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### APOPO Annual Report 2016

APOPO

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# ANNUAL REPORT 2016

WE TRAIN RATS TO SAVE LIVES

# APOPO

APOPO is a global non-profit organization registered in Belgium that researches, develops and implements detection rat technology for humanitarian purposes. Detection rats, nicknamed HeroRATs, save lives by detecting landmines and tuberculosis. APOPO is headquartered in Tanzania and clears landmines in Mozambique, Angola and Cambodia, and soon in Zimbabwe. APOPO also detects tuberculosis in Tanzania and Mozambique and soon in Ethiopia. APOPO's research and development center is based in Tanzania.

**Over 60 countries suffer from the threat of landmines and other explosive remnants of war that cause tragic accidents and hold back communities from developing their productive land.**

**Meanwhile, slow and inaccurate diagnostics make tuberculosis the world's biggest killer from an infectious disease – around 10 million people contract TB every year, 3 million go undiagnosed and 1.8 million die.**

## CORE VALUES

**QUALITY** Demonstrating and promoting high standards in research, design, training and implementation of detection rats technology

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

**SOCIAL TRANSFORMATION** Developing skills, creating jobs, improving socio-economic and environmental conditions, releasing land for development, and combating public health issues

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





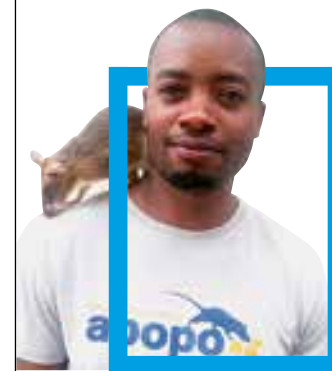
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# INTRODUCTION

Tuberculosis is hard to avoid where I live in Dar es Salaam. We all know someone who has been affected in one way or another, and often, as in the case of Juma\*, my colleague's friend, people here are not getting the attention they need. He'd been to his local clinic a number of times but the doctors had been unable to identify his illness. He became seriously sick until we examined him and sent his sputum sample to the rats. APOPO confirmed that he was TB-positive and he was placed on immediate treatment and is now doing well. It's Juma's story that make my job worthwhile.

Though I've been with APOPO since 2014, it can still be painful to see people struggle because they can't get the right treatment. I experience this every day due to my outreach work in the city's communities. Poverty is a key factor, and unless international governments embrace a cheap, fast and accurate diagnostic that they can afford, the fight with tuberculosis will go on and on. This is where the rats come in, because they can be integrated into existing methods which they improve at a very low cost – a crucial factor for the economically challenged countries in which we work. I am proud, therefore, to be working alongside APOPO's dedicated staff and the HeroRATs in Tanzania and Mozambique who raised partner-clinic TB detection rates by over 50 percent last year. But we won't rest there. APOPO is always moving forwards, and our research and development work has improved not only the performance of the rats and the rate of TB detection but also our understanding of how to make them cost-efficient enough for constrained



**DR JOSEPH SOKA**  
PROJECT MEDICAL OFFICER,  
APOPO, DAR ES SALAAM,  
TANZANIA

health authorities to take them on. The rats work on an economy of scale and our facilities can handle many more samples because the rats work so quickly, so performance improvement is ready and waiting.

Yet one challenge we still face is skepticism about our technology. I admit that I myself was doubtful at first: These are rats, after all, and I had not been brought up to think of them as our friends. This changed as soon as I saw them work. They can check 100 samples in 20 minutes, something that takes a lab technician using conventional microscopy about four days. This is serious speed!

We therefore invite non-partner-clinics and other policy makers within the sectors we work to embrace our HeroRATs and offer us a chance to significantly speed up their own efforts. Or perhaps to accompany me on a home visit to meet six-year-old Neema\*. She had a persistent cough, lost weight and became very weak until the HeroRATs identified what her clinic didn't – tuberculosis. Seeing how vibrant and energetic she is today is enough to show anyone the difference we are making.

APOPO is a growing and inspiring global organization that successfully addresses two major humanitarian issues: landmines and tuberculosis. We need to continue and scale up our efforts. I therefore offer my sincere gratitude to all our partners and donors for their kind and generous support. Without you we would not be able to deliver our life-saving work.

\* NAMES HAVE BEEN CHANGED FOR PRIVACY.

# LANDMINE DETECTION

Landmines are used during wars to protect strategic locations, block enemy travel routes and slow down enemy soldiers by physically maiming them. Yet long after conflicts end, they remain hidden, active and indiscriminate. At more than 6,000, annual global landmine accidents are unacceptably tragic; 78% of them involve civilians unrelated to conflicts, and 38% of these are children.

Every bit as tragic is the immense and negative impact posed by landmines to the development of mine-contaminated countries. Vast areas are rendered off-limits, often for decades, yet only about 3% of the land typically contains any explosive material at all. The rest sits needlessly idle while terrorized communities are cut off from basic needs such as water sources, travel routes and the ability to grow crops and raise livestock.

Yet global support for solving the landmine issue is declining. Clearing landmines and unexploded ordnance (UXO) is painstaking, slow and costly. This is where APOPO fits in. By integrating the HeroRATs into conventional approaches of using machines and human deminers with metal detectors, APOPO significantly speeds up mine clearance. This prevents countless accidents and quickly returns people to their land for development and sustenance, at a fraction of the cost, leaving funds to address yet more tasks. ■







# MINE ACTION



## GLOBAL LANDMINES\*

6,461

GLOBAL CASUALTIES  
IN 2015

78%

OF ALL LANDMINE  
CASUALTIES ARE CIVILIAN

38%

ARE CHILDREN

64

COUNTRIES AND AREAS  
IN THE WORLD ARE STILL  
CONTAMINATED WITH  
LANDMINES

\* FROM THE LANDMINE  
MONITOR 2016

APOPO's HeroRATs are too light to set off the landmines and very quick at finding them, making them a perfect "tool" for detection and clearance. They ignore scrap metal and only detect explosives, which makes them much faster at detecting landmines than conventional metal detectors. In fact, one HeroRAT can search an area the size of a tennis court in 30 minutes - this would take a manual deminer with a metal detector up to four days (depending on the levels of scrap metal present).

## SINCE APOPO BEGAN

21,599,612

TOTAL M2 OF LAND GIVEN BACK TO  
LOCAL COMMUNITIES

19,454

LANDMINES FOUND AND DESTROYED

82,709

UXO FOUND AND DESTROYED

4,667

CLUSTER MUNITIONS FOUND AND DESTROYED



**HÅVARD BACH**  
HEAD OF MINE ACTION

# MINE ACTION SUMMARY

2016 was a challenging yet productive year for APOPO Mine Action. In Cambodia the HeroRATs began mine clearance efforts alongside our partner the Cambodian Mine Action Centre (CMAC), the first time they have been deployed outside of Africa. After rigorous evaluation by CMAC, the rats were given a green light and proceeded to significantly speed up mine clearance throughout the year. The success of this valued partnership has prompted APOPO to invest more into strengthening the strong bond between the two and APOPO aims to have approximately thirty rats in Cambodia by the end of 2017.

In 2016, APOPO also initiated its mine action program in Colombia. APOPO has partnered with the Colombian organization Campaña Colombiana Contra Minas (CCCM) to jointly establish a relevant and efficient survey and clearance capacity that can help speed up the process to clear mines. Most mines in Colombia are improvised and are largely free from metal making them almost undetectable to normal mine detectors, a drawback that mine detection rats do not face since they detect the scent of explosives. APOPO hopes to bring the rats into the country in the foreseeable future.

APOPO, Mozambique, quickly became one of the principle mine action service providers in the country after its arrival in 2003. Since the mine-free announcement in 2015, APOPO has continued with operations following a request by authorities to clear areas around several old ammunition bunkers that exploded and littered thousands of unexploded ordnance over

large inhabited areas. This task will continue into 2017.

APOPO has also been asked by the Government of Zimbabwe to clear 36 linear km of high-density minefields along the Mozambican border, a task that will take several years. Operations will begin in 2017.

In Angola, APOPO has a partnership with Norwegian Peoples Aid (NPA) to provide rat teams and a brush cutter while NPA supports with management and other operational components. Despite the hardship of conducting mine action in Angola, APOPO is committed to maintain its mine action program. The humanitarian impact from clearing landmines in Angola by far exceeds that in most other mine affected countries.

## MORE THAN RATS

Often perceived as “the NGO that trains and uses rats to detect landmines”, APOPO is much more. Mine Action comprises of multiple activities, assets and methodologies. APOPO is first and foremost a mine action organization that makes use of any asset and methodology to increase efficiency. Trained African giant pouched rats are a vital and unique component that perform best when used alongside other assets (such as metal detectors and machines).

APOPO can offer mine action stakeholders unique technologies and methodologies, including rats, land release methodology

and competence/capacity building. In 2017 we will focus fully on establishing new and fruitful partnerships with national and international NGOs and organizations. APOPO welcomes any potential modalities of cooperation. The strengths of APOPO have proven effect when combined with the strengths of other organizations for a more efficient overall land release process.

## APPLIED LAND RELEASE

Land release methodology remains the most important framework for all of APOPOs survey and clearance activities and is endorsed by International Mine Action Standards (IMAS). Effective land release methodology promotes maximum release of land from the survey process, thus leaving much smaller, well-defined areas for the costlier and more time consuming clearance that uses an integrated combination of assets such as rats, metal detectors and machines. Failing to apply a well-designed and tailored land release methodology typically results in excess clearance of land that could have been reliably predicted mine free, adding costs and reducing the speed of releasing land. APOPO shares its land release methodology with partners and national authorities to ensure that the methodology is also endorsed by host nations. ■



GLORIA TIKI MOZAMBIQUE

**"We lived with landmines since the war. They protected the power lines and pylons behind us, right on our back doorstep. My daughters could hardly remember when it was safe for them to play and my grandchildren knew no different at all.**

**The land is our most productive farmland, but we couldn't work on it.**

**But we got desperate and planted crops closer to the pylons. To work land when any second something might explode and kill you is terrifying.**

**Now APOPO has cleared them away. We are so relieved."**

TEKIMITI GILBERT  
PROGRAM MANAGER  
MA COLOMBIA



## MINE ACTION COLOMBIA

In late 2016, APOPO registered as an NGO in Colombia and asked the government to consider an agreement to introduce its mine detection rats into national mine action standards. APOPO is also providing technical assistance with training and monitoring support to Campaña Colombiana Contra Minas (a Colombian Mine Action NGO). The deminer training consists of Non Technical Survey, Deminer, Section Leader and Team Leader Courses. Once teams are tested and accredited, they are authorized by the Colombian Mine Action Authority to conduct survey and clearance work throughout the country.

Colombia's landmine and explosive remnants of war problem is the result of more than five decades of conflict with non-state armed groups. The full extent of contamination remains vague, although the national database reports that at least 30 of the country's 32 departments have a mine threat. Up until December 2016, the official government record shows there has been a total of 11,460 landmine casualties—2,266 people died and 9,194 were injured. This places Colombia second in the world only to Afghanistan in terms of annual landmine casualties.

The landmine problem throughout the country consists of improvised homemade mines that are mostly plastic and glass bottles filled with explosives and that contain very little metal.



They are extremely difficult to detect by a metal detector, which is the standard method used in the country. Colombian mine action consists of digging 6-inch-deep, 1-meter-wide trenches slowly across mine-contaminated areas, clearing only about 6 square meters per day. The APOPO HeroRATs are perfect for this situation, as they search only for explosive scent and can detect the metal-free landmines. One HeroRAT can search an area the size of a tennis court in just 30 minutes.



# MINE ACTION CAMBODIA

The first APOPO mine-detection rats arrived in Cambodia in September 2015 and were put through three months of rigorous testing by APOPO's partner, the Cambodia Mine Action Center (CMAC). The rats went on to help clear 573,256 square meters across seven minefields in 2016 further cementing the highly valued partnership with CMAC, who have shown themselves to be a supportive partner. The success of this partnership has prompted APOPO to invest more into strengthening the strong bond between the two and APOPO aims to have approximately 30 rats in Cambodia by the end of 2017.

Joint APOPO/CMAC operations are carried out in the Srey Nour Area of Siem Reap, where suspect land had not been used for almost 30 years. Much-needed safe land was returned back to the communities as quickly and cost-effectively as possible. One of these areas was completely cleared in just 17 days and handed back to the local residents, who immediately planted rice crops on it. Unlike manual deminers with a metal detector, the rats ignore all the scrap metal lying around and only target the scent of explosives.

They provide immediate and accurate indications of explosives without false alarms from scrap metal. The saved time and costs is then being used for further lifesaving work. ■



**PAUL MCCARTHY**  
PROGRAM MANAGER MA CAMBODIA





LEAV SAM DEPUTY VILLAGE CHIEF FOR KHNAR PHTUOL, NEAR SIEM REAP, CAMBODIA

**"Today I am a happy man because APOPO and CMAC finished clearing another minefield near our community.**

**These fields are where we grow our rice and cassava and raise our livestock. Our children play in them or walk through them to get to school.**

**We have to use them because we have no choice: We have to feed ourselves. We know that landmines exist there because of past accidents with our precious cows, and we avoided those areas, but you never know for sure.**

**APOPO found seven landmines in the fields closest to my house. They were in places that we have ploughed and planted for the last 20 years. How we have not had an accident, I don't know. We were very shaken.**

**But now we are all overjoyed. We can plant crops, our children can play and we can rear our goats and cows over all the land without being scared any more. Thank you APOPO and CMAC!"**



## PHASE 1

**400**  
SQUARE METERS OF  
TEST BOX PER RAT

**6**  
HIDDEN MINES PER BOX  
**ALL 14 RATS PASSED**

## PHASE 2

**53,253**  
SQUARE METERS SEARCHED

**11**  
LANDMINES FOUND

**3**  
UXO FOUND

**0**  
ITEMS FOUND BY CMAC  
AFTER RAT SEARCH

## COST EFFICIENCY

A detailed cost analysis showed that the MDR driven teams were 3 times as cost effective compared to manual teams when a monthly leasing price of \$500 per rat per month is considered.



**0.31** EURO/M<sup>2</sup>  
BUSHCUTTER +  
RAT TEAM

**0.93** EURO/M<sup>2</sup>  
BUSHCUTTER +  
MANUAL TEAM

## FULLY TESTED RATS

**Before deploying APOPO's Mine Detection Rats to the Cambodia minefields, CMAC carried out 2 phases of extensive testing on their performance.**

### PHASE 1

In phase 1, each rat had to detect all 6 mines hidden in a training area of 400 m<sup>2</sup>. All 14 passed.

### PHASE 2

In phase 2, the rats were deployed on an operational minefield and were quality controlled for a period of 3 months by CMAC who checked the zones after the rats, using metal detectors. Two rats were deployed per zone to qualify for IMAS "full clearance" and a total area of 52,000m<sup>2</sup> was searched. 11 landmines and 3 UXO were found and both rats on each zone indicated above the explosive items, only making 3 false indications throughout the whole period. The shadowing CMAC manual teams did not find any explosive items missed by the rats and CMAC gave the rats a full vote of confidence and a green light to proceed.

### OPERATIONAL

For the remaining eight months of 2016, APOPO's MDR sniffed out 67 additional explosive devices, including 43 mines and 24 UXOs, hidden within 225,415m<sup>2</sup>. A 25% quality control check with metal detectors revealed that the MDR did not leave any explosive items undetected.





ASHLEY FITZPATRICK  
DEPUTY REGIONAL MANAGER,  
APOPO MA AFRICA



# MINE ACTION MOZAMBIQUE

Mozambique was one of the most severely mine-affected countries in the world, but in 2015 it was declared free of all known landmines with the completion of humanitarian demining. However, in 2016 the Instituto Nacional de Desminagem (IND) once again called on APOPO's capacity and expertise for 'residual risk' tasks on private or government land. APOPO Mozambique spent 2016 clearing hazardous items from a former ammunitions store that Mozambique's Ministry of Environment is transforming into a nature reserve, education and tourism center – the Malhazine Ecological Park.

A series of uncontrolled explosions in 2007 scattered dangerous ammunition across the site. APOPO's operations in the bunkers began in August 2015 and lasted nearly 18 months. APOPO used a combination of manual clearance teams, machines and mine-detection rats to clear the bunkers efficiently and effectively. The rats showed a very high level of proficiency detecting a high concentration of different odors in this setting and significantly speeded up clearance operations. Together with the IND and the Comissão Instaladora do Parque Ecológico de Maputo (CIPEM), on December 13, 2016, APOPO handed over the 12 bunkers that it cleared of explosive items.

In total, APOPO safely cleared and destroyed 38,828 ammunitions from the site, weighing 90,429 kilograms or over 90 tons. More than 360,000 people live in the district of Kamubukwane where the Malhazine Complex is located, and completion of this task marked an important milestone toward resolving the dangerous ammunitions contamination. ■



## MAPUTO CASE STUDY

**Mechanical preparation** – three armoured machines were deployed to conduct ground preparation/vegetation cutting to prepare soil inspection areas and in the bunker centres, vegetation clearance surrounding areas of each bunker prior to deploying manual and MDR assets for sub-surface clearance, soil excavation from bunker and transport to inspection areas for manual processing and verification.

**Manual clearance** – manual deminers with metal detectors were deployed to clear 25 metres out in all directions from the centre of each bunker to the start line of MDR designated clearance areas.

**Mine detection rats (MDR)** – MDR were used to clear an area of 25 metres out in all directions around each bunker beginning at 25 metres from the bunker centre.

**Battle area clearance (BAC)** – complete visual check in all remaining areas, and to verify and inspect soil excavated from the bunkers.

### COST EFFICIENCY

An analysis of the cost of the different assets versus their output reveals that MDR should be used as the primary clearance asset whenever possible, even during Battle Area Clearance (BAC). The number of manual deminers should be scaled for a good balance with the number of rats.

1.41 EURO/M<sup>2</sup>  
BUSHCUTTER +  
MDR DRIVEN TEAM

1.85 EURO/M<sup>2</sup>  
BUSHCUTTER +  
MANUAL TEAM





## 90 TONS DESTROYED

**Overall 90-plus tons of explosives were found and destroyed at the Malhazine bunker complex.**

**Some items were highly degraded and fused, making them dangerous and unstable; others were not fused and in relatively good condition. Due to the trauma the local community suffered during the two main explosions in 1985 and 2007, APOPO is not permitted to make in-situ demolitions for fear of mass panic in the densely populated areas nearby. For this reason, APOPO carried out the demolitions at the designated Central Demolition Site (CDS) in Moamba, about 70km from Malhazine.**

**Each demolition day the explosives were carefully prepared and packed, then moved to the demolition site with a police escort and local government officials. APOPO carried out controlled demolitions once or twice a week until all the items were destroyed.**





**ALFREDO ADAMO**  
MDR SUPERVISOR



# MINE ACTION ANGOLA

Following 27 years of civil war, Angola is littered with landmines and other explosive items that have claimed countless lives and left people living in fear. Since 2013, APOPO and partner Norwegian People's Aid (NPA) have worked across the country to clear minefields and help communities safely rebuild their lives and livelihoods. In 2016, APOPO and NPA cleared areas in Ngola Luige II and III, and another in Malanje in the northwest of the country. Malanje was a border task, clearing the site of an old military outpost. Deminers with metal detectors quickly found landmines laid in defense of the outpost. Vast surrounding areas that were important for local agriculture had to be checked for explosives too, but using metal detectors would have been too slow and costly. However, APOPO's mine-detection rats were able to quickly scour the area, finding some unexpected explosives along the way and enabling it to be freed to local communities ahead of schedule.

In Ngola Luige I, II and III, the rats helped clear land surrounding the small towns, finding a landmine not 20 meters from a school. These are typical Angolan rural townships that have been boxed in by dangerous minefields, leaving them unable to expand and develop. The whole area has now been declared safe. The school is building a football field, and residential and business expansion is now planned as more people return from the city to help develop the towns. ■





## ANGOLA/CONGO BORDER TASK

**After brush-cutters cleared overgrowth, deminers with metal detectors carried out search and clearance where landmines and UXO were expected, as well as in the battle zone. The rats then went to work in the wider surrounding areas where explosive material was expected but not certain.**

The rats checked a vast area and found a number of UXO. Due to their speed, the whole task was finished six months faster than if teams were using only metal detectors, producing significant cost and time savings that were rolled over to help other communities. The total area in which explosives were found constituted a tiny percentage of the whole site, illustrating the tragedy of communities all around the world that for decades are needlessly being held back from using their land.

The area will now be developed into a transnational market—farmers of the surrounding agricultural land will benefit from supplying market needs. The whole region is expected to become a vibrant, developed trading area that will boost the local economy from practically zero production over the last four decades.

### THE BORDER MINEFIELDS BETWEEN MOZAMBIQUE AND ZIMBABWE

Zimbabwe is among the most heavily landmine impacted countries in the world having inherited around 1.5 million landmines from the war of independence in the 1970's, laid along 766 km of the Zambian and Mozambican borders. Despite good progress in landmine clearance there is still more than 200 km<sup>2</sup> minefields that pose a threat to local communities. The Zimbabwe Mine Action Center (ZIMAC), since the war over 1,550 people have been killed by mine-related accidents and another 2,000 injured, whilst over 120,000 head of livestock have died. Hidden landmines exist in the immediate proximity of houses, schools, and health clinics, access to prime agricultural land is denied to farmers, and communities are often separated from their primary water sources.

In 2016 APOPO signed an agreement with ZIMAC and the Ministry of Defence granting permission to work in Zimbabwe and was tasked with surveyance and clearance of a 35 km long stretch of minefield, between the Sango border post and Crocks Corner. Preparations for setting up the programme and a minefield assessment were undertaken in 2016. APOPO will recruit and train deminers and management staff from Zimbabwe during first half of 2017. The operational capacity of APOPO is expected to be a mix of manual demining teams and rat teams. APOPO initially plans to employ and train 55 Zimbabwean staff over the course of the project.

**"For 15 years we didn't use the land until APOPO and NPA checked it. They found nothing. But would you take the risk?"**

EDUARDO PONA,  
FARMER, ANGOLA



# FIGHTING LANDMINES

## 2016 GLOBAL IMPACT

961,946

TOTAL M2 OF LAND  
GIVEN BACK TO LOCAL  
COMMUNITIES

882

LANDMINES FOUND  
AND DESTROYED

33,812

UXO FOUND  
AND DESTROYED

37

HERORATS DEPLOYED





## 2016 GLOBAL IMPACT

58,415

SAMPLES SCREENED  
BY RATS

30,714

PRESUMPTIVE TB  
PATIENTS SCREENED  
BY RATS

1,764

ADDITIONAL TB PATIENTS  
DETECTED BY RATS

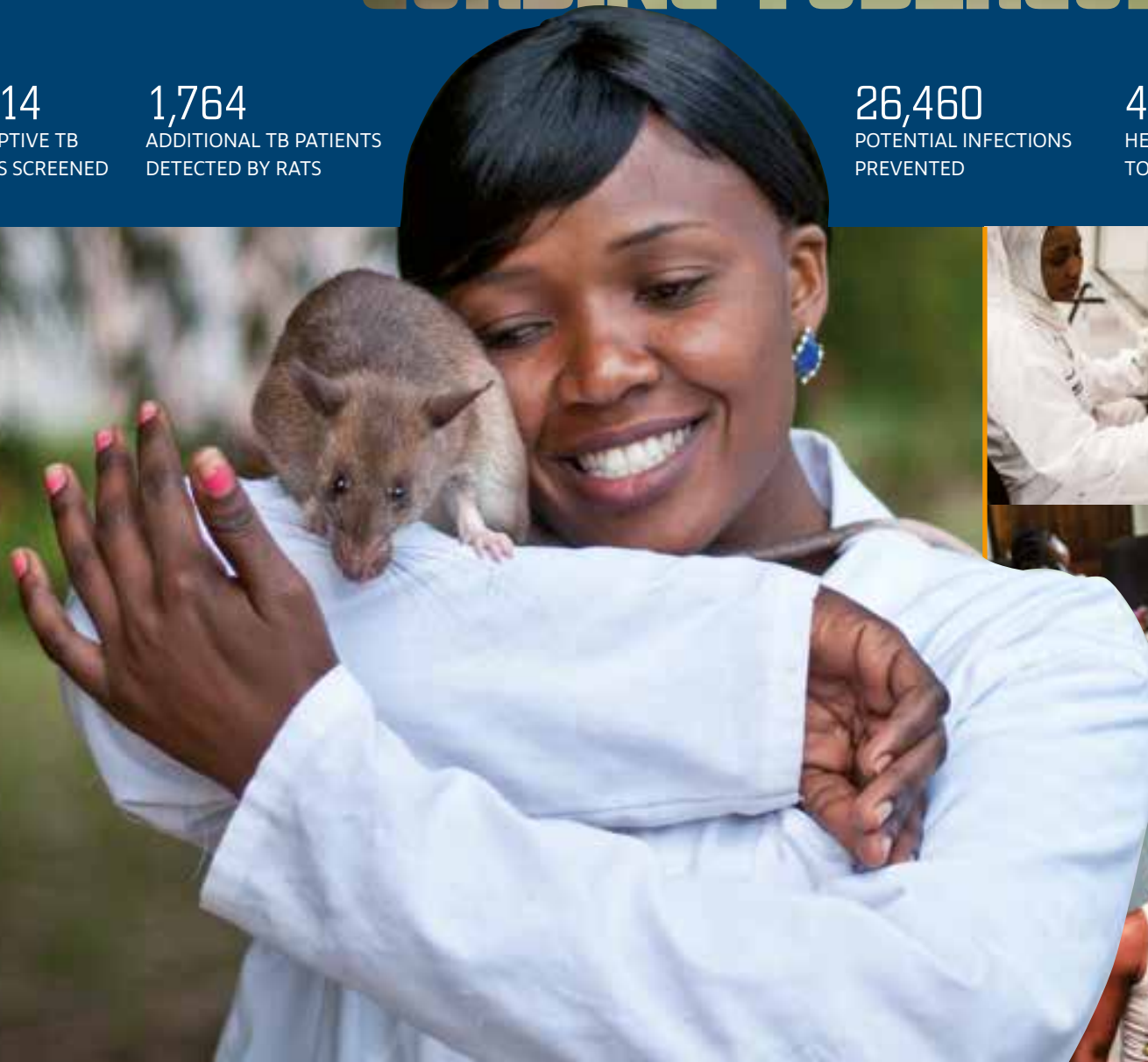
26,460

POTENTIAL INFECTIONS  
PREVENTED

45

HERORATS WORKING  
TO DETECT TB

# CURBING TUBERCULOSIS





# TUBERCULOSIS DETECTION

In late 2015, the World Health Organization (WHO) announced that tuberculosis now kills more people per year than HIV/AIDS or malaria. In 2016 there were 10.4 million new TB patients globally, and 1.8 million people died from the disease. The WHO has listed 30 countries as 'High TB-Burden,' including Tanzania and Mozambique, where APOPO already operates.

In many countries, the conventional method of diagnosing tuberculosis is inadequate, resulting in a poor rate of global decline of the disease. The HeroRATs' unique speed and sensitivity combined with conventional TB diagnostics is a powerful combo that's proven to increase detection rates in public clinics by over 40% in 2016. This means more TB-positive people who have been missed by clinics are now put on life-saving treatment before they can infect other people and prolong the vicious cycle of tuberculosis.

APOPO's TB-detecting HeroRATs offset the low sensitivity of conventional methods by rechecking the samples that the clinics already tested and finding additional TB-positive patients who were missed. The results are sent back to clinics within 24 hours. A HeroRAT can check 100 sputum samples for tuberculosis in just 20 minutes – a job that would take a lab technician using conventional microscopy up to four days. The speed of the HeroRATs is a crucial factor in reducing costs and getting people treatment as soon as possible. ■

## HERORAT TB FACT

100  
SAMPLES  
IN 20  
MINUTES

THE HERORATS CAN CHECK 100 SPUTUM SAMPLES IN 20 MINUTES. THIS CAN TAKE A LABORATORY TECHNICIAN IN A PUBLIC CLINIC UP TO FOUR DAYS USING CONVENTIONAL MICROSCOPY.

DUE TO THE SPEED AND SENSITIVITY OF THE HERORATS, MORE PEOPLE ARE STARTING TREATMENT AND GETTING THEIR LIVES BACK ON TRACK EVERY DAY.

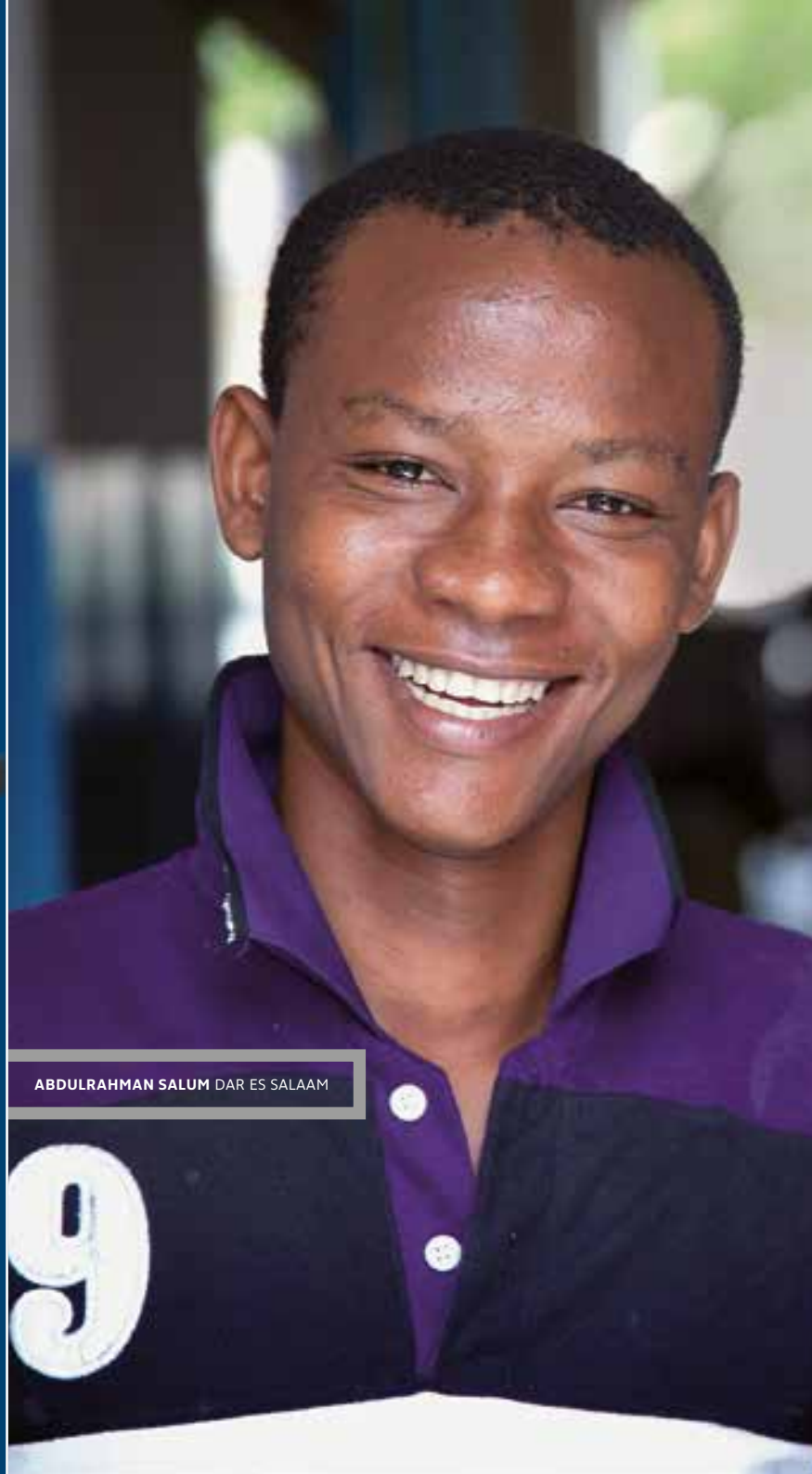


## KEEPING FAMILIES TOGETHER

**"When my wife was near the end of her pregnancy with our daughter, I started to feel pain in my chest. I had sore joints and I began losing weight. I am a mechanic and a truck driver, transporting heavy loads to neighboring countries. It's a dangerous job if you are not fit and alert.**

**I went to a clinic for a TB test but the result was negative. My wife was nearing her due date and I couldn't work and didn't know how to get better. I was afraid I might give them my disease so I moved away to my father's house. While staying there I got a call from the clinic explaining that the APOPO rats had detected tuberculosis in my sputum sample. Rats! I couldn't believe it! But I started treatment and improved immediately."**

ABDULRAHMAN SALUM DAR ES SALAAM



**"I am very grateful for all the efforts of APOPO and the HeroRATs. Without them, I surely wouldn't see my daughter grow up."**





**DR CHRISTIAAN MULDER**  
HEAD OF TB DETECTION

# TB DETECTION SUMMARY

APOPO's TB detection programs continued to have a significant impact in 2016. APOPO's innovative TB detection HeroRATs work with unique speed and sensitivity, and when combined with conventional TB diagnostics, they detected an additional 1,114 TB-positive patients in Tanzania and increased detection rates of public clinics by 36%. In Maputo, the rats detected 650 additional TB-positive patients, increasing the detection rates of public clinics by 57% – the largest contribution to case detection in Maputo since the program began. This means that more TB-positive people who have been missed by public clinics are now put on life-saving treatment before they can infect other people and prolong the vicious cycle of TB.



## FROM THE ONSET

**200,308**  
PRESUMPTIVE TB  
PATIENTS SCREENED  
BY RATS

**11,002**  
ADDITIONAL  
TB PATIENTS DETECTED  
BY RATS

**165,030**  
POTENTIAL INFECTIONS  
PREVENTED

## 24-HOUR RESULTS

In November 2016, APOPO Tanzania opened its new TB Detection Facility in Dar es Salaam to implement its new strategy of providing diagnostic results within 24 hours. Ten TB-detecting HeroRATs work at the lab alongside 12 staff made up of rat handlers and lab technicians.

Despite being curable and preventable, tuberculosis is a deadly infection of the lungs that kills more than 30,000 people in Tanzania every year. Over 30% of all estimated TB cases are not detected or treated properly. The failure to identify these patients makes it very difficult to reduce the spread of the disease, because an untreated TB-positive patient can pass the disease to up to 15 people within a year, creating an endless cycle.

The new facility will deliver APOPO results within 24 hours so patients get them when they return to clinic for their standard results, significantly increasing the number of people getting on treatment. In fact, the same model has been implemented at the APOPO facility in Maputo, Mozambique, since October 2015.





LUCY CHESIRE TUBERCULOSIS ADVOCACY CONSORTIUM,  
KENYA

**"The APOPO model of TB detection using rats is amazing considering that they were able to confirm 1,764 suspect TB patients this year, that had initially been missed by their local clinics.**

**I look forward to seeing the APOPO TB detection operations expand to even more countries in Africa next year putting more people on life saving treatment and breaking the tuberculosis vicious cycle."**



DR NEGUSSIE BENE  
PROGRAM MANAGER TB  
ETHIOPIA

## TB DETECTION ETHIOPIA

In November 2016, APOPO signed a partnership agreement with the Armauer Hansen Research Institute (AHRI). In collaboration with the Addis Ababa Health Bureau the project aims to screen presumptive pulmonary TB patients living in the capital, Addis Ababa, using the APOPO TB-detection rats.

Like most Sub-Saharan African countries, the case detection rate in Ethiopia is far from the global target of 70%, and it is one of the 30 high-TB-burden countries with a prevalence of 192/100,000 of the population (WHO, 2016). In addition to the nationwide coverage of the DOTS (Directly Observed Treatment, Short Course) strategy, Ethiopia launched a complemen-

tary approach to reach TB patients through health extension workers. But despite all these efforts, TB remains one of the major public-health challenges Ethiopia is currently facing.

APOPO will replicate its success in Tanzania and Mozambique in enhanced TB-case-finding in Ethiopia to contribute to the national effort to contain the spread of the disease. The Federal Ministry of Health proposed a partnership with AHRI, an autonomous federal government organization mandated to undertake biomedical, clinical and medical biotechnology research, and to adopt and implement scientific technologies to improve clinical care, health and well-being of the public as well as conduct clinical trials on new and improved medical diagnostic methods, vaccines and drugs.

APOPO's HeroRATs will also screen 52,500 inmates in 35 Ethiopian prisons. This project will be implemented in collaboration with the German Leprosy & TB Relief Association (GLRA) in Ethiopia, the Federal Prison Administration and the National TB Control Program. ■





# TB DETECTION TANZANIA

The APOPO TB Tanzania program expanded its laboratory base to two geographic locations in Tanzania in 2016. The new state-of-the-art TB-detection rats facility was opened in Dar es Salaam to speed up TB screening, provide 24-hour results and increase coverage of TB-suspect patients in the city. An extra 1,114 TB-positive patients who had been misdiagnosed in local clinics were detected, and 774 started immediate treatment for tuberculosis. This prevented possible transmission of the disease to up to 11,610 people within a year.

The Morogoro TB Detection facility currently tests TB-suspect samples from four nearby clinics but in 2017 expects to add another eleven. It will also be focusing on research studies, as detailed on the research and development pages.

## E-COMPLIANCE INNOVATION

APOPO and its partners MUKIKUTE and OPASHA began a project focusing on treatment initiation and adherence using “e-compliance” technology for patients whom APOPO identified as TB-positive. MUKIKUTE is a volunteer organization of community health workers who are all former patients of tuberculosis. These volunteers, using software and tablet technology supplied by OpASHA, carried out efficient tracking of patients and monitored how well they stuck to treatment. The e-compliance project will generate more accurate data for measuring the impact of APOPO’s TB-detection intervention and will also provide general treatment-adherence data for patients in Dar es Salaam. MUKIKUTE volunteers received



**DR GEORGIES MGOHE**  
PROGRAM MANAGER TB  
TANZANIA

training on e-compliance, and over 2,600 patients will be tracked in coming years of this project.

## 10,000 PATIENTS

In May 2016, APOPO reached a landmark of identifying 10,000 TB-positive patients in Mozambique and Tanzania who were initially misdiagnosed by their local clinics.

In Sub-Saharan Africa, public clinics use conventional methods to detect tuberculosis, such as microscopy, which is only 20% to 60% accurate. Throw in other limitations such as power cuts, lack of trained staff, lack of supplies and the slow method of diagnosis, and the result is that around 50% of all TB-positive patients who visit the clinics are sent home with a negative diagnosis. Not only will this eventually prove fatal to the patient, but someone with tuberculosis who is not treated can infect up to 15 other people within a year. That means that APOPO has potentially halted 150,000 further infections since operations began. ■







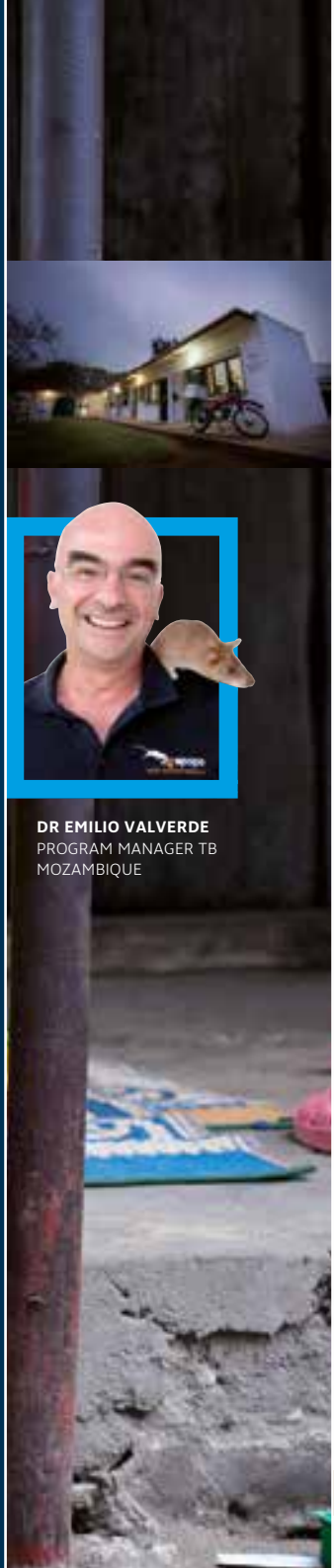
# TB DETECTION MOZAMBIQUE

The APOPO Mozambique TB Detection Program covers all TB-suspect microscopy samples submitted at public clinics in the city of Maputo. In 2016, the HeroRATs detected a high number of TB-positive patients who had previously been misdiagnosed by the clinics.

To improve treatment rates as well as detection rates, APOPO embarked on a 24-hour result-delivery strategy involving daily collection of samples and subsequent evaluation by the rats. Fluorescence microscopy verification at the APOPO laboratory was carried out on 'rat suspect' samples, and TB-positive results were delivered by phone to the clinics early the next morning, with hard copies arriving later the same day. The 24-hour strategy allows patients to get accurate results when they return to the clinic for their standard clinic test results, allowing more patients to get on treatment immediately.

While an increase of 10% to 15% in the treatment-initiation rate was observed, the new strategy also uncovered that a significant proportion of patients never return to pick up their results. This demonstrates the need for a better understanding of the social and economic factors such as TB stigma and transport costs affecting patient access to health care. APOPO has begun collaboration with researchers from the Vrije University in the Netherlands to conduct a survey to investigate these factors and to design strategies and policies to address them.

A study to screen prison inmates from facilities in Southern Mozambique was completed in July. The APOPO HeroRats confirmed their potential as an important tool in mass-screening programs for high-risk groups, as they were more sensitive than clinical questionnaires in identifying TB-suspect individuals. The study report will be published in 2017. ■



**DR EMILIO VALVERDE**  
PROGRAM MANAGER TB  
MOZAMBIQUE





JORGE ARMANDO MBOANA APOPO MOTORBIKE COURIER, MOZAMBIQUE

## MOTORBIKE RIDER

**"As a motorbike courier, I sometimes ride 120 kilometers a week collecting sputum samples from our partner clinics. My bike is always in good condition so that I don't let anyone down. I check the samples are properly stored and patient data has been carefully recorded before I leave. Safety is my priority, and I take pride in delivering the samples to the APOPO lab every day knowing that the rats will save the lives of misdiagnosed patients."**



## PRESIDENTIAL VISIT

In June 2016, the APOPO Maputo TB team was honored to receive His Excellency Filipe Jacinto Nyusi, the president of the Republic of Mozambique at the APOPO facility. The president visited several projects in different departments at the Eduardo Mondlane University, the oldest and largest university in Mozambique and APOPO's partner along with the Ministry of Health. His visit gave APOPO the opportunity to demonstrate at the highest level the importance of the HeroRATs in the national TB-detection program and how their incredible sense of smell truly saves lives. ■



## WISHES COME TRUE

The 2016 World Innovation Summit for Health (WISH) took place at the Qatar National Convention Center in November. WISH brings together internationally renowned health-care experts, government officials and advisory groups to take an in-depth look at some of the most pressing health challenges in the world today.

APOPO exhibited its innovative TB diagnostics to some of the world's leading health experts, decision-makers and media as a part of the "Innovation Showcase."

"APOPO is already making a difference to people's lives all over the world. The WISH conference is an excellent showcase that allows us to bring our work to a more global audience."

CHARLIE RICHTER APOPO U.S. DIRECTOR





# TANZANIA TRAINING CENTER

Trained rats were not required for the majority of the year, enabling breathing space for the training team to review and improve methods and prepare for major changes on the horizon.

Enhancements to the landmine detection training included the addition of more “blind” landmines in our training field. Blind landmines are unmarked so even the trainers are unaware of their location and rats are not rewarded for finding them. Blind training more closely aligns to the real minefield scenario, better preparing the rats for accreditation and making for a smoother transition to live operations. On the same lines, the rotation of trainers handling the rats was also stepped up, again shortening the rat’s acclimation time when they arrive at their new locations with new handlers.

With the help of subtle improvement in the breeding program, our family of HeroRATs rapidly grew to support APOPO operations. Six expert rats joined the TB-detection team in Mozambique, while ten more spearheaded TB-detection in our new Dar es Salaam lab and still others were bred to lead the new team in Ethiopia. Eight rats were accredited in preparation to join the mine action program in Cambodia with sixteen others readied to join the same team in the new year. Additionally, a number of rats were bred to support the expansion and focus on research and development in 2017. ■



**DR CYNTHIA FAST**  
HEAD OF TRAINING AND  
BEHAVIORAL RESEARCH



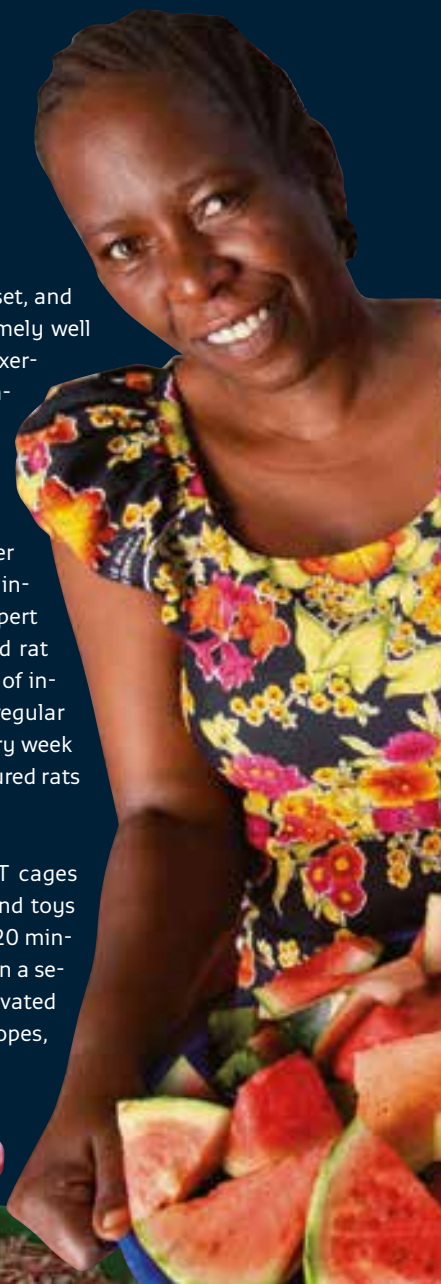
# ANIMAL WELFARE

## TREATED LIKE THE HEROES THEY ARE

Each of our rats is considered a highly valuable asset, and animal welfare is our top priority. They are extremely well cared for, receiving excellent nutrition, regular exercise, stimulation and enrichment, and loving attention from our expert handlers.

The HeroRAT diet consists of high-quality rodent pellets, fresh peanuts, plenty of fresh fruits and vegetables, small sun-dried fish and clean water that is regularly infused with extra vitamins and minerals to boost the rats' immune systems. Our expert rat handlers are trained in basic nursing care and rat first aid. Routine care includes daily observations of individual animals, weekly health inspections and regular prevention treatments for common parasites. Every week a vet inspects the rats. When necessary, sick or injured rats are interned at the APOPO sick bay.

To stimulate and enrich our rats' lives, HeroRAT cages include complexity, challenges, exercise wheels and toys rather than just plenty of space. The rats also get 20 minutes a day (plus working time) outside their cages in a series of large shaded play enclosures containing elevated platforms with ramps, climbing branches and ropes, tunnels and an exercise wheel. ■



# RESEARCH AND DEVELOPMENT

## TRUSTING IN RESEARCH AND DEVELOPMENT

"APOPO has always believed that innovation should be grounded in empirical research. To that end, APOPO took the initiative to increase focus and expand its R&D team in 2016. With more than 10 years of experience in animal behavior, including a psychology Ph.D. in animal learning and behavior and behavioral neuroscience from UCLA, and research on the rodent olfactory system at Rutgers University, I was well poised to head the team. When I arrived in October, I was very impressed by the abilities of the African giant pouched rat, and watching them in action heightened my enthusiasm about how we can develop their potential for other life-saving applications.

To support research capacity and strategic planning, I spearheaded the formation of APOPO's R&D Scientific Advisory Committee with members from the global community representing diverse areas of expertise. Additionally, my recruitment campaign to attract high-level students to join our research team was very successful. These efforts effectively broaden APOPO's scientific network while maintaining our productive partnerships with the University of Antwerp, Sokoine University of Agriculture, Western Michigan University, Waikato University, and the Max Planck Institute.

The primary objective of the R&D endeavor is to empirically inform training and operational protocols for new and existing applications. This is accomplished through multi-faceted research into the variables that influence learning and performance of our HeroRATs. This work provides the firm foundation APOPO needs to become a center of excellence in rat scent detection technology.

## ILLICIT WILDLIFE DETECTION

Pangolins are one of the most widely trafficked mammals in the world and African species are now facing possible extinction due to illegal trade. In late 2016, APOPO established a partnership with Endangered Wildlife Trust of South Africa to collaborate on a proof-of-principle experiment, funded by the US Fish and Wildlife Services, to examine the abilities of our African giant pouched rats to detect illegally trafficked pangolins and African hardwoods.

Twelve young rats were selected and socialized in preparation for training to begin in 2017. These rats will first be trained to indicate the presence of pangolin derivatives or endangered timber, but not common masking materials found in shipping containers, such as beans. If successful, later stages of the experiment will explore possible methods for the rats to assess the contents of shipping containers." ■

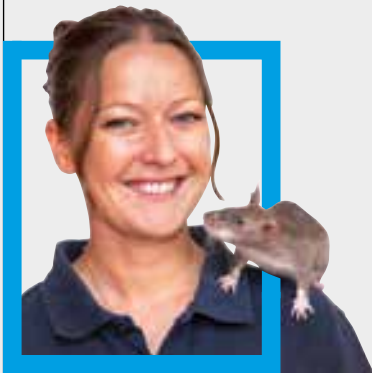
DR CYNTHIA FAST HEAD OF TRAINING AND BEHAVIORAL RESEARCH



# RESEARCH AND DEVELOPMENT ONGOING STUDIES

## ACCURACY STUDY

In 2016 we studied the accuracy of TB detection rats by comparing them with 1) the standard technology used in clinics (smear microscopy), 2) GeneXpert (very accurate but expensive) and 3) the gold-standard definitive culture (slow and expensive). This study found that the rats are significantly more sensitive than the smear microscopy used in clinics, that is, they are more likely to find TB-positive samples. Our results also revealed that having all rat-assessed samples re-tested using GeneXpert led to the greatest discovery of patients compared to all the possible combinations of follow-up diagnostic tests after rat-assessment.



**DR CYNTHIA FAST**  
HEAD OF TRAINING AND  
BEHAVIORAL RESEARCH

## VOLATILE ORGANIC COMPOUNDS (VOCs)

APOPO is continuing fundamental research into what the rats actually smell through collaboration with the Max Planck Institute and Braunschweig University. TB Detection rats make their decisions based on what VOCs have been paired with food in the past, but human sputum samples contain many other substances that emit VOCs in addition to the TB bacteria. We currently train our rats to indicate over samples that were found positive by clinics. These samples are not standardized (especially with regards to additional VOCs that may be present) and may cause idiosyncrasies between rats in detection of a single sample. Thus, our VOC research may allow us to isolate the TB-specific compounds the rats are able to detect. Importantly, these compounds could then be used during training as standardized samples to dramatically enhance rat-detection performance.





### GENERALIZATION AND INDICATION TIMES

Over the years, APOPO has developed and partially automated its 'line cage' for training and deploying TB-detection rats. APOPO is also currently using this apparatus to investigate the basic variables that influence training success as well as explore alternative training paradigms. This research is conducted with well-defined scent samples commonly used in the fragrance industry, and is generously supported by the Philanthropic Foundation Firmenich Family.

Some variables under investigation include 1) the optimal indication time, 2) the interaction between target prevalence and reinforcement rate, as well as 3) the rat's ability to generalize from single-to-multiple, multiple-to-single, and related scent compounds. In our current line cage, the rat indicates a target sample by interrupting a photobeam with its nose. Our research revealed that indication times of 3 to 4 seconds produce optimal rat performance. A very low indication time increased the sensitivity but decreased the specificity, and vice versa for a longer indication time. We also found that *Cricetomys An-sorgei* rats are capable of detecting highly diluted samples of extremely low concentrations of the pure scents.

The alternative training paradigms we are investigating explore the possibility of quickly retraining rats on new target scents. This ability might prove beneficial when urgent demands for detection occur. As a first step, this research examined the rat's ability to detect multiple target scents. Next, it explores how quickly rats can be retrained to new target scents. Finally, the possibility of rats 'matching' newly presented target scents from an array of samples will be investigated.



### LOW-PREVALENCE POPULATIONS

APOPO conducted research to evaluate the potential for detection rats to serve as the initial test for mass-screening activities of high-risk populations. For this study, 4,000 prisoners in Maputo and Morogoro were tested by the rats and by GeneXpert. In these populations, actual prevalence of TB is very low, ranging from 0.3% to 2%, as opposed to the 10% to 25% at TB clinics. As part of this project, we initially trained the rats to continue working, even when they received very few rewards during each session. The results of this study are currently being analyzed, but initial results suggest that rats are able to assess sample sets with very low target prevalence while maintaining a similar degree of accuracy. ■



**HAYLEE ELLIS**  
BEHAVIORAL RESEARCHER





ALBERT CAROL  
RAT HANDLER



## THE HABITUATION CHECKLIST

- Place rat in pocket and carry around site
- Place rubber gloves near rat and allow to sniff
- Coffee and tea: move toward rat, allow to sniff
- Other trainer: move toward rat, pick up, handle
- Place rat on bicycle and allow to explore
- Place rat on/near flowers and bushes, allow to explore
- Motorcycle (engine off): place rat on and near, allow to explore
- Soda: move toward rat, allow to sniff
- Nearby footsteps: move toward rat, gradually louder
- Harness: place a small harness on the rat then remove it
- Cellphone ringing: move toward rat, allow to sniff/explore

## GETTING TO KNOW YOU

A rat litter is generally between one and five pups that remain undisturbed with their mothers for four weeks before they begin their training. In the fifth week, the pups begin "socialization." We gently carry them around, introducing them to sights, sounds, smells and noises to get them used to the training environment and their handlers.

Handling a rat needs to be carried out firmly, yet with a gentle touch. Our rats do not like to feel exposed – they need to feel comfortable and secure, so they are held in a way that supports their large frame and are carried close to the human body. ■



## WHAT RAT?

APOPO's HeroRATs are African giant pouched rats (*Cricetomys Ansorgei*). This large muroid rodent is found throughout most of sub-Saharan Africa. HeroRATs are omnivorous and mainly nocturnal. Their long heads have large ears, and the rats get their name from cheek pouches that they use to store and carry food. They have a long bare tail, with a white tip. The body is covered with buff-colored, relatively long fur with pale under parts. These little heroes weigh about a kilo, which is too light to set off landmines. ■



# CLICK! CLICK!



Basic training begins at seven weeks. It's here that the young rats first hear clickers and receive rewards. Once the rats have accomplished basic clicker training, they are trained to discriminate between everyday smells and their target scent (either TNT odor or the smell of TB-positive sputum samples). From here on in, they will be trained as either mine-detection rats (MDR) or TB-detection rats (TBDR). The rats are introduced to target scents, then dummy scents are gradually added and the training area is expanded (MDR). Eventually the rats will be able to sniff out TNT or tuberculosis in minefields and the APOPO laboratories respectively. ■





# CARBON OFFSET



**JANET MARO**  
FOUNDER  
SUSTAINABLE  
AGRICULTURE  
TANZANIA

Trees absorb harmful carbon dioxide (CO<sub>2</sub>) from the atmosphere and store it as carbon in their stems and roots. They also convert CO<sub>2</sub> to oxygen, which they return to the atmosphere (carbon sequestration). A mature tree can contribute roughly to the sequestration of 1 ton of carbon dioxide per year.

In April, APOPO partnered with Sustainable Agriculture Tanzania (SAT), an NGO based in Morogoro, to begin a project in the nearby Uluguru Mountains to plant 50,000 trees in the next ten years to offset our CO<sub>2</sub>, mainly from transport. In 2016 the farmers trained by SAT aimed to plant 2,000 trees and set up tree nurseries in three mountain villages with over 4,000 seedlings each. They expect to plant a further 6,000 trees in 2017.

**“The forests hugely support the biodiversity in this area and play a vital role in safeguarding the climate by naturally reducing carbon. We are proud of APOPO taking this step to restore degraded landscapes and decrease the deforestation, which is driven by basic needs, such as subsistence farming and reliance on firewood for fuel.” ■**



## CARBON OFFSET PROJECT

**12**  
TYPES OF TREES

**60**  
FARMERS TRAINED  
BY SAT

**12,000**  
SEEDLINGS PREPARED  
IN 3 NURSERIES

**1,842**  
SEEDLINGS PLANTED  
IN 2016







**ABDALLA SAIDI**  
FARMER, MOROGORO

## BETTER SOIL

"Before the APOPO tree-planting scheme, I never realized that trees could help me other than for firewood. But SAT taught me the importance of trees for the environment. Now I properly prepare the tree seedlings and use sustainable farming techniques to help my soil. If I look after the trees, they will help me look after my family, so there will be enough food at home and I can send my children to school." ■



**DR. ROBERT MACHANG'U**, PROFESSOR OF  
VETERINARY MICROBIOLOGY, SOKOINE UNIVERSITY  
OF AGRICULTURE, TANZANIA

## SUA BELIEF FROM THE BEGINNING



Twenty years ago, while leading the Rodent Research Project at the Sokoine University of Agriculture (SUA) in Morogoro, Tanzania, a colleague, Ron Verhagen, came to me with an unusual request. A group of innovators from a humanitarian organization called APOPO, in Antwerp, Belgium had come up with an idea that rats could be trained to sniff out landmines – they wanted to know what we thought.

Having worked with rodents for many years by that time, for me the idea was logical. Rats are excellent sniffers and potential bio-sensors, and, as the saying goes, 'landmines stink!' The question was which rats would be suitable, and if they could be trained to respond to target scents by indicating to us when they had made a hit.

The team here saw the potential immediately and as a center of academic excellence we were keen to investigate. SUA has been a proud and constant source of support and encouragement to the project ever since.

The journey has been relatively smooth, though these things take time. APOPO moved the research project to SUA and we combined knowledge and experience to prove that rats are indeed excellent detectors of landmines, and later tuberculosis. The Tanzanian Defense Force who have a base nearby were cautiously supportive (where else would APOPO get the explosives to train the rats?) and the Mozambican Government also deserve credit for inviting, through the endorsement of SUA, giant rats into their mined lands to help solve their landmine problem. They were not disappointed and APOPO is now their preferred operator.

SUA and APOPO's other Tanzanian government partners have not been let down either. APOPO has become one of our projects of prestige, known globally, not only for the innovation, but also for its solid grounding in applied science and as a leader in vapor detection. Most of all we are proud that with the support of other international partners, institutions, donors, and the public, the project has resulted in thousands upon thousands of lives saved around the globe. ■





# MAKING NOISE

**JAMES PURSEY**  
HEAD OF COMMUNICATIONS



In 2016, we saw more media coverage of APOPO than ever before, with the publication of more than 700 global online and traditional press articles. This creates more support not just for APOPO but for the many other organizations and civil societies that are trying to bring an end to the two major global problems we also face – landmines and tuberculosis.

As our public profile grows, so too does a loyal online community that our expert team works hard to engage, support and develop. By the end of 2016, over 88,000 supporters across our newsletter and social media accounts were regularly sharing our news, carrying out fundraising and generally spreading the word.

APOPO is also honored to have received a multitude of prestigious awards over the years in recognition of the hard work of our staff. This year we came in at number 15 out of 500 NGOs in the NGO Advisor ratings; at the World Government Summit in Dubai we won the 'Most Innovative Solution' award over 15 other organizations; once again we were ranked as a top-rated nonprofit by GreatNonProfits; and GlobalGiving named us 'Top-Ranked' and 'Vetted Organization' grabbing the attention of many more potential supporters.

Make sure you go to our website and sign up for our newsletter, and follow us on Facebook, Twitter and Instagram. You can also donate and adopt on our support pages. ■

## Media appearances

## Facebook followers

## Twitter followers

## Website users

## Newsletter subscribers

## MARKETING PARTNERS

APOPO is indebted to specialists from the marketing and media sector, who have kindly donated their time, skills and professional expertise.



	2014	2015	2016
Media appearances	121	388	736
Facebook followers	18,843	30,671	43,908
Twitter followers	3,035	4,728	5,921
Website users	83,463	192,242	136,742
Newsletter subscribers	8,956	15,162	21,006



## TOP- RANKED BY GLOBAL GIVING

APOPO is honored to have received a multitude of prestigious awards over the years in recognition of the hard work of our staff. APOPO participated in a Global Giving year-end crowd-funding campaign, with matched giving from the Bill and Melinda Gates Foundation. The campaign raised over \$52,000 for APOPO, and APOPO received more individual gifts than any other organization resulting in being 'top-ranked' by Global Giving. This year APOPO also came in at number 15 out of 500 NGOs in the NGO Advisor ratings; at the World Government Summit in Dubai we won the 'Most Innovative Solution' award over 15 other organizations

# ADOPT-A-RAT

APOPO re-launched its flagship fundraising service, the HeroRAT adoption, just in time for the 2016 holiday season. Over the past two years we have listened carefully to the feedback of our supporters, and we're excited to deliver the changes demanded by our fans.

We've gone back to real rats, and there are three of our amazing little heroes up for grabs. With the new adoption experience, donors receive a welcome pack stuffed with exciting facts, pictures and stories, an adoption certificate and a monthly impact update featuring statistics on their adopted HeroRAT's real-life performance as well as the latest pictures and video from the field.

Our supporters have warmly welcomed the new adoption program, with more than 1,200 new donors from eight countries signing up to date. APOPO would like to extend our thanks to all of our thousands of HeroRAT adopters new and old for your generous support.

Remember, you can adopt a rat or gift one to a loved one by making a one-off payment or monthly installments.

**TO ADOPT A RAT GO TO  
[WWW.APOPO.ORG/ADOPT](http://WWW.APOPO.ORG/ADOPT)**

FOR YOUR EYES ONLY!

TOP SECRET



### MARCOUS

is a bundle of energy and an elite mine detection rat based in Siem Reap, Cambodia. A real character with a steely determination, Marcous sniffs out explosives ninety six times faster than conventional solutions.

### CHEWA

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

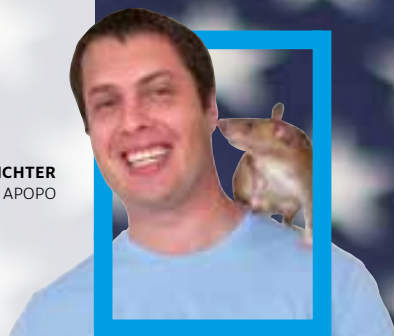
### IKEMBA

was the runt of the litter and almost never made it, but with the dedicated support of the APOPO team, she's now one of the best mine-detection rats in the business. Born in Morogoro, Tanzania, Ikemba deployed to Malanje, Angola, where she helps sniff out mines in one of the most mine-affected places in the world.



# APOPO U.S. OFFICE

**CHARLIE RICHTER**  
U.S. DIRECTOR AT APOPO



In 2016, APOPO U.S. continued to play a major fundraising and business development role focused on U.S. based donors and partners. The office was critical in securing funding for the upcoming 2017 expansion of its TB Program to Ethiopia, where APOPO expects to detect at least 1,200 additional TB patients a year who are missed by the local clinics or living in crowded prisons. APOPO U.S. is also excited to have welcomed new Board Member Kristen Davis, who has deep networks and an impressive array of experience, including serving as the IT Director of the International New York Times. ■

## A FANTASTIC SOLUTION

**"I've been a huge APOPO fan since I first adopted a birthday HeroRAT for my father. It is an honor to join the board of APOPO U.S. With decades of IT experience, I will focus on helping APOPO modernize and streamline its data systems."**

**HeroRATs are a fantastic low-cost solution to detect tuberculosis and landmines. Sharing their cost-saving value through efficient, real-time data systems should help APOPO build loyal stakeholders and increase its reach and impact."**

**KRISTEN DAVIS** FORMER IT DIRECTOR OF INTERNATIONAL NEW YORK TIMES

# APOPO SWISS FOUNDATION

The newly formed APOPO Foundation in Geneva had a busy year. The Swiss office pursued its role of liaison within the Mine Action and health sectors, creating opportunities with major international stakeholders and agencies such as the WHO and the Global Fund, and supporting APOPO's long-existing partners such as GICHD.

Strengthening relationships with influential donors like the Philanthropic Foundation Firmenich Family and building on new local partnerships like with the City of Geneva, remains at the core of APOPO Foundation's roots. Convinced by the need of mutually beneficial relationships with the private sectors, the Foundation put together a tailored corporate package to work with companies that are equally motivated to promote positive social impact.

APOPO Foundation is also dedicated to improving APOPO's national visibility resulting in increased media attention with media heavyweights La Tribune de Genève, l'Agefi, Le Matin in Switzerland and Le Monde and Le Figaro in France.

Keeping in line with the local social innovation ecosystem, APOPO Foundation initiated the creation of the Swiss Fund-raising Group, a dialogue platform for respected local innovators such as International Bridges to Justice designed to help build synergy and tackle societal and humanitarian challenges together. The APOPO Foundation is increasingly present within the European social entrepreneurship sector through



**ANNA BOUCHIER**  
EXECUTIVE DIRECTOR  
SWITZERLAND

its long-standing relationship with Ashoka. APOPO was notably one of the 36 out of 1,200 social organizations selected as a 'UBS/Ashoka Social Innovator' in September and was elected a member of the European Venture Philanthropy Association in December 2016.

## EDUCATION INITIATIVE

APOPO Foundation launched a local program, the Education Initiative. This is an awareness campaign designed for schools to illustrate how science and entrepreneurship can be vectors of positive humanitarian global change. In partnership with the City of Geneva, APOPO Foundation met more than 1,000 students aged 8 to 19 to present the HeroRATs, the positive impact they have on the world and how the dream of a few can influence the lives of many. ■



# 20 YEARS OF APOPO A FASCINATING JOURNEY

Right at the start of our journey, when we came up with the idea of using trained rats to address the global landmine issue, you can say that we met with some 'resistance'. Not only the mine action professionals, but even personal friends thought we had gone over the edge. They thought technology should solve it, not rats ("Are you serious?!").

Detection animals at the time were not considered technology; they were more a mix and match of undocumented methods and efforts mostly claiming flawless, but unverified results. During these first 10 years, there was a major investment in science and technology against landmines, but hardly any new technologies made it to the field.

We aimed to go the route of empirically based, peer-reviewed applied research. The first ten years of our journey were characterized by explorations and experiments, collaborative research with analytical chemists and behavioural experts, slowly building the science behind all the methods. And we developed systems to detect landmines, which were trialed, standardized and independently accredited. After the initial research effort, our focus moved to expansion, cost efficiency and sustainability and the next 10 years were about operations: clearing minefields and detecting TB patients, improving and saving the lives of the vulnerable communities plagued by war and disease.

Now that we have a cost efficient and effective technology that is implemented by partners and integrated with current technologies, we need to strategize how we can have the most positive impact for the least possible resources and scale up in other countries. But persisting scepticism and the global social economic climate poses an extra challenge to funding. However, milestones such as helping towards the Mine Free announcement of Mozambique in 2015 are what make this journey worthwhile and hopefully help to convince the sceptics.

Looking to the future, with a massive global inflow of new technologies, will detection rats still have a place to contribute to society? The reality is that most landmines are still detected by the slow and painstaking methods using metal detectors. TB diagnostic technology has greatly improved accuracy, but the unacceptable proportion of missed cases has hardly changed. And that's just landmines and tuberculosis. APOPO also firmly believes that further researching and optimizing the capabilities of the detection rats will identify other areas where the rats can address some of worlds persisting problems; that studying the behaviour of the rats will improve the synergy between the animals and their trainers; that developing this local technology and building skills provides a sustainable economic model which benefits the affected societies at large.

I'd like to thank all our donors and the great support from many individuals throughout our life saving journey. ■



**CHRISTOPHE COX**  
CEO APOPO

**I'D LIKE TO THANK  
ALL OUR PARTNERS  
AND DONORS.**





## BALANCE SHEET IN EURO

# FINANCIAL UPDATE

ASSETS	2016	2015
<b>Fixed Assets</b>	-	<b>474,794</b>
Furniture, vehicles and equipment APOPO	-	361,431
Furniture, vehicles and equipment under partnerships	-	113,363
<b>Current assets</b>	<b>4,220,830</b>	<b>2,866,020</b>
Current receivables	408,408	481,445
Other assets	579,131	-
Cash and equivalents	3,233,291	2,384,575
<b>TOTAL ASSETS</b>	<b>4,220,830</b>	<b>3,340,814</b>
LIABILITIES		
<b>Net capital</b>	<b>2,027,720</b>	<b>1,897,264</b>
Funds of the organization	328,046	328,046
Retained Earnings	1,699,674	1,569,217
<b>Long term liabilities</b>	<b>2,189,379</b>	<b>1,457,233</b>
Deferred Income (Grants)	2,189,379	1,457,233
<b>Current liabilities</b>	<b>3,731</b>	<b>(13,683)</b>
Current payables	3,731	(13,683)
<b>TOTAL LIABILITIES</b>	<b>4,220,830</b>	<b>3,340,814</b>

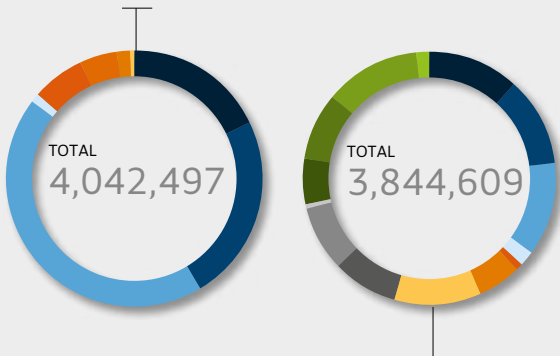
## PROFIT&LOSS STATEMENT (EURO)

	2016	2015
Total Income	4,025,444	6,422,413
Total Operational Expenses	2,309,359	1,945,875
Total Personnel Expenses	1,478,516	2,729,815
Depreciation	55,126	675,729
Other costs	12,758	289,058
<b>Operating Result</b>	<b>169,685</b>	<b>781,936</b>
Financial Result	(39,743)	(77,383)
Extraordinary Result	514	5,123
<b>Net Income</b>	<b>130,457</b>	<b>709,675</b>



# DONATIONS & SUBSIDIES 2016 IN EURO\*

Public fundraising	727,101
Government grants	953,300
Foundations	1,770,730
International institution grants	48,577
Corporate grants	261,072
Research grants	200,836
Other unrestricted income	63,830
Financial income	17,053



## EXPENSES AND INVESTMENTS 2016 PER ACTIVITY IN EURO\*

Mine Action Mozambique	451,462
Mine Action Angola	439,082
Mine Action Cambodia	457,256
Mine Action Zimbabwe	80,736
Mine Action Colombia	28,888
Training Mine Detection Rats	211,346
TB program Tanzania-Morogoro	424,990
TB program Tanzania-Dar	325,038
TB program Mozambique	318,947
TB program Ethiopia	22,489
Research and Development	226,893
Management costs Tanzanian office	327,340
Managament cost International offices	473,511
Exchange loss	56,631

\* Cash based



# BUILDING ON SUCCESS

**BART WEETJENS**  
APOPO FOUNDER

Since 1997 APOPO has researched, developed and pioneered the innovative use of African giant pouched rats in landmine detection and other applications, and has become a world leader in scent detection technology.

It is wonderful to see how twenty years after the initial research, APOPO continues building on its successes, increasing operational impact in both mine action and early detection of tuberculosis and allowing people to get on with their lives free of terror and disease.

2016 has been progressive year with operational expansion into new countries, notably Zimbabwe and Colombia for mine action, and Ethiopia for tuberculosis. APOPO continues to provide a highly cost-effective, impacting, appropriate solution to the most difficult, expensive and dangerous detection tasks facing countries with the biggest needs.

Who would have thought twenty years ago that training rats to sniff out landmines would enable close to a million subsistence farmers to return to their homesteads and live a life free from fear? Well, just a tiny group of researchers at University of Antwerp and Sokoine University of Agriculture cherished this initial vision. They joined forces and set off on a remarkable journey of collaboration and innovation, driven by a sense of care and compassion for the most vulnerable on the planet, diligently and persistently defeating the odds.

How many lives will HeroRATs save in the coming twenty years? ■



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## SUPPORT OUR WORK

### HeroRAT Adoption Program

For 6€ per month or more you can contribute to APOPO's life saving mission and receive updates of your own HeroRAT

[www.apopo.org/adopt](http://www.apopo.org/adopt)

You can also make a donation at:  
[www.apopo.org/donate](http://www.apopo.org/donate)

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