



Repurposing finds new health-giving uses for old medicines

Medicines that have been approved to medicate one ailment are being repurposed to treat others, saving lives and giving fresh hope to millions saddled with disease.

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Drug discovery is slow, expensive and often ends in failure, so no wonder scientists are exploring new ways to medicate disease. One source of hope lies in 'drug repurposing', where new uses are found for established medicines.

For example, the humble dexamethasone proved a lifesaver during the Covid-19 pandemic, significantly reducing mortality in critical patients who are put on oxygen or ventilators.

Yet the drug was not developed with a killer virus in mind. Dexamethasone became a licenced medication half a century before the advent of Covid-19, and it was designed to help patients with swelling and severe allergies. The serendipitous discovery that it also kept people alive during the coronavirus pandemic was the result of the scientists working at lightening-speed in the field of "drug repurposing".

Drug repurposing is not just some niche area of scientific exploration. Finding new uses for pre-existing medicines is becoming a major focus for research bodies the world over, with Europe leading the way.

Drug discovery

‘We’ll still need to discover new drugs, but drug repurposing is going to play a growing role in medicine, and it’s going to be particularly important in the area of rare diseases,’ said Anton Ussi, coordinator of the recently launched, €22.6m [Horizon-funded REMEDI4ALL project](#). ‘It could make the difference between having no drugs to treat a debilitating condition to having a repurposed one that has a big impact on quality of life.’

There are clear benefits to repurposing ‘old’ drugs to tackle diseases for which treatment is lacking. Developing a drug from scratch is a huge undertaking. The average cost is over €1 billion, and typically it takes more than decade for a new medicine to complete its journey from initial discovery through clinical trials and to the marketplace. What’s more, many therapeutic molecules that look promising near the start of the research process are eventually ditched because they’re found to be either ineffective or unsafe.

‘By turning our attention to an existing drug, in optimal circumstances, a new treatment can be found in just a few years and for a fraction of the cost – rather than many years of research and tens of millions, even hundreds of millions, of euro,’ said Mr Ussi, who is based at [EATRIS, the European infrastructure for translational medicine](#).

Many steps

Drug repurposing may bring efficiencies to drug development, but many steps still stand between a researcher’s light-bulb idea and a boxed medicine. Clinical trials are needed to establish a medicine’s effectiveness at treating the new condition. The drug must be deemed safe for its new application. Dosage protocols must be established. Patient advocacy groups must be consulted. Regulatory authorities must be satisfied. A manufacturer and distributor must be found.

However, patchy coordination between academics and institutions working in the field is stymying progress. Teams are working on their projects in silos and expertise is going untapped. As a result, many researchers working on a promising idea simply give up.

Elaborating, Mr Ussi said, ‘There are islands of great research activity but it’s difficult to take your research to the end without outside professional help.

‘Take the example of an expert clinician who knows anecdotally that a drug used off-label (for an unapproved purpose) slows down a disease,’ he said. ‘This clinician may want to validate their hunch so the drug can become authorised to treat that disease, but they don’t have access to the broad range of experts and disciplines needed to do so. Because of this, most would-be drug developers run out of capacity.’

The aim of REMEDI4ALL is to catch enthusiastic researchers and research groups before they fall. ‘We want to make the world of drug repurposing more understandable,’ said Mr Ussi. ‘We’re creating development teams that can get to grips with the specific requirements of a project and help move the process along to completion.’

Through its ‘transparent and predictable pipeline’, REMEDI4ALL will bring experts in all areas of drug development from all over the world into one space.

Repurposing process

‘Everyone who has a role in the repurposing process will become part of our network,’ said Mr Ussi. ‘Our vibrant community will be able to help researchers execute their projects at any phase of development. Our vision for 10 years from now is that drug repurposing will work efficiently, so projects with real potential don’t get stuck in bottlenecks.’

Another [Horizon project, the brand new REPO4EU](#) describes itself as a “platform for precision drug repurposing”. REPO4EU will be working closely with the REMEDI4ALL group to make the process fast, cost-effective and patient-centric. With ambitions to turbo-boost the world of drug repurposing, they will address unmet medical needs in all disease areas.

Funded by the Horizon Europe programme to the tune of €23 million, the project also aims to develop a permanent European infrastructure that can serve as a resource for every potential researcher or small-to-medium-size enterprise interested in drug repurposing. But that’s where the similarities between the two projects end.

The “high-precision” REPO4EU approach to finding new applications for registered drugs (based on a seminal study from 2015 on the relationships between diseases) is predicated on the finding that, when all human diseases are plotted on a network map, disease clusters emerge.

Significantly, diseases in a given cluster share the same risk genes. In other words, specific gene mutations can trigger a cascade of events that can give rise to any disease from within its cluster.

The REPO4EU team position is that a disease should therefore be described less as an “organ malfunction” (say, heart or kidney failure) and more as a precise “mechanistic” problem (i.e. focused on the mechanisms giving rise to disease). This is nothing short of a paradigm shift.

Precision cure

In their quest to find new purposes for established medicines, the REPO4EU researchers are zeroing in on drugs that are known to target a particular mechanism, explained Prof. Harald Schmidt, coordinator of REPO4EU and professor of pharmacology at Maastricht University. Next, the team will design high-precision clinical trials to ‘rapidly and safely cure’ conditions that share this mechanism.

‘Patients will be selected based on symptoms and, more importantly, the detection of the disease mechanism. This means every treated patient is expected to benefit,’ said Prof. Schmidt.

He believes the project will herald the end of the organ-based structure of medicine. ‘Right now, we hardly understand the cause of any chronic disease at the level of genes and cellular signalling, and so we’re left with chronically treating symptoms with low precision and limited patient benefit.’

He added: ‘The traditional, reductionist “one disease, one target, one drug” dogma has had its time. Ours is a completely new approach to medicine, and our team is totally convinced by it. Network medicine will redefine what we call a disease, how we diagnose it, and how we cure it – not just treat it.’

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