**Computers breakthrough in battle against bugs – video transcript provided by the ABC’s 7.30 report 19/1/12**

**Tracy Bowden, Presenter:** For decades, antibiotics have been the front-line weapon in the battle against bacterial infections but recently the bugs have been fighting back. New strains of antibiotic-resistant bacteria are emerging that can defeat the most powerful drugs available.

Now Australian scientists are look at a new way to counteract those bacteria. Gavin Fang reports.

**Gavin Fang:** You're about to get a glimpse of one of the best-kept secrets in Australian science. For security reasons, the scientists who work here don't like to advertise the address.

**Prof. Peter Taylor, Victorian Life Sciences Computation Initiative:** There are always people who misunderstand the purpose of a given institution.

**Gavin Fang:** What they're trying to protect is one of the most powerful computers in the country, a super-computer that is giving researchers the muscle to push back the boundaries of science.

**John Wagner, IBM Research Collaboratory for Life Science:** What used to take us many days can now be done in several minutes. That's not to say what we do takes several minutes. What we do instead is we do much larger problems. We tend to expand out the problems we're thinking about but that's really how science has progressed.

So the computing power changes, the problems that you think about and the scale that you think about it, it lets you do new things you couldn't do before.

**Gavin Fang:** The IBM Blue Gene computer, as it's known, can perform about 25 trillion computations every second, making it tens of thousands of times faster than a home PC.

**Peter Taylor:** The machines we have are collections of processes, not greatly different from what you might have in a desktop computer. Whereas in a desktop computer you might have one or two, in the typical supercomputer you would have thousands of those processes.

They're all interconnected so they can all work together and share information back and forth.

**Gavin Fang:** All that computer power needs a focus and right now one of the things it's working on is the problem of potentially fatal antibiotic-resistant bacteria.

Associate Professor Matthew Perugini is leading the team pitting the supercomputer against the superbug.

**Assoc. Prof. Matthew Perugini, Enzymologist, La Trobe University:** Antibiotic resistance is one of the most important global health problems. There is an increasing rise in antibiotic-resistant strains, these are bacterial strains such as golden staph and other superbugs like vancanisen-resistant angilicocci (phonetic). And these are prevalent in our community, number one, but also in our hospitals.

**Challana Vary:** I haven't felt that I've wanted to eat a lot of foods.

**Gavin Fang:** Challana Vary knows all about antibiotic-resistant bugs. She returned from a holiday in Morocco last year with an illness that at fist baffled the doctors at the Royal Melbourne Hospital.

**Challana Vary:** Came home, about a week after I was back started having really weird pains and shivers and gradually, really bad back pain and then my body sort of just shut down.

I was getting my blood monitored three times a day, I was getting constant heavy pain killers. I remember looking outside and thinking, "No-one even knows what this is. No-one knows what I've got. No-one really knows what they can do to treat it."

**Gavin Fang:** It turned out that the 25-year-old had an antibiotic-resistant strain of the common bug E. coli. It took four different types of antibiotics to get the bacteria under control. Six months later, she's still not completely recovered.

**Challana Vary:** Christmas was the first time I really felt like food and I just sort of felt well because everything in my immune system's been really bad since and just been really tired and I just - to sort of get back into the real world took a really long, slow process.

**Gavin Fang:** Antibiotic-resistant bacteria strains are on the rise because of overuse of drugs in humans and in livestock. In fact, completely drug-resistant strains of diseases like tuberculosis are emerging overseas.

There are now several thousand cases of antibiotic-resistant bugs in Australia every year.

**Scientist:** Next stage is the rotor.

**Gavin Fang:** But it could be that the enzymes that are found in the bacteria are the answer to the problem.

**Matthew Perugini:** The bacterium have a number of different metabolic pathways that are essential for survival and essential also for virulence so what we're doing, we're targeting that pathway, a key pathway which keeps the bacterium alive. Doesn't exist in humans, in the host. So it makes it, therefore, quite attractive to target that particular pathway, given that's unlikely you'll develop side effects in the human host.

**Gavin Fang:** This is what the enzyme looks like and it's where the supercomputer comes into play. Using the computer, the research team has modelled how the enzymes in the bacteria move.

**John Wagner:** It turns out that the dynamics of the protein, that is how a protein moves around, jiggles and moves actually can also help determine its function.

As a protein moves around and changes its confirmation it can open up little cracks and crevices. Our hope is that we can actually start to get small molecule inhibitors into those little cracks and crevices, in a sense change the way that we think about designing antibiotics.

**Matthew Perugini:** What we're seeing is the enzyme is actually undergoing all these dynamic motions and by using that information we can then target the drugs to target various if you like sub-motions within the enzyme and this is real exciting so five years ago this was imagination and now it's become a reality so we can take our static structures and watch them move and that helps us discover new antibiotics.

**Gavin Fang:** The work will have to be tested on real bacteria to prove that it's accurate and before any drugs can be developed but scientists say in the future it's likely more biological research will be done in the virtual world.

**Peter Taylor:** One could imagine that if our ability to model how, say, drugs interact with their targets and how they affect an organism as a whole, then we could basically avoid any sort of animal testing. We could do it all in silica, if you like, in the computer, which would certainly be a great benefit. I don't think there's anybody who would quarrel with trying to do that.

**Gavin Fang:** It might be a decade before that happens but the revolution seems to have already begun.

**Matthew Perugini:** The reality is it's probably more than a billion dollars to develop an antibiotic and approximately 20 to 25 years but with a supercomputer we can drastically reduce that time of discovery. We can bring down, we can simulate very powerful simulations, complex simulations and as you could imagine, reduce the time it takes to discover that drug by potentially up to 50, 60, 70, maybe 80% of the time.

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