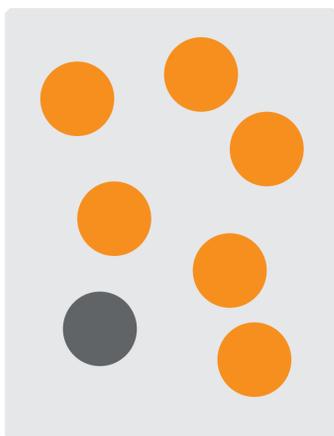


How do we make new cancer drugs?



1 Choosing a target



Your cancer drug needs to act on a 'target' in the cell – the fault that is driving the cancer.

Often these will be signals within cancer cells – which have been permanently switched on, or turned up too high. These signals can push a cancer cell to divide too fast.

We often want to block these faulty signals to stop cancer cells from dividing and if possible to trigger their death.

The more we know about a target protein and its structure, the better we can design drugs to block its action.

Recent advances in biology, in areas such as genomics and computational biology, have hugely increased our knowledge of target molecules and their precise structures.

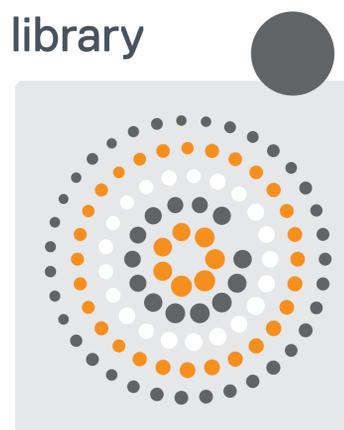
2 Screening a compound library

Your first step is to find a molecule that binds to the target.

We start in our compound library – a collection of thousands of molecules that have properties that make them useful starting points for a drug.

We perform 'high-throughput screening' using a robot to rapidly test hundreds or thousands of molecules at a time, to see if we have anything in our library that will bind to our target.

We might screen seven million molecules before we select one as the starting point for the new drug.

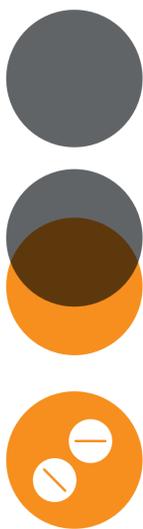


3 Optimisation

Once we've found a molecule that looks promising, our chemists need to optimise it before it becomes a drug.

We need to modify the molecule by adding new chemical groups to it to give it all the properties we need in a future drug. For example we might want to make it bind to the target more strongly or make it less reactive in the body.

It's also very important that the molecule is soluble in water, as the drug eventually needs to operate in the aqueous environment of the body – we might need to add to the molecule to make this possible.



4 Testing in cells and animals

Once we have a potential drug, it needs to be tested carefully in cells and animals to check that it is safe and likely to work before it is given to people.

We want to check that the drug has the right effect –stopping cancers from growing and spreading. We test the drug on cells grown in a dish, and give it to animals to see what happens in a whole-body setting.

Drugs are also tested to make sure they're not toxic before we give them to people. By giving the drugs to animals before patients, we can get important information about a safe dose to try in people.



5 Clinical trials

A drug must go through careful clinical trials before it is considered safe and effective enough to treat patients.

Three types of clinical trials are carried out to test that a drug is active, safe and better than what is already available.

Phase I trials are the first time that the treatment has been tried in humans and are used to find the right treatment dose and schedule.

Phase II trials look for clinical activity of a treatment by measuring patient survival and disease progression. Increasingly these days researchers will go directly from a phase I to a phase II trial to speed up the development of the drug.

Phase III trials compare your new drug to the standard treatment to check that it really is better than the current treatments. Often these are big and expensive trials – but we hope that using smarter trial designs can give us robust results more quickly and cheaply, based on smaller numbers of patients.



6 Treating patients

You have discovered, developed and tested a new drug!

Once regulators have checked your data and approved the drug, cancer patients can start taking the new treatment. New drug discoveries like this are an important part of the quest to defeat cancer.



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