Interactions of Class I Homeodomain Leucine Zipper Proteins

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Unlike animals, plants are unable to escape a dangerous environment by moving away – therefore they need other ways to protect themselves. When plants are exposed to unfavourable environmental conditions, like low temperatures or high salt concentrations, they activate a huge variety of mechanisms, act fast or slow and confer an increased tolerance towards this kind of stress.

These changes are conferred by activation of transcription factors which in turn bind to special sites in the regulatory regions of some genes. When they bind, they induce the production of the proteins which are encoded by these genes. How a small number of transcription factors can regulate so many proteins is one of the biggest mysteries of biology.

This study investigate a class of transcription factors, the homeodomain leucine-zipper proteins of class I, which are implicated in the response to very low temperatures and other stress responses. It is based on the same idea the writing is based on: although we only have 26 characters, we are able to write hundreds of thousands of words by putting them together. This family of transcription factors seem to be able to increase the number of effects in a similar way: by varying interactions with each other.

We fused the homeodomain leucine-zipper proteins with two parts of a fluorescent protein which regains its activity when both parts come in close contact. Then we transformed two different transcription factors, each fused with a different part of the fluorescent protein, into tobacco leaves and observed if the activity is reactivated. In several combinations, we noticed interactions in both wild type and mutants. Analysis of the genes in mutants shows that some of the interactions are dependent on the environmental conditions.

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