WE TRAIN RATS TO SAVE LIVES

ANNUAL REPORT 2017
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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!
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%.

SCHOOLKIDS AND LANDMINES

Our school is in the middle of land that used to hide land-mines that were laid to defend a military camp during the war. After the war finished, the mines were left there. Last month, a young person was severely injured by stepping on a landmine. The school administration was shocked at the finding, and we had to do something about the mines.

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

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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 69,250 casualties, 78% of them civilians and 42% of those children. Landmines and ERW also hamper economic recovery and development in war-affected areas. Villages are cut off from basic necessities such as water supplies and essential travel routes, and communities are prevented from using better land for growing crops, raising livestock, or development.

APOPO’S SOLUTION

APOPO’s mine detection rats (MDR) are too light to detonate the landmines and are very quiet, 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 be 97% effective at landmine detection, helping return safe land to vulnerable communities as quickly and cost-effectively as possible.

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

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
MINE ACTION

As APOPO, we endeavour 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 with a high rate of accuracy, relevance by helping to improve the efficiency of the broader mine action sector for the benefit of those affected by landmines and ERW. We make 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 partners as well as ourselves. 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.

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POP-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 infrastructural purposes. This directly benefited over 6,122 people who were finally able to 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 People’s Postcode Lottery, the Dutch Postcode Lottery, the Global Development Group, Basmatic 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

MINE ACTION ANGOLA

In 2012, APOPO engaged with Norwegian People’s Aid (NPA) to build on the success of its 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. In 2017, the program 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 brush-cutting machine. APOPO 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 150 people in 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 Norwegian Government’s Commission on Demining and Humanitarian Assistance (NIFMAG). 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.

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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 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 Australian Postcode Lottery, the South African Postcode Lottery and the Embassy of Australia in Zimbabwe.

MOZAMBIQUE

Zimbabwe declared itself landmine-free in 2015, marking an end to decades of deficits and suffering. In the late 1970s, the new Mozambican government, facing a war of liberation against South African-backed forces, resorted to the use of landmines. By the end of the decade, 500,000 mines had been spread across the country. In the years following the end of the war, the country has been working on clearing these landmines with the help of various international NGOs. In 2015, it was declared mine-free, 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 a part of this historic success story, helping to clear the last minefield 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 Songoane Complex in the district of Manhiça, is still overmined with ERW, and 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 remnants in the area and plans to clear the last remaining area in 2018 when funding is secured. In 2015, 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 flow back, vastly improving the funding situation. The early part of 2018 will be spent cementing connections and, we hope to be up and running by midyear.

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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 aerial demining capacity. This capacity building will ensure that the CCEM teams work safely and efficiently, reduce release methods so that, when open, and found are not wasted when clearing mines. To date, APOPO has trained 12 CCEM non-technical teams, and more capacity building will be provided throughout 2018. APOPO is working with CCEM to gain government approval for the introduction of the mine detection rats to increase the productivity of the CCEM 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. This 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 organizations 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 program in Colombia is made possible by our partners and donors, Campaña Colombiana Contra Minas and the Dutch Postcode Lottery.

**TEKIMITI GILBERT**
Program Manager MA COLOMBIA

APOPO and CCCM have worked together in Colombia since 2016 to develop a standard operating procedure and train demining teams. This capacity building will ensure that the CCEM teams work safely and efficiently, reduce release methods so that, when found, are not wasted when clearing mines.
ince 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.

**APOPO TRAINING AND RESEARCH DEVELOPMENT CENTER, TANZANIA**

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.

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Professor John M. Pearce, FRS, FLSW, FBPsS

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 monitoring learning, and memory and their underlying neural mechanisms with a variety of species, including rats, mice, pigeons, and hermit crabs.

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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 inhibition of behavior of our rats.
- The inaugural meeting of the R&D Scientific Advisory Committee, held in Antwerp, Belgium.
- The Pavlovian Society annual conference in Philadelphia, U.S.
- Hosting a visit from world-renowned animal learning scientists by Dr. Cindy Fast as an invited speaker at the Pavlovian Society annual conference in Philadelphia, U.S.
- Presentation of APOPO’s operational impact and recent developments to the 2017 Royal Society of Medicine in London.
- The U.S. Fish and Wildlife Services and the Endangered Wildlife Trust (EWT) of South Africa, we are investigating the potential for detection in the controlled laboratory setting to detect both landmines and African hardwoods. The rats are showing great potential at detecting both targets from among materials commonly used to mask landmines, such as granite.
- The first phase of a preliminary experiment examining how diet and nutrition may interact with the rats’ physical activity level and scent-detection ability. For example, in landmine-detection, APOPO’s rats are trained to detect at the ground when snipers are present, which can sometimes be ambiguous or poor challenges, because pawing and scratching at the ground while navigating through the ground is part of the natural behavior of our rats. Additionally, there may be times when it is not desirable for the rat to detect the ground’s surface. For these reasons, APOPO designed a new harness equipped with a micro-switch that allows the rat to detect only, and unequivocally, “mines”.
- The inaugural meeting of the R&D Scientific Advisory Committee, held in Antwerp, Belgium.
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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

61,928 SUSPECT TB SAMPLES SCREENED

1,677 ADDITIONAL TB CASES DETECTED

25,155 POTENTIAL INFECTIONS HALTED
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 who died or others will remain ill and likely to pass the pathogen on to others.

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 received significant interest.

Tuberculosis DETECTION

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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 patient irrespective of age and HIV status, that can be used without a stable power source. For TB, such a 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 received significant interest.
How can a technology undergoing R&D already make a difference?

Our TB-detection rats are a technology for ‘research use’. The rats were originally screened and then treated as human patients and were only later treated as research participants. This allowed us to develop a new technology that can be used in real-life settings to treat TB patients safely and effectively.

Case detection - and then?

Our TB-detection rats were able to detect TB cases with high accuracy, allowing us to identify patients who were not previously diagnosed. This information was then used to improve the treatment of TB patients in Tanzania.

Impact 2017

- Additional patients diagnosed: 1,244
- Samples evaluated: 49,817
- Impact 2017
TB DETECTION MOZAMBIQUE

The Mozambican APOPO TB program maintains 100% coverage of all microscopy TB suspect samples for TB detection in the city of Maputo. However, in 2017, Mozambican health authorities started a welcome roll out of the GeneXpert technology from LED fluorescence microscopy to 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 reviewed by the APOPO. Nevertheless, TB detection cases 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. APOPO identifies them as TB-positive. The 24-hour results strategy implemented in 2015 allowed a larger number of the additional patients to receive their results at the clinic and begin treatment. Still, it was verified that a significant number of patients are lost to follow-up through not returning for confirmation at the time of sample delivery to the laboratories for confirmation by Xpert. Based on molecular biology procedures, Xpert, thus contributing to the efforts of the government of Mozambique to implement this methodology in the highest number of cases.

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 pilots were a success, as activities were able to work up to 90% of all additional patients identified by APOPO, with 86% of them initiating TB treatment (the remaining had either died or refused to be treated).

Impact 2017

- Samples evaluated: 12,111
- National patients diagnosed: 433
- Positive in tuberculosis test: 336

The entire year was dedicated to building the APOPO testing facility in the premises of ARM, procurement and installation of equipment, staff recruitment and training, procurement of 24 rats for the enhanced case finding research, and the construction of the facility and equipment procurement. The project was completed by mid-2018, with the enhanced case finding activities being in full swing by the end of 2018.

The APOPO Mozambique TB program, funded by the Government of Flanders, is hosted by Armauer Hansen Research Institute (AHRI), a government research institute in Ethiopia. This project is hosted by Armauer Hansen Research Institute (AHRI), the German Leprosy and Tuberculosis Association (DAHW) Ethiopia office, the Armauer Hansen Research Institute (AHRI), the German Leprosy and Tuberculosis Association (DAHW), and the Federal Prison Administration Commission, Ethiopia and Addis Ababa City Council Health Bureau.

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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.

MARI KURAISHI, CHAIRPERSON, APOPO U.S.

“"At GlobalGiving, I am surrounded by stories of innovative grassroots organizations on a daily basis, but APOPO’s detection rate always stand 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.”

ANNA BOUCHIER, EXECUTIVE DIRECTOR, APOPO SWISS FOUNDATION

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

YVES HERVIEU-CAUSSE, CHAIRPERSON, SWISS BOARD
In 2017, the long-standing relationship and efforts between APOPO and Sokoine University of Agriculture (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 collabora- tion research capacity in the regional priority areas. These re- sources will go on to develop and apply science and technology and meet the demand for skills required to solve Africa’s most prevailing 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 fantastic 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.”

“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.”

“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.”

In April 2016, APOPO partnered with Sustainable Agriculture Tanzania (SAT) to embark on a tree planting project that will help offset APOPO’s CO2 emissions caused primarily by transport and travel. The project aims to plant 50,000 trees over a five-year period, aimed at producing carbon credits to mitigate the adverse impacts of climate change. The project has been successful in planting 3,282 trees over 2017.

Dr. Ladislaus Mnyone
Director of Pest Management Centre
Sokoine University of Agriculture (SUA)

CARBON OFFSET 2017

IMPACT 2017

- 3,282 trees were planted successfully in 2017.
- 7 species of trees were planted.
- 40 farmers were trained by SAT.
- 4,246 seedlings were prepared in 2 nurseries.
- 3,282 trees were successfully planted in 2017.

“Since its inception in 2016, APOPO has committed to the noble objective of food security and environmental protection. Through its partnership with SAT, we have planted over 3,000 trees which is an important step in safeguarding our environment.”

Janet Maro, Founder SAT

“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.”

Janet Maro, Founder SAT

ANNUAL REPORT 2017
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.

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. Weighting 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 Mchapa-kazi, which means “the hard worker.”

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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 upgraded 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 has 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.

CHRISTOPHE COX
APOPO CEO

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

MEDIA AND COMMUNITY

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### Annual Report

#### Finances

#### Donations & Subsidies 2017
- Public fundraising: €408,026
- Government grants: €502,517
- Foundations grants: €2.691,157
- Research grants: €239,022
- Miscellaneous operating income: €42,055

#### Expenses and Investments

#### Profit & Loss Statement (Euro)

**2017**  
- Total Income: €4,074,245  
- Total Operational Expenses: €3,317,556  
- Total Personnel Expenses: €1,291,100  
- Depreciation: €-55,126  
- Other costs: €5,270  
- Operating Result: €(539,681)  
- Financial Result: €(159,032)  
- Extraordinary Result: €8,921  
- Net Income: €(689,793)

**2016**  
- Total Income: €4,025,444  
- Total Operational Expenses: €2,309,359  
- Total Personnel Expenses: €1,478,516  
- Depreciation: €55,126  
- Other costs: €12,758  
- Operating Result: €169,685  
- Financial Result: €(39,743)  
- Extraordinary Result: €514  
- Net Income: €130,457

### Balance Sheet in Euro

#### Assets
- Fixed Assets - €0  
- Current Assets: €3,146,237  
  - Current Receivables: €302,771  
  - Other Assets: €507,000  
  - Cash and Equivalents: €2,336,465

#### Liabilities
- Net Capital: €1,337,927  
- Funds of the Organization: €328,046  
- Other Reserves: €-  
- Retained Earnings: €1,009,881  
- Long term Liabilities: €1,804,397  
- Current Liabilities: €3,913  
- Current Payables: €3,913

#### Total Assets: €4,084,028  
#### Total Liabilities: €3,146,237  

#### In Euro*

**Expenses and Investments 2017 by Activity**
- Mine Action Mozambique: €111,900  
- Mine Action Angola: €468,721  
- Mine Action Cambodia: €537,519  
- Mine Action Zimbabwe: €182,234  
- Mine Action Colombia: €328,046  
- Visitor Center Cambodia: €85,858  
- Training Technical Survey Dogs: €425,500  
- TB Program Tanzania-Morogoro: €355,441  
- TB Program Tanzania-Dar: €193,734  
- TB Program Mozambique: €342,699  
- TB Program Ethiopia: €236,828  
- Research and Development: €239,285  
- Training Mine Detection Rats: €175,648  
- U.S Office: €107,381  
- Swiss Foundation: €136,779  
- Marketing: €322,760  
- Administration: €478,698  
- Carbon Offset: €5,000  
- Exchange Fluctuations: €157,206

*Cash-based
APOPO

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