Transcript of Metapro Project video

Narrator: Our planet's flowers and crops produce many useful chemical substances. But one class in particular – isoprenoid secondary metabolites – offer a source of compounds that can be uniquely beneficial or economically valuable to human kind. Left to their own devices however, most plants either produce tiny amounts of these compounds or make them very slowly and chemical synthesis is costly and environmentally fraught. The Metapro research project is trying to find a reliable and biologically renewable source of these useful compounds.

Dr Mark Taylor: We want to develop a green factory for producing these useful compounds in naturally occurring plant organs like potato tubers and tomato fruit in a way that does not rely on chemical synthesis and products from the petro-chemical industry.

Narrator: The Metapro team at Dundee are concentrating on enhancing the production of the isoprenoid Astaxanthin. Astaxanthin is a carotenoid, a colourant producing an orange to pink shade. It is also an anti-oxidant that is believed to have a number of health benefits including protection against a range of chronic diseases. Selecting a suitable plant to act as the 'green factory' for the production of Astaxanthin was crucial.

Dr Mark Taylor: The potato is a good crop for this project because it has a natural storage organ that accumulates valuable compounds, it has a pre-disposition to accumulate this sort of compound so we just need to change it a little bit to accumulate the Astaxanthin.

Narrator: That change is achieved by introducing into the potato the genes from another plant species – algae, a natural producer of Astaxanthin in the wild.

Dr Ray Campbell: Tubers don't normally accumulate Astaxanthin but by using genetic engineering we are able to insert these genes from species which naturally accumulate Astaxanthin. We use a bacterium called Agrobacterium. Agrobacterium is a natural genetic engineer; we are able to introduce some genes into this Agrobacterium strain which in turn introduces the genes into the potato plant.

Narrator: It is a carefully controlled process carried out in sealed conditions to exclude the possibility of contamination with the outside environment and traditional breeding methods also have a role in this project.

Dr Mark Taylor: There is a lot of natural variation in all the different types of potato. So some potato types actually have the genes that are useful already and it's just a matter of marking those genes for introduction by natural breeding into a better commercial variety.

Narrator: Analysis of the expression of genes using microarray technology can help researchers judge which ones are key to the production of the carotenoid.

Dr Mark Taylor: There are about 40,000 genes that are expressed in a potato and each spot on the microarray represents one of these genes and the colour of the

spot represents whether or not it is turned on or off or the degree to which it is turned on. And so we can associate genes that are switched on or off with what's happening in the pathway.

Narrator: But understanding the role of genes in the process only tells the scientists part of the story. They also need to examine the structure of the plant cell to find out where the Astaxanthin accumulates. Metapro PhD student Stefania Pasare has been overseeing the use of enzyme trackers to delve into the cell biology. Considerable progress has already been made and further advances could help the team elevate the amount of Astaxanthin they are already collecting.

Dr Mark Taylor: I think we have made some breakthroughs already, we have shown that we can actually persuade the potato to accumulate quite reasonable, economically significant levels of Astaxanthin. We have also identified new mechanisms which breakdown the carotenoids and we are working to remove those from the potato. We have got some clues about the site of synthesis of the compound. Additionally, I should say, that some genetic studies in combination with the new information we are getting about the potato genome, which has just been elucidated, has enabled us to look at some of the storage mechanisms and we are quite excited about the potential of those results.

Narrator: The research team in Dundee is one of eight partners involved in various aspects of the Metapro project. Work is also being carried out in London and in Germany, Israel, Italy and Romania. This multidisciplinary, pan-European approach to collaboration has already delivered significant progress towards the Metapro goal of producing cheap, renewable sources of secondary metabolites. Scientists are optimistic of making further advances as the project continues.

Dr Mark Taylor: Here we have a normal control potato it is actually a pale yellow fleshed colour whereas the experimental one that we have been developing, hopefully we can see, has got this pinky-orange colour and that is due to the Astaxanthin that is accumulating in it. And this is one of our earlier prototypes and we believe we will be able to get more of this pinky-orange colour into the tuber and the more we get the better a factory it is for producing this compound.