Chagas. No one else meets those needs," explains Marcelo Hoyos, technical marketing manager for BASF's Pest Control Solutions business and one of the 50 BASF volunteers from different business units

in Argentina who, together with their families, have committed to this project. As part of the three-year program, which has now been extended to run a further year until July 2014, BASF Argentina is not only supplying Fendona® – an insecticide which can safely be sprayed inside homes – it is also providing its expertise to the local authorities and local people.

A vital part of the program is to increase people's understanding of Chagas, to encourage the proper use of medicines and the insecticide, and to foster active community engagement. A network of strategic partners has been created, including the regional government, institutions in the town such as the hospital and school, and Solidagro – an NGO specializing in local development. Training courses are run for local people explaining how to stop the bugs from breeding inside their homes and contaminating food and kitchen utensils.


An innovative online management system has been developed for monitoring progress and the knowledge gained is being exchanged with other municipalities, provincial authorities and NGOs to produce a joint study of best practices. The results so far have been encouraging. The proportion of infested houses in the rural area has been reduced from 17.9% in 2010 to 2.9% outdoor and 0% indoor infestation in 2013.

"Vamos por nuestro país" is a self-sustaining project that will permit continuity and outreach to other communities after BASF's participation and can serve as a template for other programs tackling insect-borne diseases.

The experience of being involved in this award-winning project has had a huge impact, says BASF employee Hoyos. "We have seen that we can help people to help themselves and it has taught me to re-evaluate the importance of the family and education as the basis for improving the quality of life. But the battle has only just begun!"



Left Carter Center Vice President for Health Programs Dr. Donald R. Hopkins shows children in a village in South Sudan, where Guinea worm is endemic, how a pipe filter should be used in order to prevent infection.



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