

EUREKA EUROSTARS PROJECT 7054 MODAPEP



GUT BUGS KEY TO BOWEL HEALTH

A new test developed by the Eurostars MODAPEP project uses biology and mathematics to diagnose bowel disease and predict whether patients are at risk of serious problems.

Inflammatory bowel disease (IBD) affects between 2.5 million and 3 million people in Europe. The disease has a significant economic and social impact: direct healthcare costs are estimated to be between €4.6 billion and €5.6 billion per year¹, and the condition can have a profound impact on quality of life. As the prevalence is rising, so too will the costs.

One of the big challenges is diagnosing IBD early and figuring out who is at highest risk of developing major complications which may require surgery if left untreated.

Now two SMEs – the diagnostics company IS Diagnostics in the Netherlands and Applied Maths, a bioinformatics firm in Belgium – have come up with a test for diagnosing IBD using a faecal sample.

Gut reactions

Central to the story are the millions of bacteria that line the gut. The so-called gut microbiota is packed with lots of different kinds of bacteria but the composition of this microscopic world appears to be different in people who have IBD compared to those who do not.

'We developed a molecular test that can easily amplify and identify bacteria using a completely novel technique,' explains Dr Dries Budding of IS Diagnostics.

Developing the test was far from easy. Faecal samples contain huge numbers of bacteria of various species. Identifying them involves amplifying bacterial genomes and sequencing them, before checking these sequences against a database.

The trouble is that many of these bacteria are very complex and have long strands of genetic material. These must be 'chopped up' so that researchers can work with them.

'When you chop these bacterial genomes up and then try to put them back together it gets very complex,' says Dr Budding. 'It's like you have a jigsaw of 10,000 pieces that you've mixed with other jigsaws.'



It's like solving a jigsaw of 10,000 pieces that you've mixed with other jigsaws

To overcome this, the diagnostics experts turned to a team of programmers and data specialists. 'We worked with Applied Maths who are experts at working through exactly this kind of puzzle,' Dr Budding says. 'They developed an algorithm that can sort through the jigsaw pieces and allow us to make a database that turns our data into the names of bacteria'.

As a result, the researchers were able to look at the make-up of the gut microbiota in people with Crohn's disease and ulcerative colitis – two forms of IBD. The role of bioinformatics was crucial.

'We provided a novel assembly algorithm for assembly of long-range metagenomics

data,' says Dr Hannes Pouseele of Applied Maths. 'The use of precise and efficient algorithms to make sense out of data will become even more important in solving healthcare problems.'

CE-marked and ready for sale. But there's more...

One important aspect of IBD is that symptoms can come and go: patients may enjoy periods where the disease is quiet and then, for reasons unknown, it suddenly becomes active. In serious cases, the bowel may need to be surgically removed.

The test developed by the MODAPEP project paves the way for doctors to identify patients susceptible to an exacerbation – before their symptoms flare up.

This area of research also opens the door to an intriguing therapeutic intervention. If scientists know which bacteria are key to a healthy gut they can intervene by adding more good bacteria.

'Patients whose IBD is in a quiet state could transition towards a more active state if certain important bacteria are lost,' says Dr Budding. 'It would be possible to provide these to rebalance their gut microbiota.'

The basic test kit developing through the project has now been CE-marked and is ready for sale. Some hospitals have already started using it.

The techniques used for design the diagnostic kit could even be used to test for other diseases where bacteria play an important role. The intersection between microbiology and mathematics looks like fertile ground for medical research.

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MAIN PARTNER

IS Diagnostics
www.is-diagnostics.com

OTHER PARTNER

Applied Maths
www.applied-maths.com

TOTAL R&D INVESTMENT

€1.31 M

DURATION

35 months

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