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Harnessing the natural product pathways of Nature

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Nature makes thousands of molecules– natural products– that have many applications. In fact, many are used as medicines. Plants in particular are an extremely important source of these molecules. Our group aims to discover the genes inside of plants that are responsible for doing the chemistry that creates these molecules from very simple starting materials. By discovering these genes, we can produce important natural products in greater quantities in ways that are environmentally friendly. We are developing new methods to find these genes. We can now look at single plant cells, and see which genes, and which natural products, are found in each individual cell. These methods allow us to find the genes that we are looking for much more quickly. Very often, important natural products are made by plants in very small quantities, or the natural plant producers are hard to grow. This means that it is hard to get enough natural product to use in the clinic. Once we discover the genes that are responsible for making a natural product- for example, the anti-cancer drug vinblastine- we can insert them into yeast or tobacco plants; then these yeast cultures or tobacco plants produce the natural product. We also look for examples in which Nature has made the same molecule twice. From these examples, we can compare and contrast two different chemical solutions that nature has evolved. We can then, in the laboratory, mix and match the two chemical pathways to design our own. For example, we showed that the insect repellent nepetalactone is made by both the catnip plant and aphids.

References

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