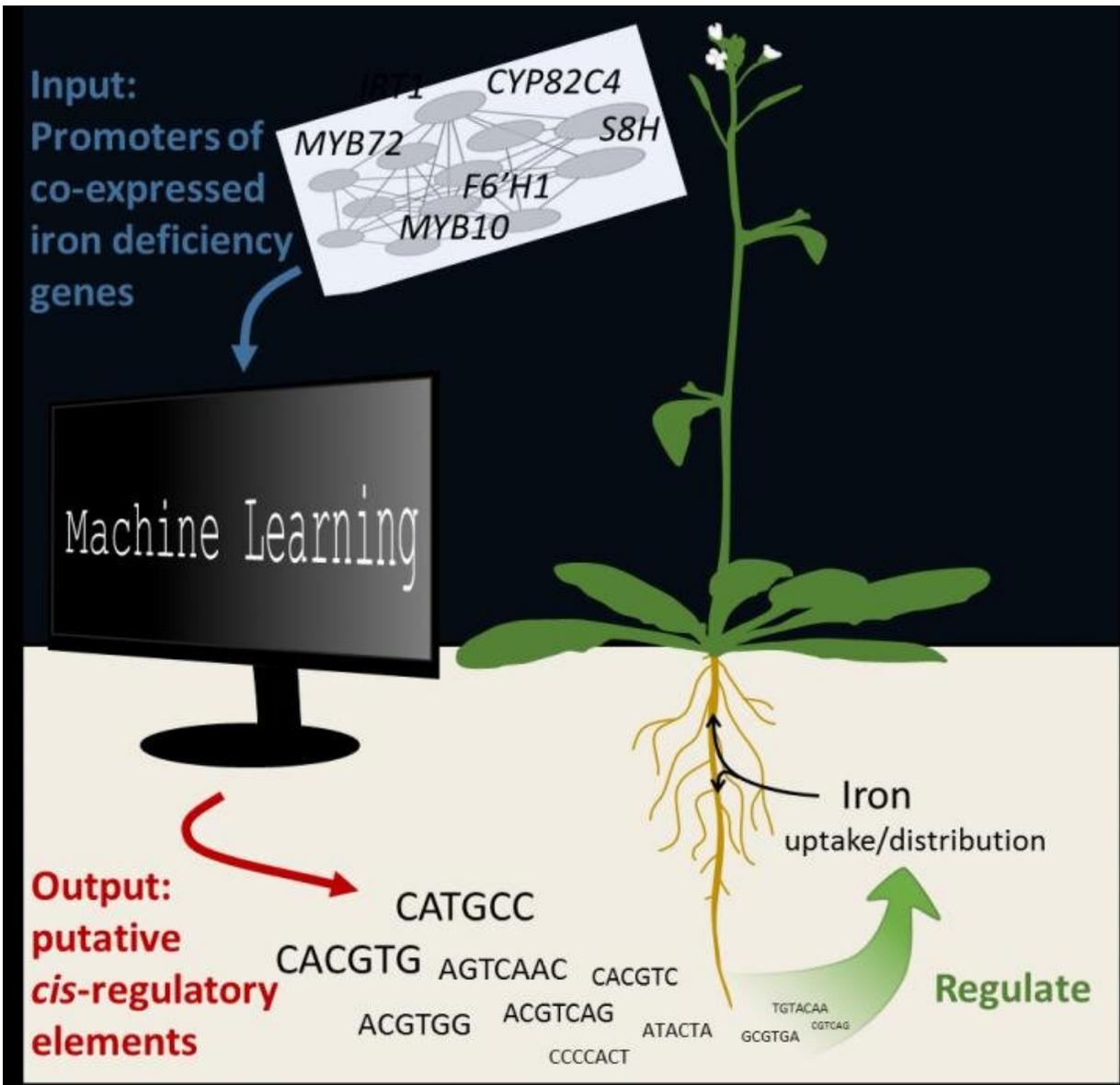


The regulators active during iron deficiency

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Bioinformatics work steps needed to identify the *cis*-regulatory elements. The findings of the study help to understand genetic regulation of plant responses to

iron deficiency. Credit: HHU / Birte Schwarz

Iron deficiency is a critical situation for plants, which respond using specific genetic programmes. Biologists from Heinrich Heine University Düsseldorf (HHU) and Michigan State University (MSU) used artificial intelligence methods to examine how to predict regulatory genetic sequences. They have now published the findings from their joint research work in the journal *Plant Physiology*.

When a plant is lacking important nutrients, it cannot simply move to another location where it can get the nutrients it needs. Instead, it has to adapt to the situation by adjusting its metabolism. It does this by activating certain programmes incorporated in its genome.

Iron is one of those nutrients that is essential for [plants](#)' growth and survival. It plays a role in photosynthesis and water regulation. Plants absorb [iron](#) through their roots, but the iron must be present in sufficient quantities and in a form that can be processed by the plant.

Past research has identified more than 1,000 genes in [plant roots](#) that can be active in regulatory processes responding to iron deficiency. 'Cis-regulatory elements' (CREs) coordinate the specific genetic response. A team of researchers working under Prof. Dr. Petra Bauer from the HHU Institute of Botany and Prof. Dr. Shin-Han Shiu from the Department of Plant Biology at MSU has developed a method for predicting candidates for these specific CREs. The team used an artificial intelligence method known as the machine learning approach.

The approach helped the researchers to identify roughly 100 CRE candidates in the model plant *Arabidopsis thaliana* (thale cress). They used this knowledge to determine [transcription factors](#)—specific CRE-

binding proteins that trigger the response to [iron deficiency](#) and activate it in the root cells.

For optimised plant cultivation, it is important to know how the plant responds in situations of scarcity and whether any targeted cultivation measures can be taken to produce particularly robust plants. "Growers can use the CREs identified to increase iron uptake in new plant varieties in a targeted manner," emphasises Prof. Bauer. Her staff member and first author of the study, Dr. Birte Schwarz, adds: "In this way, a better supply of iron can be ensured along with better adaptation of the plants to poor soil."

More information: Birte Schwarz et al, Putative cis-regulatory elements predict iron deficiency responses in Arabidopsis roots, *Plant Physiology* (2020). [DOI: 10.1104/pp.19.00760](https://doi.org/10.1104/pp.19.00760)

Provided by Heinrich-Heine University Duesseldorf

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