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theguardian

GM mouse created to detect landmines

The genetically modified mouse is five hundred times more sensitive to the smell of explosive than a normal mouse

Alok Jha, science correspondent
guardian.co.uk, Monday 15 October 2012 10.32 EDT



The GM mouse is exceptionally sensitive to DNT, a similar-smelling version of the TNT used in landmines.
Photograph: Feinstein Lab, Hunter College

Scientists have genetically modified mice to enable them to sniff out landmines. They hope the GM mouse, known as MouSensor, could one day become a useful tool to help deal with the dangerous legacies of past wars.

More than 70 countries are contaminated by landmines, a constant reminder of previous conflicts. "Long after wars have ended, communities are still impeded from going back to their normal, daily activities because of all these mines still affecting their land," said Charlotte D'Hulst of Hunter College, New York, who led the team that developed the MouSensor.

One approach to clearing landmines is to use [HeroRats](#), giant pouched rats that are trained to sniff out landmines by the Belgian NGO, Apopo.

Two of these, with a human handler, can clear an area of 300 sq metres in less than two hours. It would take two people about two days to do the same. One disadvantage of the HeroRats system, however, is that the rats need nine months' training before they are ready for landmine detection.

D'Hulst wanted to improve on the HeroRats concept by creating a genetically modified "supersniffer" mouse, sensitive to the specific odour of the explosives in landmines, TNT.

Scientists recently found a receptor in the mouse's olfactory bulb (the collection of neurons in the nose that detects smells) which specifically recognised a chemical called DNT – a less explosive, but similar-smelling, version of TNT. D'Hulst modified a mouse's genes to give it a much larger proportion of DNT receptors in its nose compared with the nose of a normal mouse.

In a normal mouse's olfactory bulb, there are 10m neurons in total, with about 4,000 specialised for a particular odour. D'Hulst's GM mouse has 10,000 to 1m neurons specialised for DNT, increasing the animal's ability to detect the smell of the explosives 500-fold. She will present the latest results from her work this week at the [annual meeting of the Society for Neuroscience in New Orleans](#).

So far, the mouse has not been tested in the field and D'Hulst has yet to work out the best landmine-clearing protocol for her MouSensors. She said one approach might be to take advantage of the fact that the mouse would probably change its behaviour when it came across a landmine.

Given its extreme sensitivity to TNT, the mouse would probably have some sort of seizure when it sniffed explosives, said D'Hulst, because so many neurons in its olfactory bulb would be firing at once. And that seizure might be detectable by some device implanted into the mouse.

"We are thinking along the lines of implanting a chip under the skin of these animals that would wirelessly report back to a computer when the animal's behaviour is changing upon being triggered by a TNT landmine," said D'Hulst. Once the location of a landmine had been identified, a bomb-disposal expert could go in and neutralise it in the normal way. The mouse itself would be safe from the landmine, since it would be too small to trigger an explosion.

Ben Lark, head of the International Committee of the Red Cross weapon contamination unit, said biosensors such as the GM mice would only be one way of detecting landmines and only in certain situations.

"They wouldn't replace other means," said Lark. "There are three different types of approach: the manual approach, which is people with detectors; machines, such as a flail; and then you have biosensors – which are traditionally dogs. You never use one means on its own.

"The other thing is, the moment you have a minefield you have lots of mines together. If you have too many it saturates an area. I would assume if the mouse had such super-rodent powers it would be overwhelmed fairly quickly."

Developing the MouSensor technology to detect landmines is a proof of concept for D'Hulst. GM mice could be created to detect a range of other odours too, she said, for example to diagnose tuberculosis by sniffing compounds on the breath of sick individuals.

The bacteria that cause TB emit compounds that can be sniffed out in saliva samples, she said. However, developing a GM mouse that could detect them would not be a trivial task – researchers would first have to identify the neurons in the mouse's olfactory bulb that detected the TB odour in question (from the millions of possibilities in the mouse's nose) and then identify and modify the correct parts of the genome to create their desired biological sensor.

As for the landmine-detecting mouse, D'Hulst said she would need to carry out more tests and work with the NGOs involved in landmine disposal to work out the best way to develop the technology. "If we have to put a time on [testing in the field], we hope it will be within five years," she said.

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 Contributor

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prairie

15 October 2012 4:20PM

Now if they could create a GM mouse that can sniff out scum bags, we could use them in Washington.

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[Responses](#) (1)

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Aengil

15 October 2012 4:21PM

Given its extreme sensitivity to TNT, the mouse would probably have some sort of seizure when it sniffed explosives ... "We are thinking along the lines of implanting a chip under the skin of these animals that would wirelessly report back to a computer"

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That doesn't sound like a whole lot of fun for the mouse.

Granted, landmines aren't a whole lot of fun for anyone and there's always a good case for finding more effective ways of detecting and removing them, but it's hard to think that giving mice seizures is the way to go.



MrEurope

[Recommend?](#) (39)



15 October 2012 4:29PM

Response to [Aengil](#), 15 October 2012 4:21PM

- 1) The life of human beings is more important than the life of a mouse
- 2) The mouse would be killed in the process, merely perhaps distressed
- 3) The mouse would not even have been bred/born if it wasn't for this application (so its life would not have happened to begin with)

You gotta keep some perspective here ;)

[Responses \(5\)](#)[Report](#)[Share](#)**labellevue**

15 October 2012 4:34PM

Response to [MrEurope](#), 15 October 2012 4:29PM

i get your overall point but number three is a dumb argument.

[Recommend? \(41\)](#)[Responses \(0\)](#)[Report](#)[Share](#)**AdamTut**

15 October 2012 4:34PM

Every now and again, one has to stop and marvel at how far, how fast, molecular biology has come.

Gene cloning was first done in the 70s, well within the living memory of many scientists who are still active. It was an amazing breakthrough, but the original paper simply took two bits of bacterial DNA and stuck them together. That's now routine in undergraduate practicals. The first transgenic mice were reported in the early 80s.

Now here we are with the ability to predictively ramp up, 500-fold, the ability of a mouse to smell a specific chemical, by gene manipulation. I leave it to others to discuss the ethics of this (and there are clearly issues), but as a technical achievement, it's just astonishing.

What's even more astonishing, however, is that it isn't - advances like this have become almost commonplace. Students today accept this kind of thing in the same way as they accept iPADSs and Skype - never having known a world without them, they take them for granted.

So I wonder what it will take to astonish today's generation (other than leaping from a capsule 24 miles up in air)?

[Recommend? \(11\)](#)[Responses \(0\)](#)[Report](#)[Share](#)**xxxFred**

15 October 2012 4:41PM

Response to [prairie](#), 15 October 2012 4:20PM

Now if they could create a GM mouse that can sniff out scum bags, we could use them in Washington.

And if they could sniff out cheats in football it would bring a new meaning to Sir Alex Ferguson's famous phrase: "It's

[Recommend? \(4\)](#)[Responses \(0\)](#)[Report](#)[Share](#)

squeaky-bum time"!



Insolito

15 October 2012 4:41PM

It's an amazing achievement, and mice are less important than humans, but seriously, we're using mice to get landmines?

Why not just roll tortoises until they hit one and explode? Or drop cats from helicopters?

I'm not serious, but it's a bit unpleasant, no?

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PgTips

15 October 2012 4:48PM

Response to [MrEurope](#), 15 October 2012 4:29PM

The life of human beings is more important than the life of a mouse

Only to a human being - you gotta keep some perspective here ;)

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Subterranean99

15 October 2012 4:51PM

I always find it interesting that people are usually blasé about animal rights in regard to mice.

Because of their small size, people are inclined to dismiss them as 'unimportant' in comparison to larger animals such as cats and dogs, and hence less likely to provoke a reaction from people who care about animal rights when they are used in such a fashion. Rodents are seen by the public as dirtier, more prevalent and therefore more disposable.

Mice are actually highly intelligent and sensitive animals- which is precisely why they are used so widely for animal testing and for initiatives such as this.

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tipatina

15 October 2012 4:54PM

i got a tattoo of my girlfriends face done to remind me of our sexy times....my wife was absolutely livid when she found out.....it was on her back..

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tipatina

15 October 2012 4:55PM

oops wrong thread.....

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PgTips

15 October 2012 5:08PM

[Recommend?](#) (6)

[Responses](#) (0)

Response to [Subterranean99](#), 15 October 2012 4:51PM

Because of their small size, people are inclined to dismiss them as 'unimportant' in comparison to larger animals

I completely agree, but don't forget the US tried to get dolphins to blow themselves up detonating mines (didn't work, dolphins just buggered off as soon as they got the chance).

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Kevin T. Keith

15 October 2012 5:11PM

Response to [Subterranean99](#), 15 October 2012 4:51PM

"Mice are actually highly intelligent and sensitive animals- which is precisely why they are used so widely for animal testing and for initiatives such as this."

No, it isn't.

Mice are used in (some) drug and toxicity testing because they're cheap to raise in large numbers and their tissues respond to drugs and toxic chemicals similarly to human tissue. Nobody cares what the mice feel about it (which is likely: nothing). They're being used in this project because, again, they're cheap and easy to work with, and the genetic modification they carry happens to make them capable of sensing explosives - they don't get a choice in the matter, it just happens because of their genetics.

It's one thing to be against needless harm to animals (though this project seems far from needless). But anthropomorphizing them unrealistically isn't an argument against anything.

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peterthompson49

15 October 2012 5:17PM

[C](#)

you can almost hear the brains of the animal righters who are also against GM and the war in Afghanistan building up to bursting point.

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[Responses](#) (0)

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peterthompson49

15 October 2012 5:18PM

[C](#)

Response to [MrEurope](#), 15 October 2012 4:29PM

I wouldn't expect any perspective from those who disagree with this on grounds of animal rights. They don't do perspective, they only trade in absolutes.

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lizzysaurus

15 October 2012 5:21PM

Hero Rats?!!!

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Further proof that RATS ARE AWESOME!!!!



MisterMattBlack

15 October 2012 5:21PM

That's nothing I know a mouse that can drive a tank.

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peterthompson49

15 October 2012 5:23PM

C

Response to [lizzysaurus](#), 15 October 2012 5:21PM

They may well be, but isn't this about mice?

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peterthompson49

15 October 2012 5:24PM

C

Response to [MisterMattBlack](#), 15 October 2012 5:21PM

Is it a very small tank or a very big mouse?

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lizzysaurus

15 October 2012 5:29PM

Response to [peterthompson49](#), 15 October 2012 5:23PM

Yes - but the Hero Rats initiative is referenced in the article as the premise of the concept. They wanted to improve on the work being done by Hero Rats.

My comment is no where near as random as the guy accidentally talking about his tattoo!

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peterthompson49

15 October 2012 5:30PM

C

Response to [lizzysaurus](#), 15 October 2012 5:29PM

fair point. Do you think he wandered in by mistake or just wants to spread the joke?

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tdlx

15 October 2012 5:36PM

Failed experiment.

As soon as the mouse begins to realise every time it sniffs slightest amount of TNT it has a seizure it is obvious going to do its best not to encounter TNT.

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lizzysaurus

15 October 2012 5:39PM

[Recommend?](#) (2)

[Responses](#) (1)

Response to [peterthompson49](#), 15 October 2012 5:30PM

A little of column A, a little of column B

I'm going to get a tattoo of a Hero Rat to raise money for the charity...

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Spudgun88

15 October 2012 5:39PM

Response to [tdlx](#), 15 October 2012 5:36PM

Even if that was the case, if you had enough mice it wouldn't really matter.

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peterthompson49

15 October 2012 5:58PM



Response to [lizzysaurus](#), 15 October 2012 5:39PM

will it be wearing a little tin hat and have its fingers in its ears? Do they have fingers?

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PgTips

15 October 2012 6:00PM

Response to [Kevin T. Keith](#), 15 October 2012 5:11PM

anthropomorphizing them unrealistically isn't an argument against anything

It's actually a lot fairer to animals to anthropomorphize them - to make their behaviour sympathetic by likening it to our own - than it is to make them seem alien and 'other', by saying stuff like:

Nobody cares what the mice feel about it (which is likely: nothing). They're being used in this project because, again, they're cheap and easy to work with

. That's much worse, in my opinion: for "mice", just substitute any other group you want to attack (blacks, Jews etc.), and you'll see it works the same way.

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MisterMattBlack

15 October 2012 6:00PM

Response to [peterthompson49](#), 15 October 2012 5:24PM

Response to MisterMattBlack, 15 October 2012 5:21PM

Is it a very small tank or a very big mouse?

Sorry mate but that's top secret.

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[Responses \(0\)](#)

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KopiteEddie

15 October 2012 6:02PM

[Recommend? \(1\)](#)

[Responses \(0\)](#)

Landmines? They might detect landmines, but they can't resist chocolate in a mouse trap!

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PlanetGeli

15 October 2012 6:15PM

Before anyone gets too excited about this, try reading Amber Mark's Headspace (sniffer Bees and the surveillance society).

Some very dodgy security services doing some very dodgy things with olfactory science.

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[Responses \(0\)](#)

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jstaguy

15 October 2012 6:21PM

Let me get this straight:

- People can put a rover on another planet, make that rover send us email, pics, conduct science experiments on another planet, send us results, analyze chemicals, even locate that rover exactly on the landscape of an unknown terrain, but we can use that rover or other similar technology to find land mines?

- And we have to depend on rats to solve our problems here?

Is it just me, or does it look like we've got the wrong people thinking about the landmine problem?

Looks like no one really cares about the landmine problem - and these scientists that works on rats - just want to get written about - so that they can get funding - and no one will remember how much money was spent on rats - and how many land mines they defused.... just more baloney (not the rats' science - just that we still haven't solved the land mine problem)

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[Responses \(0\)](#)

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peterthompson49

15 October 2012 6:32PM

[C](#)

Response to [PgTips](#), 15 October 2012 6:00PM

oh please.... There are so many things wring with this that it is hard to know where to start. No one is "attacking" mice and if you want to play that game then I could accuse you of equating blacks and Jews with rodents.

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NigelRG

15 October 2012 6:34PM

I am not an animal rights activist. I would far rather new drugs, etc. were tested on animals, rather than humans. However, I went to a talk given by a drug company scientist, and came away rather disgusted. He dropped statements like: "We weren't sure of the effects of (the new drug) on (a body organ), so we took a couple of crates of mice and ..." I wonder how many crates of mice went into this test-work?

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[Responses \(0\)](#)

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**grazieuncazzo**

15 October 2012 6:46PM

Response to [MrEurope](#), 15 October 2012 4:29PM

Why don't they just genetically modify a human?
following Mr.Europe's "rationale"

1. The life of a "real" human is more important than the life of a GM human
2. The GM human would be killed in the process, merely perhaps distressed
3. The GM human would not have been bred/born if it wasnt for this application (so its life would not have happened to begin with)

Mice are living creatures that suffer and feel pain just like humans.

Humans make the mines and plant them so let them clear them or easier still ban the damn things.....

[Recommend?](#) (5)[Responses](#) (0)[Report](#)[Share](#)**MiltonWiltmellow**

15 October 2012 6:52PM

Developing the MouSensor technology to detect landmines is a proof of concept for D'Hulst. GM mice could be created to detect a range of other odours too, she said, for example to diagnose tuberculosis by sniffing compounds on the breath of sick individuals.

Dear Mousekind,

[You may ask what you've done to us to be treated so cruelly.](#)

We are humans.

We kill one another in countless clever ways: with sticks and stones, with poisons. with swords, with knives, with ropes, with bombs, with radiation, with water, with tanks, with fists, with fire, with bullets ... well, the list could go on almost forever for this is what we humans do especially well.

We often have what we call "a good reason" for for our monstrous destruction. Other people might do horrible things to us so we must do horrible things to them first. We call this "war."

Bombs, hidden in the earth, are set to explode when a living creature (including sheep and dogs and other people's children) steps upon one. Sometimes we even design these devices as if they're toys so they will lure other people's children into maiming themselves.

You cannot know how terribly ruthless we can be. It's only in the last few centuries that we've developed these devices, but you can be sure that had we developed them a thousand years ago, we would have found some good reason to use them then too.

We always have a good reason for doing such horrible things to one another and to all the creatures of earth.

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Our reason is always the same in the end.

We humans believe the Earth -- and indeed everything in Creation -- are here solely for our benefit.

We seem unable to see ourselves as part of Creation. This is our greatest flaw.

We cannot imagine that your life is as important to you as ours are to ourselves. And even if we could imagine it, many of us wouldn't care. Thus we ruthlessly despoil our planet -- and all life forms unfortunate enough to get in our way.

If it is any consolation, our arrogant assertion of supremacy and our clever wizardry will soon be our undoing.

Then the Earth will get back to doing what she does best: creating vibrant, multifarious life in all it's miraculous incarnations.

With respect,

Milton



DrCJ

15 October 2012 6:55PM

Well that's just terrific ... I mean I will sleep that much easier tonight ... the mouse sniffs the target, and promptly has a seizure. But since mice are flighty little chaps and spend half their lives having near-seizures I would suspect quite a few 'false positive' reactions. Not to mention some other 'slight' problems I can envisage ... like where are the mine fields? Hopefully not somewhere too cold, or too hot, or too buried, or too grassy ... maybe nice, like a cupboard perhaps? With cheese reserves.

No, I'm afraid this is a case of 'scientist and/or publicist spots opportunity for stupid story and thereby justifies future grant'.

Next!!

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PgTips

15 October 2012 7:05PM

Response to [peterthompson49](#), 15 October 2012 6:32PM

if you want to play that game then I could accuse you of equating blacks and Jews with rodents.

Yes, you've got it. I'm equating blacks with rodents, me with rodents, Jews with rodents, you with rodents. Rodents aren't a metaphor for "something unpleasant", they're sentient beings.

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peterthompson49

15 October 2012 7:51PM



there you are, quoting something I didn't say. But you're right, I don't happen to like rats much and when we had some in our garden and infesting the house I killed them. Does that make me

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a mass murderer or someone protecting the health and well-being of my family? Being sentient does not mean they are equal in status to human life.



Neurostrike

15 October 2012 8:50PM

They could at least give it some mouse-sized body armour.

Cruel b*st*rds.

[Recommend?](#) (4)

[Responses](#) (0)

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Killertomato

16 October 2012 12:46AM

Response to [PgTips](#), 15 October 2012 4:48PM

Which we all are. Get some perspective yourself.

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PgTips

16 October 2012 1:31AM

Response to [peterthompson49](#), 15 October 2012 7:51PM

I don't happen to like rats much and when we had some in our garden and infesting the house I killed them. Does that make me a mass murderer or someone protecting the health and well-being of my family?

This is a strawman argument.

Being sentient does not mean they are equal in status to human life.

From a human perspective, maybe not. It's difficult to put into practise, although morally I think they ought to be.

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31428571J

16 October 2012 1:43AM

In a normal mouse's olfactory bulb, there are 10m neurons in total, with about 4,000 specialised for a particular odour. D'Hulst's GM mouse has 10,000 to 1m neurons specialised for DNT, increasing the animal's ability to detect the smell of the explosives 500-fold. She will present the latest results from her work this week at the annual meeting of the Society for Neuroscience in New Orleans.

Crickey, 'high end' science to counteract 'low end'.

Wiki states that '*pressure, movement, **sound**, magnetism and **vibration***' can set them off.

So why not clear the area and blast some high wattage amplified music (for example)?

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[Responses](#) (1)

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bloggsie45

[Recommend?](#) (1)



16 October 2012 2:05AM

The bacteria that cause TB emit compounds that can be sniffed out in saliva samples, she said.

If this could be made to work with a reasonable level of confidence, English badgers will be forever indebted to you. (If you ever get approval to use the method from the tribes of corrupt half-wits currently installed in the Palace of Westminster)

[Responses \(0\)](#)[Report](#)[Share](#)**MISIPIMANX**

16 October 2012 2:30AM

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[Recommend? \(1\)](#)[Responses \(0\)](#)[Report](#)[Share](#)**RobCampbell**

16 October 2012 4:00AM

From what I read they seem to have simply made the DNT receptor express more widely in the olfactory bulb. That's a rather surprising thing to do since 4 years ago it was shown that if you very heavily over-express (which I guess they probably haven't done) one particular receptor then the animal becomes *unable* to smell the ligands of that receptor:

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2732586/> Still, it doesn't seem like a productive route.

I would have thought it would make more sense to, say, recruit the pheromone pathway. Replacing the DNT receptors for whatever are those that attract male mice to female mice. That way, male mice would be trying to mate with land mines and so would seek them out. Just a thought...

[Recommend? \(0\)](#)[Responses \(0\)](#)[Report](#)[Share](#)**ashleyj722**

16 October 2012 4:00AM

I'm sure these mice won't escape and breed with the local population right?

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16 October 2012 4:02AM

i.e. I should expand. There is already evidence that the mice would not have a seizure if they smell the compound in question. The authors of the study should have known that.

[Recommend? \(0\)](#)[Responses \(0\)](#)[Report](#)[Share](#)**RobCampbell**

16 October 2012 4:08AM

@ashleyj722

I really doubt it. These mice have had their sense of smell, which

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is so important to them, greatly degraded. They probably wouldn't survive long in the wild. Even if they do breed, nothing too terrible is going to happen. They'll just smell the world differently and most likely the artificial modifications will be selected against over a few generations. As it happens, the genome is in any case rife with deleted and degraded olfactory receptor genes.



thepressedfree

16 October 2012 9:40AM

Response to [31428571J](#), 16 October 2012 1:43AM

because it's not a case of "all of the above" it can be one or more of the above or none of the above.

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[Responses](#) (0)

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thepressedfree

16 October 2012 9:42AM

Response to [ashleyj722](#), 16 October 2012 4:00AM

and if they do?

does being able to smell explosives confer any advantage to mice?

if not they'll have no advantage and won't spread their genes very much.

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[Responses](#) (1)

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Aengil

16 October 2012 11:09AM

Response to [MrEurope](#), 15 October 2012 4:29PM

- 1) The life of human beings is more important than the life of a mouse
- 2) The mouse would be killed in the process, merely perhaps distressed
- 3) The mouse would not even have been bred/born if it wasn't for this application (so its life would not have happened to begin with)

You gotta keep some perspective here ;)

[Recommend?](#) (2)

[Responses](#) (0)

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Like I said, there's always a good case for finding more effective ways of detecting and removing landmines.

But to take your points in reverse, the third suggests that if you breed something for a purpose anything goes, which I would hope is self-evidently not a good argument, the second rather misses the point (who said it *would* be killed?), and the first, well...

The life of human beings is more important than the life of a mouse, you say. And I imagine most human beings would agree with you. But the implication is that the statement justifies doing *anything* to mice if it might help preserve human life. Indeed, as a general statement, it justifies doing anything to any life

considered less important than that of humans, and even, doing anything to *some* humans if they're considered less important than *other* humans - like, oh I don't know, putting mines in the ground to blow them up...

But the point I'm making is that mere self-preservation does not (or at least, should not) justify any action. As far as animal rights goes, it's obviously a highly contentious area, and I'm not going to pretend to have any authority over what anyone else should think. But I don't think it's unreasonable to suggest that at the very least, if we're going to kill, torture, or even merely distress animals for our own purposes, we should have a very solid reason to do so and a lack of feasible alternatives - to the extent that the animal option in question is the only practical effective approach.

In the case of landmine detection, we do have alternatives, and I continue to think it would be quite hard to argue that giving mice seizures is the only practical effective approach to the problem.

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