

# Catnip

## A legal feline high

Tom Parsons explores the properties and effects of catnip, alongside the ethics of its use

### The structure of the catnip compound

The catnip plant *Nepeta cataria*



*Nepeta cataria*, or the catnip plant, is known for its stimulant effect on cats. The active compound in the plant – (*cis,trans*)-nepetalactone (Figure 1) – has a five-membered ring that is fused to a six-membered ring. This ring contains a cyclic ester, or lactone, and a C=C double bond. It also has three chiral carbons (indicated by the wedges).

The *cis* in (*cis,trans*)-nepetalactone refers to the stereochemistry of the ring junction, where both hydrogens are pointing in the same direction. The prefix *trans* indicates that the methyl substituent is on the opposite side of the molecule from the lactone group. Only the (*cis,trans*)-isomer affects cats. This is a further example of how different stereoisomers can have different biological effects. This was famously illustrated by thalidomide, which was prescribed for morning sickness during pregnancy but caused deformities in the fetus – an effect caused by only one of the optical isomers of the drug.

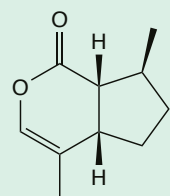


Figure 1 (*cis,trans*)-nepetalactone, the active ingredient in catnip

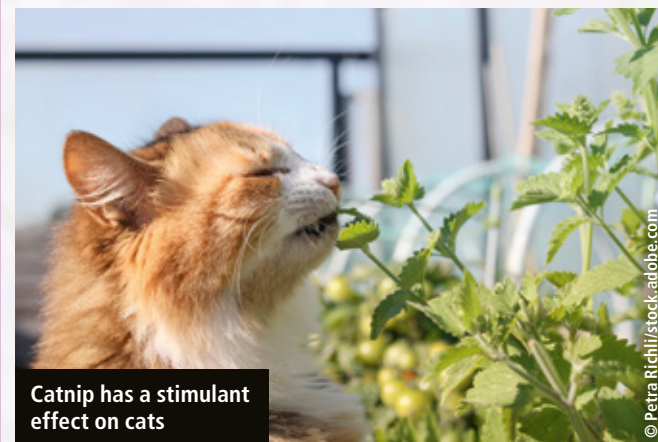
### What does the catnip compound do?

(*cis,trans*)-nepetalactone and related compounds are produced by plants to act as insect repellents. However, the structure of (*cis,trans*)-nepetalactone is similar enough to feline sex hormones that it generates a similar response in most cats. This explains the stimulant effect the plant has on cats – typically kicking, running, rolling, licking, biting and increased vocal activity. This is, however, a genetic trait, so not all cats react to catnip.

The compound has little effect when ingested, but when cats eat catnip leaves the volatile compound from the leaves is released. The lactone stimulates the olfactory centres of the brain, meaning that simply inhaling or smelling the catnip can stimulate cats. There are other known chemicals that have similar structures to cat pheromones and exhibit behavioural effects on cats. For example, Calvin Klein's 'Obsession for men' perfume is said to contain civetone, a pheromone found in civets, and can be used to attract big cats, such as tigers. It has been used to help lure people-eating big cats away from populated regions in India, to prevent further deaths.



A civet



Catnip has a stimulant effect on cats

### Isolating the catnip compound

Steam distillation (Figure 2) is commonly used to extract (*cis,trans*)-nepetalactone from catnip. This technique is also used for extracting other natural products, such as limonene from lemons.

Unlike in standard distillation, the extracted compound does not require a lower boiling point than water – (*cis,trans*)-nepetalactone has a boiling point of 271 °C. Instead, the steam vapour carries the natural product extract with it as it travels from the reaction mixture to a condenser. The condensate is a

mixture of two layers: the low-density (*cis,trans*)-nepetalactone on the top, with the water underneath. A further separating procedure is then performed.

The yields for this process are typically very low, with single-digit percentages of the product mass compared with the mass of the starting material. Synthetic methods to manufacture natural products like (*cis,trans*)-nepetalactone are therefore under development.

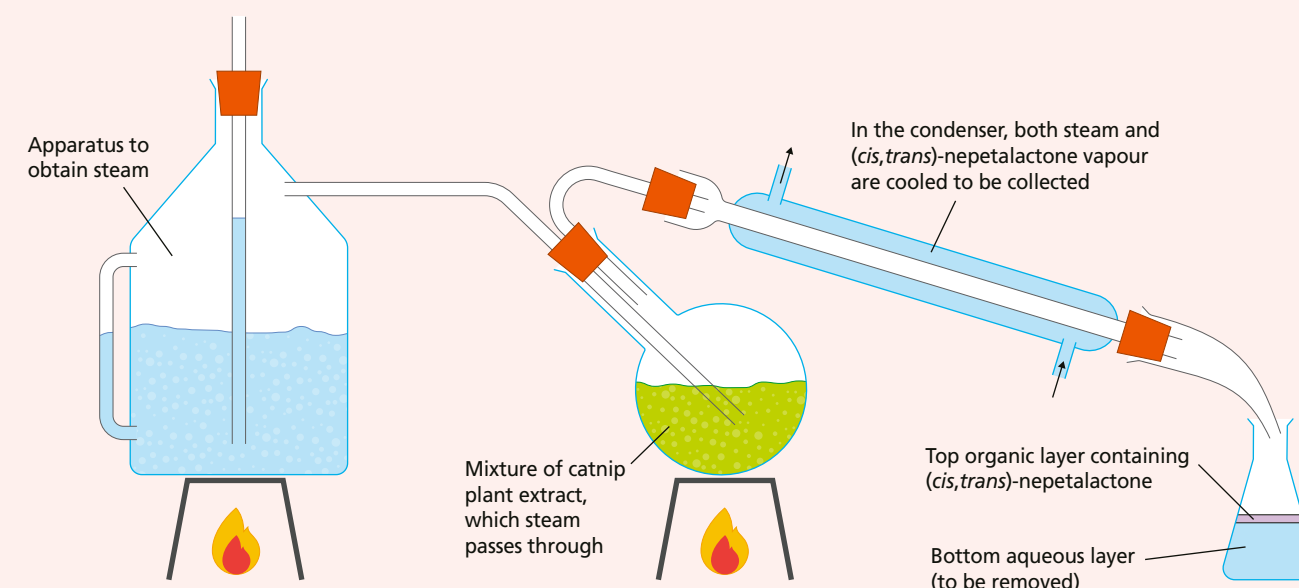


Figure 2 A typical experimental set-up for steam distillation

### Ethics of using catnip

I have exposed my cat, Dora, to catnip on many occasions. I usually use catnip to help her get used to new things in the house – such as a new cat-scratcher – but is this ethical? There are debates about whether cats should be given catnip, mostly around the issue of informed consent. Can a cat consent to having its consciousness altered?

Under UK law cats can be considered property (Animal Welfare Act 2006) and owners have a duty of care for their cats – meaning that owners should decide what is best for their cat. So, should an owner be able to drug their cat with the catnip plant? Catnip itself is not addictive and has minimal negative side effects with low exposure, so most owners view the drug as harmless fun. In any case, the approach I take is to allow the cat to 'opt out', so they can decide for themselves if they want to use catnip, rather than forcing it upon them. However, in my experience, the cat has always sought the drug out and indulged even when they had the opportunity not too.

The author's cat Dora enjoying her catnip-sprayed mouse toy



ChemistryReviewExtras

Download this poster at [www.hachettelearning.com/chemistryreviewextras](http://www.hachettelearning.com/chemistryreviewextras)

Tom Parsons is a qualified chemistry teacher, who is a full-time A-level chemistry and GCSE science and maths tutor.