apopo 20 YEARS

ANNUAL REPORT 2017

WE TRAIN RATS TO SAVE LIVES

APOPO

APOPO is a global nonprofit organization that researches, develops, and implements scent-detection technology to combat global humanitarian issues. APOPO's detection rats currently detect landmines or tuberculosis in 5 affected countries around the world.

The rats are trained through clicker/reward methods, receiving tasty food treats when they identify explosives or tuberculosis. They are never harmed, because they are too light to actually set off any landmines and are cared for under strict animal welfare guidelines.

APOPO has mine action programmes in Angola, Cambodia, and Mozambique and is preparing operations in Zimbabwe and Colombia. APOPO also detects tuberculosis in Tanzania and Mozambique, and has opened a new program in Ethiopia. APOPO's headquarters and training, research, and development center is based in Tanzania.

CORE VALUES

QUALITY
Demonstrating and promoting high standards in research, design, training, and implementation of detection rat technology.

INNOVATION
Pioneering creative research and innovative solutions within a participatory learning culture.

SOCIAL TRANSFORMATION
Developing skills, creating jobs, improving socioeconomic and environmental conditions, releasing land for development, and combatting public health issues.

DIVERSITY
Embracing diversity in all facets of the organization with respect to age, gender, religion, sexual orientation, physical abilities, nationality, and ethnicity.

apopo20 YEARS

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20 YEARS OF APOPO

JUDY KARUE
QUALITY CONTROL OFFICER
APOPO TANZANIA

"Almost two decades ago, when I heard about a project that aimed to train rats to detect landmines, I was intrigued, though like so many who hear about the project for the first time, I admit I was skeptical of its success. But with a diploma in animal training and a worthy project based in Tanzania, close to my home city of Nairobi, it seemed like a good fit, and I secured a position as a rat trainer.

I soon travelled to mine-affected areas in Mozambique and experienced first-hand the terror, heartbreak, and long-term difficulties that hidden landmines impose on struggling communities. I met people who had lost loved ones or whose own limbs were lost because of landmine accidents. And there are many more who still could not get back onto their productive land, even though the conflict had ended decades ago. They were faced with a stark choice: live hungry...or work on land that might contain landmines. This is a decision that I'm sure very few of us have to face and cannot even imagine. After this sobering trip, I returned to APOPO's HQ in Tanzania determined to help speed up detection of these insidious weapons.

Now, 20 years later, APOPO and the mine detection rats have helped to find and clear more than 100,000 landmines and other explosive items, getting hundreds of thousands of people back on their land and their lives on track. It's these results that motivate me to come to work every day - because the landmines are still out there.

APOPO is an inspiring, progressive, and innovative place to work. The tuberculosis detection research that began in 2002 now shows a potential to raise partner clinics' detection rates by 40%. We've also investigated the rats' potential to tackle other global issues such as salmonella contamination, search and rescue in collapsed buildings, and trafficking of threatened wildlife and rare African hardwoods.

Altogether, over the last 20 years, life for me at APOPO has never been dull. This won't be changing soon, and I'm proud to be part of something that will save many more lives in the future. **Happy birthday, APOPO!"** ■

HOW WE HELP

THE GLOBAL LANDMINE AND EXPLOSIVE REMNANT OF WAR (ERW) PROBLEM

Leftover landmines and explosives currently threaten almost a third of the world's countries. They remain active and dangerous long after hostilities end, causing accidents, inflicting terror, and hampering the development of vulnerable communities. In 2016, landmines and ERW caused 8,605 casualties, 78% of them civilians and 42% of those children.

Landmines and ERW also hamper economic recovery and development in war-damaged areas. Villages are cut off from basic necessities such as water supplies and essential travel routes, and communities are prevented from using fertile land for growing crops, grazing livestock, or development.

APOPO'S SOLUTION

APOPO's mine detection rats (MDR) are too light to detonate the landmines and are very quick at finding them, making them a perfect tool for speeding up detection and clearance. When they are integrated into conventional mine-clearance methods such as survey, machines, and deminers with metal detectors, MDR are proven to significantly speed up landmine detection, helping return safe land to vulnerable communities as quickly and cost-effectively as possible.

GLOBAL TUBERCULOSIS

In December 2015, the World Health Organisation (WHO) announced that tuberculosis now kills more people per year than HIV/AIDS and malaria. In 2016, there were 10.4 million new cases of tuberculosis (TB) globally, and 1.7 million of these people died. Symptoms of tuberculosis commonly include poor appetite and weight loss, a persistent cough, fever, and weakness, leaving people unable to work. Without treatment, patients usually die, and they can spread the pathogen to up to 15 other people within a year, causing a vicious cycle that's difficult to break.

APOPO'S SOLUTION

APOPO conducts research into developing and deploying rats as a TB diagnostic tool. Results show that the rats can check 100 samples for tuberculosis in 20 minutes. The same task would take a lab technician up to four days. This allows APOPO to recheck samples collected from partner clinics at a high speed and then confirm the presence of TB in the samples indicated by the rats using WHO-endorsed confirmation methods. Confirmed results are then sent back to clinics, who oversee patient counselling and treatment. The project indicates that APOPO can increase partner clinics' detection rates by 40%.

SINCE APOPO BEGAN, TO END 2017

107,385
Landmines and other explosives destroyed

22,699,534 M²
Land given back to communities

953,338
People freed from the terror of landmines

462,684
Suspect TB samples screened

12,682
Additional TB cases detected

97,050
Potential infections halted

SCHOOLKIDS AND LANDMINES

"Our school is in the middle of land that used to hide landmines that were laid to defend a military camp during the war. After the war finished, the mines were left there. We marked safe areas around the school for the children to stay secure, but we still found them playing outside boundaries or sneaking out to retrieve a ball.

Thankfully there were no accidents, but many of the children's families have been affected. This is a farming community, and it is shocking to see the serious landmine injuries that can happen to people or livestock in the fields.

A child often has to leave school to care for someone in their family who is injured. Sometimes they never return, because they have to take the place of a breadwinner who cannot work. It is very sad, because from that point, their life without even a basic education will be hard work.

APOPO, together with their partner the Cambodian Mine Action Center, have now cleared all the mines from this area. Everyone is free to travel, work, and play as they like without being terrified. I am still affected, though. Even though I know the mines are gone, when I see the children playing in the fields, I still worry."

Bundoeth Thoung, School Headmaster, Khna Phtol, Cambodia

MINE ACTION

At APOPO, we endeavor to comply with the highest standards of animal research, concept verification, animal welfare, training, and field implementation. We have the proficiency and facilities to train and deploy animals that can truly do the job. Some questions we ourselves have asked are: "Can we offer high-quality animal detection capacities to partners? Could we increase our relevance by helping to improve the efficiency of the broader mine action sector as opposed to only APOPO's own projects?" We made good progress in developing partnerships in 2017, but we want to expand it further. We firmly believe that we can offer a proven technology that will enhance the work of partners as well as ourselves.

Landmines and ERW continue to kill and maim people and hamper development, reconstruction, and normalisation of life after war. The Mine Ban Convention (APMBC) has thus adapted the goal to "accomplish all outstanding obligations under the Convention, to the fullest extent possible, by 2025." This rather ambiguous objective is for the most part achievable. However, it is essential to maintain a consistently high motion on funding. Yet funding alone does not resolve the problem: Mine action organisations must find ways to work smarter, faster, and more efficiently.

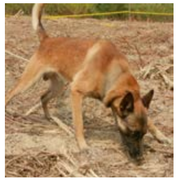
There is scope to release much more land by survey, thus leaving much less land for expensive clearance, so more rigorous use of efficient land-release methodology is a precondition. The next step is to optimise the process of technical survey and clearance. APOPO has for 20 years developed and improved the use of animals for landmine detection. With rats, the overall efficiency of a clearance process can be doubled on some tasks and even tripled in others compared to using conventional manual mine clearance alone. There is no other technology that is even close to achieving this, and all current detector systems fall far behind. Machines may offer speed but they miss too many mines to offer reliable technical survey and clearance.

APOPO's rats are a vital part of the APOPO mine action toolbox that includes manual deminers, flail and tiller machines, and armored brush-cutting excavators. In 2017, mine detection dogs were added when APOPO opened a dog training centre in Cambodia.

APOPO has always been attentive to collecting data from research, training, and operational activities. In 2017, this resulted in improved cost-comparison models showing that integrated use of rats can at least halve the cost of mine action tasks compared to manual mine clearance alone, and that rats are thoroughly reliable detectors. Since APOPO began global operations, starting in Mozambique in 2006, thousands of mines have been found by our mine detection rats in areas that have been subsequently cleared manually. Internal and external quality assurance indicated that not a single mine was missed. ■

The Dutch Postcode Lottery has supported APOPO with two grants totaling 2.5 million euros and makes our life-saving work possible in various countries and projects around the world.

EXPANDING THE MINE ACTION TOOLBOX WITH DOGS



Technical survey dogs have the unique ability to work effectively in overgrown areas, excluding the need for manual or machine-based brush cutting and hugely speeding up operations. The ultimate goal is to enable fast and very cost-efficient cancellation and release of large parts of mine-suspected areas that would otherwise require a much more rigid and expensive technical survey.

APOPO is uniquely positioned to develop scent detection animal applications following 20 years of experience in research, training, and operational use of mine detection rats (MDR) for mine clearance. As a result, APOPO has established a Technical Survey Dog training center in Kampong Scnang, Cambodia, where dogs are being trained for global deployment to mine-affected countries. APOPO has an excellent partnership with CMAC in Cambodia, allowing each organization to draw from the other's resources and strengths, and the training center employs some of the most experienced mine detection dog trainers in the world.

In 2017, eight mine detection dogs were fully trained by APOPO, and they are now leased to The Development Initiative (TDI) for survey and clearance in South Sudan under the auspices of the UN. A total of 15 to 20 more dogs will be trained in 2018. These dogs will be deployed in at least three different mine-affected countries when trained. APOPO mine detection rats and dogs can be leased by partner organisations. ■

HÅVARD BACH
HEAD OF MINE ACTION

Håvard Bach has had a distinguished 26-year mine action career, with involvement in all aspects of mine clearance. He graduated from the Norwegian Military Officers Academy in 1987 and held several army positions in Norway. He headed the Norwegian engineering component to the United Nations Interim Force in Lebanon (UNIFIL). He joined Norwegian People's Aid (NPA) in 1992 and set up its programs in Cambodia, Mozambique, and Angola.

Håvard also served as head of operational methods for the Geneva International Centre for Humanitarian Demining (GICHD) from 1999 to 2010, and he was the driving force behind major global studies on animal detection, land release, and other operational methods of survey and clearance. Håvard joined APOPO initially in 2010 and subsequently in 2016 as head of mine action. From 2011 to 2016, he was head of operational methods for NPA.

> Mine action is first and foremost about people. Women, men, and children who are maimed and killed by landmines. Children who cannot play freely outside their doorstep. Women fearing constantly for the lives of their children. Men and women who cannot cultivate land, herd their animals, and feed their families and communities.

MICHAEL HEIMAN
PROGRAM MANAGER MA CAMBODIA

MINE ACTION CAMBODIA

APOPO continued operations throughout 2017 in Siem Reap province alongside our partner the Cambodian Mine Action Center (CMAC). Together the APOPO/CMAC teams cleared nine minefields totaling 739,289 square meters of land, which was returned to the village communities for agricultural and infrastructure purposes. This directly benefited over 6122 people who were able to finally get back on their productive land.

Early in 2017, APOPO Cambodia received a further 16 mine detection rats (MDR) from our headquarters in Tanzania. Ten were integrated into operations and the remaining six began work at the new Visitor Centre in Siem Reap.

After just a few short weeks, the new MDR had achieved the high standard ready for accreditation from CMAC. All 10 rats passed their International Mine Action Standards (IMAS) tests and were immediately deployed in the Srey Nour area of the province.

Throughout the year, the program was supported by the CMAC explosive ordnance disposal (EOD) team funded by APOPO. The on-call team were kept busy visiting villages and farms in the area to investigate suspicious objects that had been uncovered, mostly old explosive items such as mortars and artillery shells. At each site, the EOD team carefully removed or destroyed the items. They also carried out mine-risk education sessions to familiarize communities with common explosive remains, warning them not to move the items, and to contact the EOD team as soon as possible.

Toward the end of the year, APOPO was extremely pleased when CMAC signed a new agreement that will keep the partnership going until the end of 2018.

The APOPO mine action programme in Cambodia is made possible by its partners and donors, the Cambodian Mine Action Centre, the Cambodian Mine Action and Victim Assistance Authority, the JTI Foundation, the Principality of Liechtenstein, the UK Peoples Postcode Lottery, the Dutch Postcode Lottery, the Global Development Group, Basmati and Goldman Sachs.

Impact 2017	
Landmines and UXO destroyed	2,349
Safe land given back to communities (M²)	738,344
People directly affected	6,122

ASHLEY FITZPATRICK
DIRECTOR OF GRANTS & CONTRACTS

MINE ACTION ANGOLA

In 2012, APOPO engaged with Norwegian People's Aid (NPA) in a strategic partnership to support ongoing countrywide humanitarian demining in Angola, which began even before the peace agreement was signed in 2002. The APOPO-NPA joint effort aims to combine the strengths of both organizations for increased operational efficiency and decreased costs - a critical and timely objective as Angola seeks to comply with Article 5 of the Anti-Personnel Mine Ban Convention by 2025.

With all of Angola's 18 provinces still suffering from landmine contamination following nearly three decades of civil war, APOPO and NPA are together tasked to demine four provinces in northwest Angola: Kwanza-Norte, Malanje, Uíge, and Zaire. While NPA focused its 2017 clearance efforts toward completing the province of Malanje, APOPO moved north to Uíge province to begin clearance there. Over the course of 2017, APOPO deployed its mine detection rats, supported by manual deminers with metal detectors and an armored brush-cutting machine, to two minefields in the municipality of Quitexe, Angola.

APOPO completed the first minefield in September 2017, successfully deploying its integrated system of mine detection rats, manual deminers with metal detectors, and a ground-preparation machine. APOPO and NPA identified and safely excavated 18 anti-personnel landmines, four items of unexploded ordnance (UXO), and 619 items of small arms and ammunitions (SAA). With the threat of landmines now resolved, the Uíge government will build a new municipal hospital to benefit 32,764 people or 6,553 families living in Quitexe municipality. In the meantime, members of the community have already begun expanding their farms - or lavaras, in the local language - to begin cultivating the formerly hazardous area. There are 330 people or 66 families living in direct proximity to the former minefield. At the time of writing, clearance of the second minefield is progressing well, and it is expected to conclude in the first quarter of 2018.

The APOPO Angola Mine Action program is made possible by its partners Norwegian People's Aid (NPA) and the National Intersectoral Commission on Demining and Humanitarian Assistance (CNIDAH). The program also thanks its donors for their generous support, including: the Trafigura Foundation, the Stanley Thomas Johnson Foundation, the UK People's Postcode Lottery, the Dutch Postcode Lottery, and the Cultures of Resistance Network.

Main figures for 2017	2017
Landmines and UXO destroyed	31
Safe land given back to communities (M²)	319,143
People directly affected benefit	32,764

ASHLEY FITZPATRICK
DIRECTOR OF GRANTS & CONTRACTS

MINE ACTION MOZAMBIQUE

Mozambique declared itself landmine-free in 2015, marking an end to decades of distress and suffering. It was the first large mine-contaminated country to be completely cleared of landmines. APOPO is proud to have been part of the Mozambican success story, hailed by the AP Mine Ban Convention (APMBC) and marked as an example to follow. APOPO was part of a collaborative effort between international NGOs, the UN, and the Instituto Nacional de Desminagem (IND) to rid Mozambique from mines.

However, there is still a small residual risk of explosive remnants of war (ERW) in the country, and a reactive national response capacity has been created to address this problem. One specific area, the Malhazine Complex in the district of Kamubukwane, is still severely contaminated with ERW, beyond what the national response capacity can address. On request from IND, APOPO has maintained parts of its operational capacity in Mozambique throughout 2017 while exploring funding options to address this one remaining task. APOPO has already cleared almost 40,000 explosive items in the area and plans to clear the last remaining area in 2018 when funding is secured.

ALESSANDRA BROLI
PROGRAM MANAGER MA ZIMBABWE

MINE ACTION ZIMBABWE

In 2016, the Zimbabwe Ministry of Defence assigned to APOPO the clearing of a minefield in the south of the country. The team arrived in Harare in September 2017 and spent the rest of the year setting up office, surveying the mine area, and reaching out to potential donors in efforts to bring funding up to operational levels.

The assigned minefield is laid in very dense belts (reportedly 5,500 mines per linear kilometer) forming a "cordon sanitaire" that runs for 37 km southeast along the border with Mozambique. The total task area is over 7,181,000 m2 and is extremely remote, bordering one of the wildest national parks in Zimbabwe, Gonarezhou National Park. Gonarezhou itself is within one of the largest conservation areas in the world - the Great Limpopo Transfrontier Park (GLTP). The GLTP is part of a bold African vision to combine three unique national parks (Gonarezhou NP in Zimbabwe, Kruger NP in South Africa, and Limpopo NP in Mozambique) by removing all human barriers so that wildlife, and tourists can roam freely within the huge ecosystem covering some 35,000 km². The minefield is located in the Sengwe Wildlife Corridor, an area specifically designated to allow for the free movement of wildlife between Kruger NP in South Africa and Gonarezhou NP in Zimbabwe. These parks boast two of the largest African elephant populations on the continent. Due to its remoteness, documentation regarding the environmental impact of the minefield is scarce; however, its location in the heart of such a conservation area suggests that the toll on wildlife must be significant. Several elephant deaths a year are reported, but while only cases involving elephants have been documented, the area is rich in other endangered mammal species that are undoubtedly affected too. Communities are also affected on both sides of the border, and it is estimated that tens of thousands of people are heavily impacted by the landmine problem within APOPO's area of responsibility, with occasional human and regular livestock accidents being reported. The area is extremely dry and unsuitable for agriculture, and livestock is people's main livelihood.

Zimbabwe is a signatory of the Mine Ban Treaty, under which it committed itself to free the country of all landmines by 2025, but as global funding diminishes, this goal is under threat. However, following a peaceful changeover of political leaders, the country is optimistic for the future, and we believe that slowly but surely the economic situation will improve and investment will begin to flow back, vastly improving the funding situation. The early part of 2018 will be spent cementing connections made, and we hope to be up and running by midyear.

The APOPO Zimbabwe Mine Action program is made possible by its partners the Zimbabwe Mine Action Centre (ZIMAC) and the Zimbabwe Ministry of Defence. The program also thanks its donors for their generous support, including: the UK People's Postcode Lottery, the Dutch People's Postcode Lottery and the Embassy of Australia in Zimbabwe.

TEKIMITI GILBERT
PROGRAM MANAGER MA COLOMBIA

MINE ACTION COLOMBIA

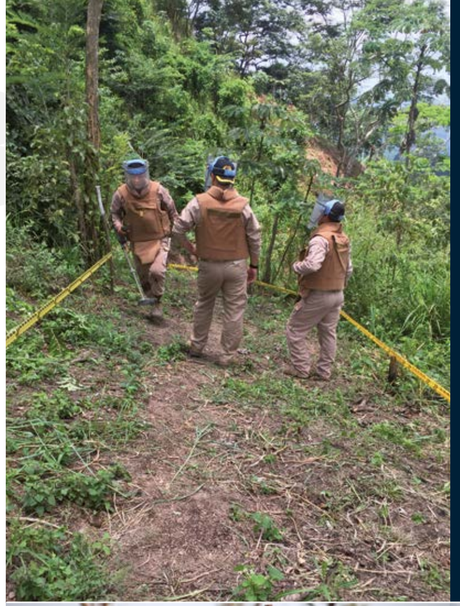
APOPO registered in Colombia as an NGO in 2016 and has since partnered with **Campaña Colombiana Contra Minas** (CCCM), the only accredited mine action NGO in the country, to provide them with assistance to develop their standard operating procedures, train their demining teams, provide monitoring of their demining operations, and provide an animal detection capacity. This capacity building will ensure that the CCCM teams work safely and employ land-release methods so that time, effort, and funds are not wasted when clearing mined areas. To date, APOPO has trained 12 CCCM nontechnical survey teams, and more capacity building will be provided throughout 2018. APOPO is working with CCCM to gain government approval for the introduction of the mine detection rats to increase the productivity of the CCCM in demining operations.

APOPO also has an agreement with the **Colombian navy** to conduct a pilot project once the government has approved the MDR. This pilot project will train Navy personnel in the use of the MDR, undergo testing and accreditation, and conduct survey and clearance operations with the Navy. This will provide proof of performance to **DAICMA** (National Mine Action Authority) that the rats are a credible means of detecting landmines and will facilitate partnerships with other mine action operators in Colombia.

The current pace of landmine clearance in Colombia is extremely slow due to the improvised nature of the mine threat. These homemade landmines are predominately built from plastic and glass bottles filled with explosives and often contain very little metal. Due to the ineffectiveness of metal detectors with these minimum-metal mines in many parts of the country, manual deminers are forced to excavate their way through each minefield, slowly and carefully digging 15-cm-deep, 1-meter-wide trenches. The average productivity for a manual deminer in Colombia is between 2 and 10 square meters per day.

MDR do not encounter this problem, as they ignore metal and search only for explosive scent. APOPO is therefore seeking to partner with other mine clearance organisations in Colombia to integrate an animal detection capability with their manual deminers that will significantly increase their productivity. The faster return of formerly contaminated land will allow rural communities to generate income and once again live without the fear of these deadly weapons.

The APOPO mine action programme in Colombia is made possible by its partners and donors, Campaña Colombiana Contra Minas and the Dutch Postcode Lottery.



SPEEDING UP

"I have been working for the Norwegian People's Aid (NPA) for 17 years in conventional mine action that uses machines and deminers with metal detectors. The mine detection rats (MDR) are an extremely effective add-on asset to our work. At one task site, the MDR found landmine fragments very quickly, which identified the landmine pattern so that an NPA deminer could quickly find, excavate, and destroy the landmines. Around the site, the rats also found other dangerous explosive material such as old bullets and mortars.

Although finding the landmines is important, what really helps the local people is the speed at which the MDR can check large areas. Often every single inch has to be properly searched, and this is where the MDR came into their own, helping us finish ahead of schedule. As well as allowing people back on to their land faster than they thought, that is time and money that we can now reallocate to other mine detection and clearance tasks, quickly helping more people."

MINE ACTION

Adao Vincent Baiao,
NPA 1st Section Commander, Malele, Angola

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People's Postcode Lottery is our largest recurring core funder. In 2017 players raised £800,000 for APOPO.

APOPO TRAINING AND RESEARCH AND DEVELOPMENT CENTER, TANZANIA

Since our beginnings as a research project in Antwerp University in Belgium almost 20 years ago, APOPO has challenged two of the world's most pressing concerns head on - landmines and tuberculosis (TB). To date, we have achieved modest success against these serious global issues with our scent-detection technology, helping to find and destroy over 100,000 landmines and detecting TB in more than 12,000 patients who otherwise would have been missed by local clinics. Nonetheless, we are committed to relentlessly questioning, developing, and refining that technology through multifaceted empirical research at our training center in Morogoro, Tanzania, where we also institute exemplary animal welfare and close monitoring and evaluation of our training methods. Our detection rats are bred, socialized, trained, and assessed here before they are deployed to global operational sites.

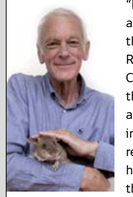
RESEARCH & DEVELOPMENT

"In 2016, I arrived at APOPO to help the organization focus on improving its rat detection technology through research and development. To broaden APOPO's scientific network and expert perspective on the diverse topics addressed by APOPO's rat detection technology, we installed an R&D advisory committee of respected scientists from around the world representing a diverse range of skills and expertise. APOPO's scientific team consults with these experts on specific matters ranging from animal scent detection and rodent olfaction to the chemical composition of volatile organic compounds, which the rats smell when detecting target substances.

Throughout 2017, we focused on building a strong research team, comprised of highly skilled students, researchers, and postdoctoral scholars who are conducting various behavioral studies aimed at optimizing detection rat training techniques through a better understanding of the rats themselves, including how they learn about the odors they smell in the world. Our efforts to build APOPO's R&D branch maintains our productive partnerships with the University of Antwerp, Sokoine University of Agriculture, Western Michigan University, Waikato University, and the Max Planck Institute while broadening our scientific affiliations to include other global research partners". ■

DR. CINDY FAST
HEAD OF TRAINING & BEHAVIORAL RESEARCH

Dr. Cindy Fast holds a Ph.D. and master's degree in psychology, specializing in learning and behavior and behavioral neuroscience from UCLA. She investigated the neurobiology of olfactory learning and perception in rodents as a postdoctoral scholar in the behavioral and systems neuroscience area at Rutgers University in New Jersey.
In addition to a number of other accolades in her field, Dr. Fast was recently awarded the New York Academy of Sciences James McKeen Cattell Award, the most prestigious award for students of psychology in the U.S. She has more than 10 years of experience conducting behavioral research examining learning and memory and their underlying neural mechanisms with a variety of species, including rats, mice, pigeons, and hermit crabs.

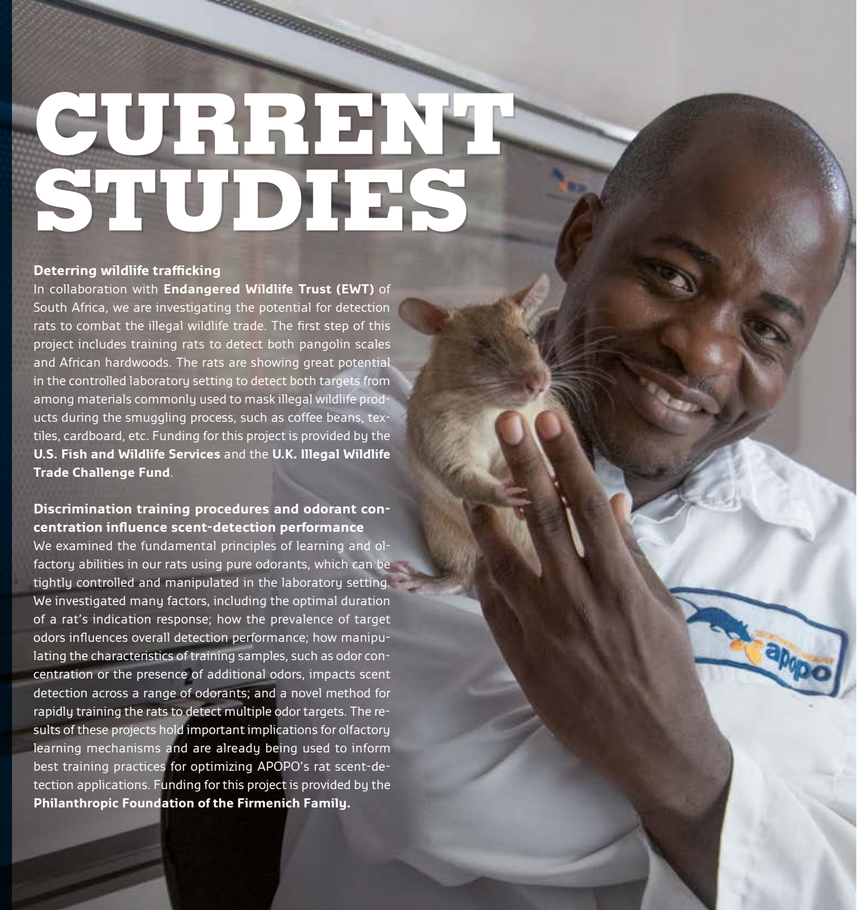


"I was fortunate to spend 10 days at the APOPO training headquarters through my role as a member of the Research and Development Advisory Committee. I was most impressed by the ingenious training methods that are used, and by the commitment to improve these methods through further research. I was also impressed with the high level of concern for the welfare of the rats throughout their lifespan."
Professor John M. Pearce, FRS, FLSW, FBPsS

HIGHLIGHTS OF 2017

- Construction of an automated evaluation apparatus with a single odor delivery port that will provide another platform for investigating the learning and olfactory behavior of our rats.
- The inaugural meeting of the R&D Scientific Advisory Committee, held in Antwerp, Belgium.
- Completion of the first phase of a preliminary experiment examining how diet and nutrition may interact with the rats' physical activity level and scent-detection performance.
- Presentation of APOPO's operational impact and research projects for a large audience of distinguished scientists by Dr. Cindy Fast as an invited speaker at the Pavlovian Society annual conference in Philadelphia, U.S.
- Hosting a visit from world-renowned animal learning and cognition specialist and member of our R&D Advisory Committee Dr. John Pearce, FRS, generating stimulating and productive discussions related to ongoing and future research projects.
- Students from the Massachusetts Institute of Technology (MIT) developed a prototype smartphone/tablet app enabling digital data collection of MDR training performance.

CURRENT STUDIES



Deterring wildlife trafficking
In collaboration with **Endangered Wildlife Trust (EWT)** of South Africa, we are investigating the potential for detection rats to combat the illegal wildlife trade. The first step of this project includes training rats to detect both pangolin scales and African hardwoods. The rats are showing great potential in the controlled laboratory setting to detect both targets from among materials commonly used to mask illegal wildlife products during the smuggling process, such as coffee beans, textiles, cardboard, etc. Funding for this project is provided by the **U.S. Fish and Wildlife Services** and the **U.K. Illegal Wildlife Trade Challenge Fund**.

Discrimination training procedures and odorant concentration influence scent-detection performance
We examined the fundamental principles of learning and olfactory abilities in our rats using pure odorants, which can be tightly controlled and manipulated in the laboratory setting. We investigated many factors, including the optimal duration of a rat's indication response; how the prevalence of target odors influences overall detection performance; how manipulating the characteristics of training samples, such as odor concentration or the presence of additional odors, impacts scent detection across a range of odorants; and a novel method for rapidly training the rats to detect multiple odor targets. The results of these projects hold important implications for olfactory learning mechanisms and are already being used to inform best training practices for optimizing APOPO's rat scent-detection applications. Funding for this project is provided by the **Philanthropic Foundation of the Firmenich Family.**

Does the diagnostic tool used to categorize training samples influence TB-detection rats' abilities?
Rats participating in our TB detection research program are typically trained with sputum samples subjected to the widely used diagnostic method of smear microscopy at our partner clinics. However, empirical evidence indicates that GeneXpert with Xpert MTB/RIF assay (Xpert) is a more accurate diagnostic. Preliminary results suggest that training rats with Xpert-confirmed samples enables them to detect even more TB-positive cases that may otherwise go undetected compared to training the rats with samples confirmed by the less sensitive smear microscopy.
This project was supported by the
UBS Optimus Foundation.

Communicating with detection rats: Identifying alternative means of indicating a target odor
While accurate detection of targets (such as landmines) cannot be underscored, it is equally important that trainers and handlers correctly identify what the rat is communicating through its behavior. For example, in landmine-detection, APOPO's rats are trained to scratch at the ground when they smell explosives. This can sometimes be ambiguous or pose challenges, because pausing and scratching at the ground while navigating novel territories is part of the natural behavior of our rats. Additionally, there may be times when it is not desirable for the rat to disturb the ground's surface. For these reasons, APOPO designed a new harness equipped with a micro-switch that allows the rat to directly and unequivocally "communicate" to a human handler that it has detected an odor target

by pulling a small ball that activates an unambiguous visual or auditory signal. Five young rats were successfully trained to use this device in 2017, thereby establishing its feasibility and supporting further development.

Trainer behavior impacts rat detection performance
Among APOPO's greatest assets are our rats and our passionate and knowledgeable trainers. Despite their great skill and dedication, we hypothesized that subtle differences in trainer behavior could influence rat performance. Specifically, we examined how the accuracy of clicker and food reward timing and data collection impacts the rats' real or perceived detection performance. After obtaining baseline measures, we delivered Behavioral Skills Training (BST) a training package used to teach a variety of skills to people using just three components including instructions, modeling, and rehearsal with feedback) to four trainers working with 11 rats. Although the rat's performance initially appeared to decrease, closer inspection revealed that this was driven by a change in reporting, not the rat's behavior. After a short period of BST, more consistency between trainers was observed, and the rats' scent-detection performance improved significantly. This experiment demonstrated the impact trainers have on modifying the rat's behavior and how APOPO may benefit from providing BST to all trainers.

Breeding/Training
In 2017, we successfully bred and raised 67 rat pups that then underwent training. A total of 38 of these young rat pups were trained for mine detection, and 20 have already met internal accreditation standards; only four rats were needed to contribute to the ongoing research assessing TB-detection abilities. The remaining 25 pups participated in other R&D projects throughout the year.

In addition to training the 38 young rats described above, our mine detection rat training team successfully prepared 24 rats to join the team in Cambodia and readied 16 additional rats to join the Angola team in the new year. A further 10 rats were trained to lead the new TB-detection research project in Addis Ababa, Ethiopia.

To meet these training needs and build internal capacity, our training headquarters also welcomed seven new rodent trainers/handlers in 2017, who, with five new trainers/handlers recruited for the Ethiopia project, participated in a stringent training program to achieve internal accreditation. ■

IMPACT 2017

MINE ACTION

2,380
LANDMINES AND OTHER EXPLOSIVES DESTROYED

738,344 M2
LAND GIVEN BACK TO COMMUNITIES

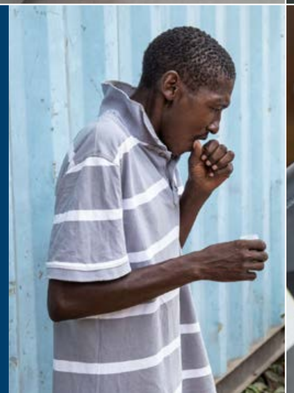
38,886
PEOPLE FREED FROM THE TERROR OF LANDMINES

TUBERCULOSIS DETECTION

61,928
SUSPECT TB SAMPLES SCREENED

1,677
ADDITIONAL TB CASES DETECTED

25,155
POTENTIAL INFECTIONS HALTED



TUBERCULOSIS DETECTION

Tuberculosis (TB) is an old disease, probably as old as humanity itself. However, it is not a disease of the past. The World Health Organization estimated in its latest report that 10.4 million people in 2016 fell ill with TB and, among them, 4.1 million were missed by health systems as left undiagnosed, untreated or unreported. Many of these "missed" patients will die and others will remain ill and likely to pass the pathogen on to others.

How can so many people fall through the net?

One cause is existing barriers to accessing healthcare; another is the limitations of the current conventional diagnostic tools for TB in clinics. The ideal test is one that is simple, cheap, fast, reliable, accurate across patients irrespective of age and HIV status, and that can be used without a stable power source. For TB, such test has yet to be developed.

What is APOPO's goal?

Our aspiration is to tackle TB through the deployment of the African giant pouched rat and using its remarkable sense of smell. Looking back on more than a decade of research, the list of results is substantial. Initial research began in 2002, with a successful proof of principle that rats can be trained to detect TB in human sputum samples, and in the following years, the discovery of TB-specific volatile organic compounds (VOCs), which are the source of the scent that rats detect. Since then, APOPO has further developed its scent-detection technology and evaluated the TB-detection rats' performance and qualities under field conditions. Partnerships began with four clinics of the National TB and Leprosy Program in Tanzania in 2007. By the end of 2017, collaborators had risen to 57 local clinics in Tanzania and 14 in Mozambique, as well as 30 clinics ready to partner on the new research program in Ethiopia. Our field research allowed us to demonstrate the rats' low cost and high speed of sample evaluation in different settings.

Overall our research achieved a marked increase in TB case detection by about 40% compared to case detection at the clinics. Since the research program began, that has amounted to 12,680 additionally detected TB-positive patients (1,677 in year 2017 alone) who otherwise would have received a negative test result. Analyses by age group and HIV status suggest even higher yields among young children and people living with HIV.

The latest diagnostic accuracy study (published in November 2017) showed that a team of rats is more sensitive than sputum microscopy when compared to bacterial culture (gold standard). It also indicated that the rats, unlike other tests, are equally successful in correctly identifying TB among people living with HIV and those without. However, the rats' specificity, which is the ability to correctly rule out the disease, was suboptimal. Thus, further research and development is needed. In 2017 we were given the opportunity to present our results to expert audiences at the Tanzania Health Summit, and the African region and World conferences of the International Union Against Tuberculosis and Lung Disease, where our results recieved significant interest.

DR. LENA FIEBIG
HEAD OF TUBERCULOSIS

Dr. Fiebig joined APOPO in July 2017 as Head of Tuberculosis. She is trained as an infectious disease epidemiologist (Ph.D.) and veterinarian doctor, and she has gained substantial practical experience in TB epidemiology, surveillance, and epidemic control through her work at the Robert Koch Institute, the National Public Health Institute in Germany, and through WHO consultancies and research stays in various African countries. Her special interest lies in improving TB case finding, linkage to care, and prevention of spread through innovative approaches.

How can a technology undergoing R&D already make a difference?

Our TB-detection rats are a technology 'for research use'. The rats retest human sputum samples that have already been tested for TB using conventional methods in our collaborating health centers. When a rat suspects TB in a sample that has previously tested negative, the sample will be rechecked by WHO-endorsed confirmation tests (such as LED fluorescence microscopy) in our quality-assured labs. Upon agreement with the national TB programs and local health authorities in the countries in which we work, our confirmed TB-positive results are conveyed back to the clinics, which then orchestrate patient treatment. This is how our research increases the TB case detection.

Case detection – and then?

Detecting cases of the disease is key to controlling TB but it can only unlock benefits when patients are then treated effectively and reliably cured. To make this possible we strive for an 'overnight' service so that clinics are notified of outcomes before patients return for their standard result the day after their initial visit. We also partner with local community-based organizations who sensitize and educate patients, and ensure that patients who tested positive return to official TB clinics to receive care. Over 2017, this model was successfully implemented in APOPOs new laboratory in Dar es Salaam. Same-day testing and 24-hour result turnaround were achieved, and 81% of patients - markedly more than before the opening of the new central lab - were successfully linked to care.

In 2017 APOPO also began to pilot an innovative digital tool, Operation ASHA's eCompliance, in Dar es Salaam supported by the Human Development Innovation Fund (HDIF). Community health workers from the patient organization MUKIKUTE visit TB patients at home and bring them their medicines. Both patients and health workers document the visit with the digital device. This approach reduces the frequency of the required hospital visit for the patient, and aims to improve treatment adherence rates and ultimately the number of people cured from TB. ■

QUALITY CONTROL

"We use an external quality assurance test (EQA) from the United Kingdom National External Quality Assessment Service for Microbiology (UK NEQAS) three times a year to check our performance in conventional and fluorescence microscopic identification of Mycobacterium tuberculosis. We are given sputum smear samples to analyze and send back. Our results are graded and returned. This process makes sure all procedures are followed correctly, that the lab personnel are operating correctly, and that our outputs are accurate. Our results are usually very good, but this EQA test helps us make changes where necessary. As a team, we always discuss how we can achieve improvements. It is very important to maintain high standards by following the standard operating procedures and maintaining the safety protocols. That way the quality of the samples and results is guaranteed. Following the same NEQAS procedures that other labs in the world follow makes sure that we, too, have standardized outputs."

Maryguiven Stephen,
Laboratory Technologist,
APOPO TB Tanzania

DR. GEORGIES MGODE
PROGRAM MANAGER TB TANZANIA

TB DETECTION TANZANIA

In 2017 the diagnostic activities at the new Dar es Salaam laboratory and our Morogoro laboratory ran at full speed, and we doubled the number of collaborating TB clinics in Tanzania from 28 to 57, thus achieving wider geographic coverage of our field research and diagnostic activities. APOPO now covers a high proportion of microscopy TB-suspect samples produced in the city of Dar es Salaam and clinics in the Coast region, Morogoro and Dodoma, the capital city of Tanzania. The number of presumptive TB patients tested also increased to over 30,000 compared to 22,000 in the previous year. Similarly, the percentage of patients additionally detected by rats as TB-positive and confirmed by a WHO-endorsed diagnostic test increased (1,244 compared to 1,117). Through our investigations into using the rats to help APOPO produce 24-hour results, an increase of the proportion of newly detected patients who were started on treatment by clinics increased from 71% in 2016 to 81% in 2017. Partnerships with community-based organizations such as MUKIKUTE and PASADA also greatly improved the patient tracking and the treatment of additional patients.

Through the increase in collaborating clinics, more people in periphery areas of Dar es Salaam, Coast region, Morogoro, and Dodoma have access to services through partnerships with five TB clinics in periphery settings mostly located more than 100 km from a major hospital. People in these settings may have particular difficulty of accessing good-quality diagnostic services.

Detailed analyses of our results stressed that our TB-detection research intervention was especially valuable among TB patients with a low number of TB-causing bacteria in their sputum, which cannot be easily detected by conventional microscopy. That makes our research particularly interesting for TB detection in children, among whom TB is often difficult to diagnose because the bacterial load is lower and they often cannot produce sputum in the desired quality and quantity.

The APOPO TB Detection research program in Tanzania collaborates with the key research partners Sokoine University of Agriculture, National Tuberculosis and Leprosy Program (NTLP), National Institute for Medical Research (NIMR), the community-based organizations MUKIKUTE and PASADA and the Tanzania Veterinary Laboratory Agency (TVLA). Main donors of the program include the Carraresi Foundation, the UKAID and the Human Development Innovation Fund (HDIF), the U.S. Global Development Lab, Nationale Postcode Loterij, the Principality of Liechtenstein, the Swiss Federal Department for Foreign Affairs – Embassy of Switzerland in Tanzania, and the Embassy of the Federal Republic of Germany in Dar es Salaam, Tanzania.

Impact 2017	
Samples evaluated	49,817
Additional patients diagnosed	1,244
Increase in detection rate	32%

DR. EMILIO VALVERDE
PROGRAM MANAGER, TB MOZAMBIQUE

TB DETECTION MOZAMBIQUE

The Mozambique APOPO TB program maintains 100% coverage of all microscopy TB-suspect samples produced in the city of Maputo. However, in 2017, Mozambican health authorities started a welcome roll out of the GeneXpert technology with the TB test Xpert MTB/RIF (Xpert). Based on molecular biology procedures, Xpert is recommended by international agencies for diagnosing TB. Substitution of microscopy by Xpert resulted in a lower number of samples being received by the APOPO. Nevertheless, TB detection rates in the evaluated samples by the rats were 59%, and thus even higher than in previous years.

One of the most important goals since the project started in 2013 was to increase the number of patients tracked down for treatment after APOPO identifies them as TB-positive. The 24-hours results strategy implemented in 2015 allowed a larger number of the additional patients to receive their results at clinic and begin treatment. Still, it was verified that a significant number of patients are lost to follow-up through not returning to clinics for their results.

To tackle this issue, and following the example of the APOPO Tanzania TB program, a pilot program was conducted between June and November of 2017 in two clinics in collaboration with Associação Kenguelekezé, a community-based organization working in the city of Maputo. This involved patient identification at the time of sample delivery to the laboratories for TB testing and subsequent tracking of those not returning for results after more than two days. The pilot was a success, as activists were able to find up to 93% of all additional patients identified by APOPO, with 86% of them initiating TB treatment (the remaining had either died or refused to be treated). Success of the pilot experience prompted expansion of activities to the remaining clinics, starting in December 2017.

Flanders government renewed its confidence in the Mozambique TB program with another three-year funding period which started in October. In this new phase we will change our confirmation technology from LED fluorescence microscopy to Xpert, thus contributing to the efforts of the government of Mozambique to implement this methodology in the highest number of cases.

The Mozambique APOPO TB program is funded and partnered by the Government of Flanders. We collaborate with the Universidade Eduardo Mondlane (UEM), the Mozambique National Tuberculosis Control Program (PNTC), the Instituto Nacional De Saúde (INS), the Maputo City Council Department of Health and the Maputo Health Directorate. Our main operational partner is Kenguelekezé.

Impact 2017	
Samples evaluated	12,111
Additional patients diagnosed	433
Increase in detection rate	59%

DR. NEGUSSIE BEYENE
PROGRAM MANAGER, TB ETHIOPIA

TB DETECTION ETHIOPIA

The AHRI-APOPO Tuberculosis Research Project in Ethiopia is hosted by Armauer Hansen Research Institute (AHRI), a government research institute. This project has two research aims: rat detection followed by concentrated smear microscopy as confirmation for enhanced case finding among presumptive TB cases attending TB clinics in Addis Ababa (enhanced case finding), and exploring the speed and detection ability of the rats for active case finding through mass screening of inmates and prison staff in 35 prisons across Ethiopia.

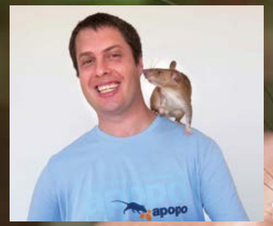
The enhanced case finding research aims to assess the rats' contribution to the national TB control program in Ethiopia by increasing the number of identified TB-patients by at least 35% in the short term, and the capability of a local capacity of TB detection rats and quality personnel to create a long-term impact on reducing the TB problem in Ethiopia. Financial support is obtained from Skoll Foundation for the startup (construction of the facility and equipment procurement) and two years implementation of the operational research.

The three years of active case finding research aims to screen 52,500 prison inmates and staff in 35 prisons all over the country. APOPO expects to find about 930 active TB cases that serve as a TB reservoir in the population in general and the prison community in particular. This prison project is supported by Elton John AIDS Foundation. It is being implemented in collaboration with the German Leprosy and Tuberculosis Relief Association in Ethiopian (GLRA-Ethiopia) and the Federal Prisons Administration Commission.

The entire year was dedicated to building the APOPO testing facility in the premises of AHRI, procurement and installation of equipment, staff recruitment and training, importing of trained rats from the training center in Tanzania, selection of participating public health centers and prisons, securing ethical clearance and completion of all other necessary preparatory activities. The project will be in full swing by mid-2018 in both the enhanced case and active case finding wings.

The Ethiopian APOPO TB program is funded by Skoll Foundation and Elton John AIDS Foundation and partnered by Armauer Hansen Research Institute (AHRI), the German Leprosy and Tuberculosis Association (DAHW) Ethiopia office, the Federal Prison Administration Commission, Ethiopia and Addis Ababa City Council Health Bureau.

ANNUAL REPORT TUBERCULOSIS DETECTION



CHARLIE RICHTER,
U.S. DIRECTOR

APOPO U.S. OFFICE

APOPO U.S. aims to support the organization's overall global activities by strengthening collaboration with U.S. donors and operational partners. The office facilitates direct tax-deductible donations for the U.S. public, which makes up over 50% of the organization's global public supporters. Based in Washington, D.C., APOPO U.S. also looks to forge partnerships with other U.S.-based global demining and public health implementers so that APOPO's detection rat technology can impact more communities across the globe.

In 2017, APOPO U.S. played a leadership role in launching APOPO's VIP HeroRAT adoption, which allows organizations and individuals giving more than $7,000 to sponsor their very own HeroRAT in the field. The office also supports the APOPO Colombia Mine Action program due to the proximity of the offices and the strong commitment and interest from U.S. organizations and individuals to support the peace process. APOPO U.S. also formed partnerships with U.S. zoos, and in 2018, live, simulated mine detection rat demonstrations are expected to be a feature of at least one major zoo in the U.S.

INSPIRING PEOPLE

"At GlobalGiving, I am surrounded by stories of innovative grassroots organizations on a daily basis, but APOPO's detection rats always stood out. I look forward to seeing APOPO's impact and global reach grow as the organization gains traction within the mine action community and innovates into new areas. Live HeroRAT exhibits at zoos will allow us to demonstrate to thousands of potential supporters how quickly the rats detect landmines. We hope this will inspire people to discover innovation in unexpected places, just like the founders did at APOPO."

MARI KURAISHI,
CHAIRPERSON, APOPO U.S.

ANNA BOUCHIER,
EXECUTIVE DIRECTOR

APOPO SWISS FOUNDATION

The APOPO Foundation, which opened in Switzerland in 2015, aims to support the organization's overall global activities by strengthening its network and financial resources. The office facilitates direct tax-deductible donations for Swiss donors and aims to further engage its local audiences in support of APOPO's life-saving activities worldwide. Based in Geneva, at the forefront of international mine action efforts and international health, we pursue a role of liaison with both existing and potential partners and donors in Switzerland, identifying opportunities for joint communication and events to foster long-lasting partnerships, as well as increasing engagement with international players such as the Global Fund, WHO, GICHD, and UNDP.

In 2017, the APOPO Foundation continued to support the global fundraising effort of APOPO in Switzerland and further afield, bringing its total funds raised to over CHF 500,000. The office was notably instrumental in securing funding to ensure continuation of mine action operations in both Angola and Cambodia. The Foundation also intensified its promotion of rat detection technology by taking part in a number of conferences and panels at the invitation of International Schools, the United Nations, and the Swiss Confederation, among others. Dedicated to support the groundbreaking movement of the Sustainable Development Goals (SDG), the Foundation was thrilled to see the mine detection rats featured in the demining section of the "SDG Stories." This is an interactive platform created by the Perception Change Project (PCP) of the United Nations in Geneva (UNOG) that reinterprets traditional stories through the prism of the SDGs and is dedicated to informing the public around those issues.

In October, the Foundation had the honor to host a 20th-anniversary celebration in Geneva, an inspiring event designed to reflect on APOPO's 20 years of impact, and we warmly thank the organization's supporters everywhere.

TRUE DIFFERENCE

"We were very grateful to see so many people joining us for our 20th-anniversary celebration event centered on our detection rats innovation, its evolution, and our life-saving missions around the world. It was a wonderful opportunity to warmly thank again all our donors, partners, and friends. Your support allows us to make a true difference."

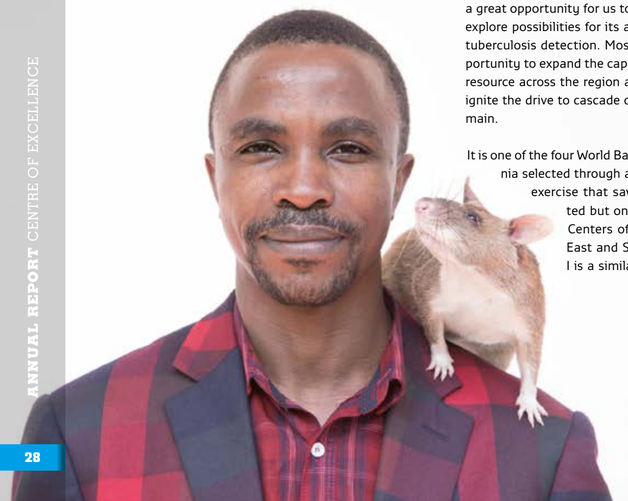
YVES HERVIEU-CAUSSE,
CHAIRPERSON, SWISS BOARD

DR. LADISLAUS MNYONE

DIRECTOR OF PEST MANAGEMENT CENTRE

CENTRE OF EXCELLENCE

Sokoine University of Agriculture (SUA) a Centre of Excellence



"In 2017, the long-standing relationship and efforts between APOPO and SUA's Pest Management Centre led to a milestone we will all remain proud of: We were chosen by the World Bank as an Africa Centre of Excellence for Innovative Rodent Pest Management and Biosensor Technology Development. This center provides a great opportunity for us to refine biosensor technology and explore possibilities for its application beyond landmine and tuberculosis detection. Most importantly, it provides an opportunity to expand the capacity in terms of a trained human resource across the region and beyond, and consequently to ignite the drive to cascade our technologies to the public domain.

It is one of the four World Bank Centers of Excellence in Tanzania selected through a rigorous and highly competitive exercise that saw 116 project proposals submitted but only 24 chosen to form the African Centers of Excellence II (ACE II) across the East and Southern Africa (ESA) region. ACE I is a similar set of African Centers of Excellence in West Africa. Each of the 24 ACEs will be funded up to U.S. $6 million over the five years of the project.

The objective of the ACE II project is to strengthen selected higher education institutions in Eastern and Southern Africa to deliver quality postgraduate education and build collaborative research capacity in the regional priority areas. These experts will go on to develop and apply science and technology and meet the demand for skills required to solve Africa's most pressing challenges.

The launch of the Tanzanian African Centers of Excellence took place on August 23, 2017, at the Nelson Mandela Institute of Science and Technology in Arusha.

I trust that we will maximally exploit this rare opportunity to achieve even more lucrative milestones for the betterment of our needy and marginalized communities. Thanks to the World Bank for its confidence and trust in us. Rest assured of my support as the Director of Pest Management Centre towards the realization of this endeavor."

"The Centre of Excellence provides an opportunity to expand capacity in terms of trained human resources across the region and beyond, and consequently to ignite the drive to cascade our technologies to the public domain."

CARBON OFFSET 2017

In April 2016, APOPO partnered with Sustainable Agriculture Tanzania (SAT) to embark on a tree planting project that will help offset APOPO's C02 emissions caused primarily by transport and travel. The project aims to plant 50,000 trees over a ten-year period, as well as promote other sustainable agriculture practices that preserve soil productivity and protect the nearby virgin rainforest from deforestation. Once they have reached maturity each tree can sequester 50,000 tons of carbon dioxide per year.

3,282 trees were planted successfully over 2017, by farmers located on the Uluguru mountains who were previously selected and trained by SAT. More than ten different species of tree were planted for various purposes. These trained farmers will help restore degraded landscapes and decrease deforestation, which is driven by basic needs such as subsistence farming and reliance on firewood for fuel. As watersheds, the forests of the Uluguru Mountains are of critical importance to indigenous village communities, the cities of Morogoro and Dar es Salaam, and the survival of plants and animals unique to the region.

Janet Maro, Founder SAT

"As a humanitarian NGO embracing social transformation and innovation, we are proud to be part of APOPO's plan to play a proactive role in safeguarding our climate and planet through offsetting its carbon footprint."

IMPACT 2017	
Types of trees planted:	7
Farmers trained by SAT:	40
Seedlings prepared in 2 nurseries:	4,246
Trees successfully planted:	3,282

CAMBODIA VISITOR CENTRE

BENJAMIN CARRICHON
MANAGER, CAMBODIA VISITOR CENTER

Since the start of the APOPO Cambodia Mine Action program in 2015, the public has shown a strong interest in the use of rats to detect landmines. APOPO capitalized on this by opening a Visitor Centre to highlight our work and raise public awareness about the global issue of landmines.

The Center provides background to APOPO's work to give our visitors a better understanding of mine action and how landmines affect local communities, and also to introduce and demonstrate the work of the mine detection rats. The MDR provide our supportive national partner The Cambodian Mine Action Center (CMAC) with a unique solution to speeding up demining efforts in the country, helping to detect landmines faster than by using conventional methods such as metal detectors.

APOPO has also been careful to make sure the center is environmentally friendly by supporting the community through employing locally and working with ethical and local suppliers. By the end of the year, the center had already hosted more than 1,000 visitors from all around the world.

Visitors have been impressed by APOPO's work, and most are not aware that Cambodia remains one of the most mine-affected countries in the world. On popular online ratings sites, the Visitor Center has achieved a perfect five-star score. We will now work to make the center more accessible to non-English-speaking people, host local events such as photography exhibitions, and develop a section about the APOPO TB-detection rats. ■

tripadvisor

"I visited Apopo when it first opened and was blown away! It was so amazing to learn about the incredible work that they have already done and are continuing to do in Cambodia and around the world. It was also a real delight to see the rats in action. They are so well treated and really are Heroes!"

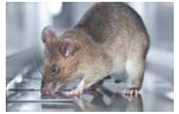
5-star review, Trip Advisor

RAT ADOPTION

The best animal adoption in the world

APOPO's HeroRAT adoption gives you the chance to join one of three HeroRATs on a life-saving adventure. Every adoption comes complete with a 10-page welcome pack, adoption certificate, and monthly impact updates with the latest news, pictures, and statistics from the field. For as little as U.S. $7 a month, you can adopt or gift a HeroRAT and help save lives. And now you can make your adoption extra special by including a printed welcome pack, soft toy, or T-shirt as part of the package as well. **Visit our website to find out more!**

Meet our HeroRATs



Shuri is a staff favourite with a cheeky personality who brings a smile to the face of everyone she meets. Just a youngster, she has recently graduated from APOPO mine detection training with flying colors. With a flash of her whiskers, Shuri will help sniff out landmines in Angola one of the most mine-affected places in the world.

Magawa is one of the friendliest HeroRATs ever, but once he gets to work, he's as determined as they come. Based in Siem Reap, Cambodia, Magawa sniffs out deadly explosives 96 times faster than conventional solutions can find them.

Chewa is one of the biggest HeroRATs of all time. Weighing in at a monstrous 1.36 kg, Chewa's weight meant he was always destined to sniff out tuberculosis rather than landmines (just in case he set them off!). Chewa (pronounced Cheh-wah) means "brave" in Swahili, but his handlers call him Mchapakazi, which means "the hard worker."

THEORY OF CHANGE

DONOR SUPPORT AND PARTNER-SHIPS

DIRECT IMPACT
(organizational capacity)

KEY STAFF, EQUIPMENT HERORAT TRAINING

DIRECT PROGRAM SUPPORT

MARKETING AND NETWORKING

RESEARCH & DEVELOPMENT

DIRECT IMPACT
(operational capacity)

CLEARING LANDMINES FASTER

DETECTING TUBERCULOSIS FASTER.

RAISED PROFILE, QUALITY SALES PRODUCTS, INCREASED FUND-RAISING'

IMPROVED HERORAT PERFOR-MANCE, STUDIES ENABLED, NEW APPLICATIONS INVESTIGATED

ENABLED IMPACT
(short term)

MORE SAFE LAND RETURNED TO COMMUNITIES

LESS FEAR & ACCIDENTS, LAND USED FOR PRODUCE AND DEVELOPMENT

PEOPLE FREE FROM TB. FURTHER INFECTIONS HALTED

BACK TO SCHOOL AND WORK, LESS MEDICAL FEES, FAMILY STARTS SAVING. LESS STRAIN ON HEALTH SERVICES

OTHER SOCIAL ISSUES ADDRESSED - HARDWOOD TRAFFICKING, SEARCH AND RESCUE

ENABLED IMPACT
(long term)

COUNTRY IS MINE FREE

ECONOMY STRENGTHENS AND DEVELOPS

TB CYCLE BROKEN

LONG TERM PEACE AND STABILITY

FAMILY PROSPECTS IMPROVE

INFRASTRUCTURE REBUILT (MA)

BREADWINNERS HOLD DOWN JOBS (TB)

HEALTH SERVICES RECOVER (TB)

LONG TERM PART-NERSHIPS AND CORE FUNDING (MARKETING)

WILDLIFE AND FAUNA RECOVERS

CHRISTOPHE COX
APOPO CEO

Thank you to our partners and donors

Over the years, the vital support for APOPO from our donors and partners has never ceased to amaze and humble me. This was brought all the more home to me during 2017, our 20th-birthday year, when I was able to reflect on the significant advances in our work that have been accelerated by your help, enabling far-reaching and sustained impact, supporting the communities where we work.

For almost 20 years, people like you have directly helped us strengthen foundations that upgrade not just the ability of our HeroRATs to detect landmines and tuberculosis but also APOPO's overall capacity to address these grave global issues. With your continued support in 2017, we built on those foundations by setting foot in two new landmine-contaminated countries, constructing a new TB facility in Ethiopia, and commencing investigations on exciting new areas that address wildlife conservation and carbon offsetting. As well as this, you directly boosted our organizational capability by helping us acquire key staff and operational equipment that have huge potential for helping us to work more efficiently and capitalise on opportunities. Our enhanced marketing activities have already raised the profile of the issues of landmines and global tuberculosis, as well as putting us in a good position to increase our public funding income.

I would personally like to thank each of you for caring about what is happening in the world. So it is with very special thanks that I hope you have read through this report and found out about how you have helped us impact the communities who need it most. ■

MEDIA AND COMMUNITY

APOPO is indebted to all the journalists, media specialists and loyal supporters who continue to spread the word and support our work.

BBC · DW Deutsche Welle · Forbes MEDIA · theguardian · The Washington Post

Media appearances	501
Facebook followers	73,637
Twitter followers	6,856
Instagram followers	16,103
Website users	106,252
Newsletter subscribers	21,136

BALANCE SHEET IN EURO

FINANCIAL UPDATE

ASSETS	2017	2016
Fixed Assets	**-**	**0**
Current assets	**3,146,237**	**4,220,830**
Current receivables	302,771	408,408
Other assets	507,000	579,131
Cash and equivalents	2,336,465	3,233,291
TOTAL ASSETS	**3,146,237**	**4,220,830**
LIABILITIES		
Net capital	**1,337,927**	**2,027,720**
Funds of the organization	328,046	328,046
Other reserves	-	-
Retained Earnings	1,009,881	1,699,674
Long term liabilities	**1,804,397**	**2,189,379**
Deferred Income (Grants)	**1,804,397**	**2,189,379**
Current liabilities	**3,913**	**3,731**
Current payables	**3,913**	**3,731**
TOTAL LIABILITIES	**3,146,237**	**4,220,830**

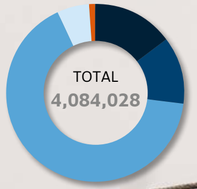
PROFIT&LOSS STATEMENT (EURO)

	2017	2016
Total Income	4,074,245	4,025,444
Total Operational Expenses	3,317,556	2,309,359
Total Personnel Expenses	1,291,100	1,478,516
Depreciation	-	55,126
Other costs	5,270	12,758
Operating Result	**(539,681)**	**169,685**
Financial Result	(159,032)	(39,743)
Extraordinary Result	8,921	514
Net Income	**(689,793)**	**130,457**

IN EURO*

DONATIONS & SUBSIDIES 2017

- Public fundraising 608,636
- Government grants 502,517
- Foundations grants 2,691,157
- Research grants 239,022
- Miscellaneous operating income 42,695



IN EURO*

EXPENSES AND INVESTMENTS 2017 PER ACTIVITY

Mine Action Mozambique	111.900
Mine Action Angola	468.721
Mine Action Cambodia	537.519
Mine Action Zimbabwe	182.234
Mine Action Colombia	99.671
Visitor Center Cambodia	85.858
Training Technical Survey Dogs	425.500
TB program Tanzania-Morogoro	350.441
TB program Tanzania-Dar	193.734
TB program Mozambique	349.828
TB program Ethiopia	342.699
Research and Development	239.285
Training Mine Detection Rats	175.648
U.S Office	107.381
Swiss Foundation	136.779
Marketing	322.760
Administration	478.069
Carbon Offset	5.000
Exchange Fluctuations	157.206

*** Cash based**

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