The function of NIMA-related kinase 6 in the straight growth of plant cells

November 29 2017

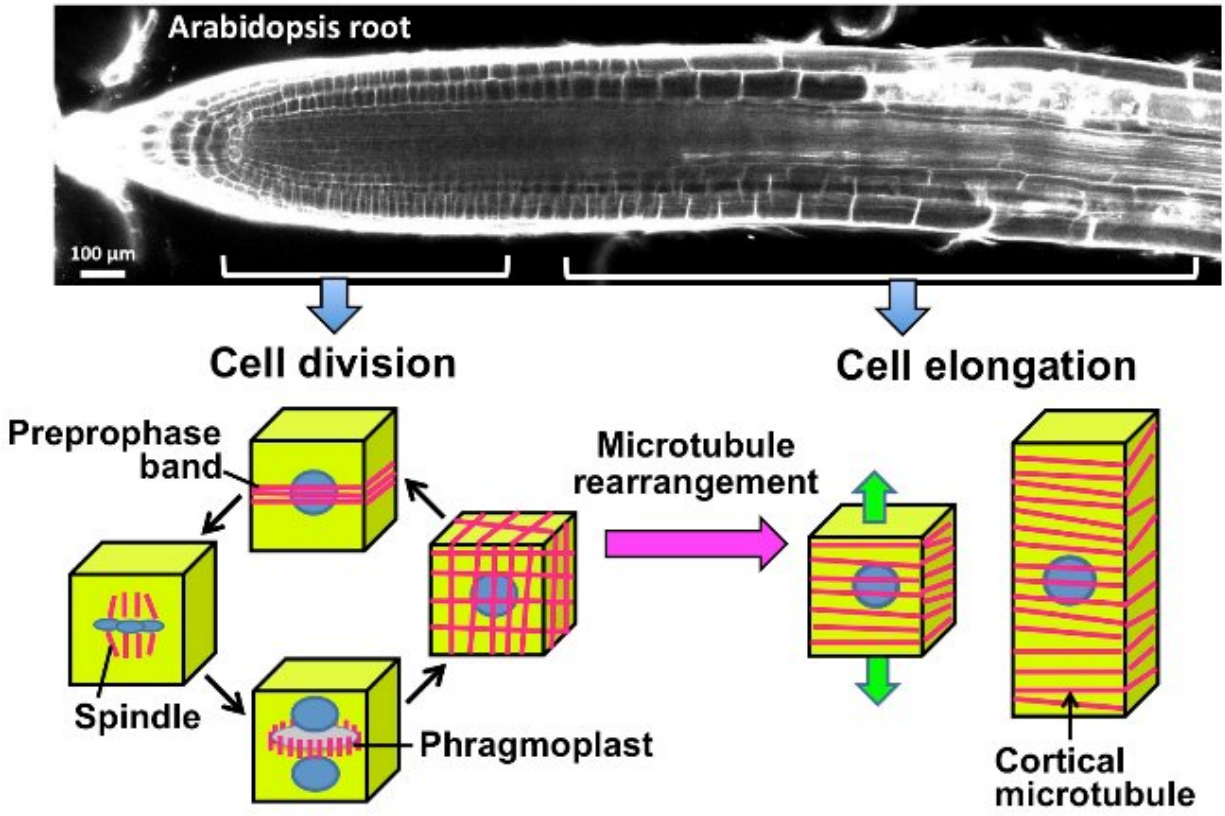

Figure 1. Microtubules (red lines) regulate cell division and expansion. Credit: Okayama University

Plants continuously generate various kinds of organs such as roots, leaves and flowers. The growth morphology of each organ is achieved by the

directional growth of plant cells. Prior to cell growth, an intracellular cytoskeleton called a microtubule aligns perpendicularly to the growth axis to determine growth direction of plant cells (Fig. 1). Various proteins have been shown to regulate the dynamic behavior of microtubules, but the mechanism of microtubule alignment remains unresolved.

Now, Hiroyasu Motose, Shogo Takatani, Taku Takahashi, and their colleagues at Okayama University and NAIST have revealed the function of NIMA-related kinase 6 (NEK6) in the straight growth of plant cells. They employed live cell imaging to investigate the dynamic behavior of microtubules and NEK6 proteins in combination with the advantage of genetic analyses in the model plant Arabidopsis thalana.

The results showed that NEK6 protein removes aberrant microtubules to align them before directional cell growth (Fig. 2). NEK6 phosphorylates specific amino-acid residues of tubulin proteins—the building blocks of microtubules—and eliminates abnormal microtubules. In the absence of NEK6, microtubules are crooked and plant cells cannot grow straight (Fig. 3). This study clearly demonstrates the novel regulatory mechanism of microtubule organization and directional growth in plants. Since microtubules and NEK proteins are well conserved in most organisms and participate in essential cellular processes (e.g. cell division) and various diseases (e.g. cancers and ciliopathy), the findings shed new lights on the principles in these biological phenomena.

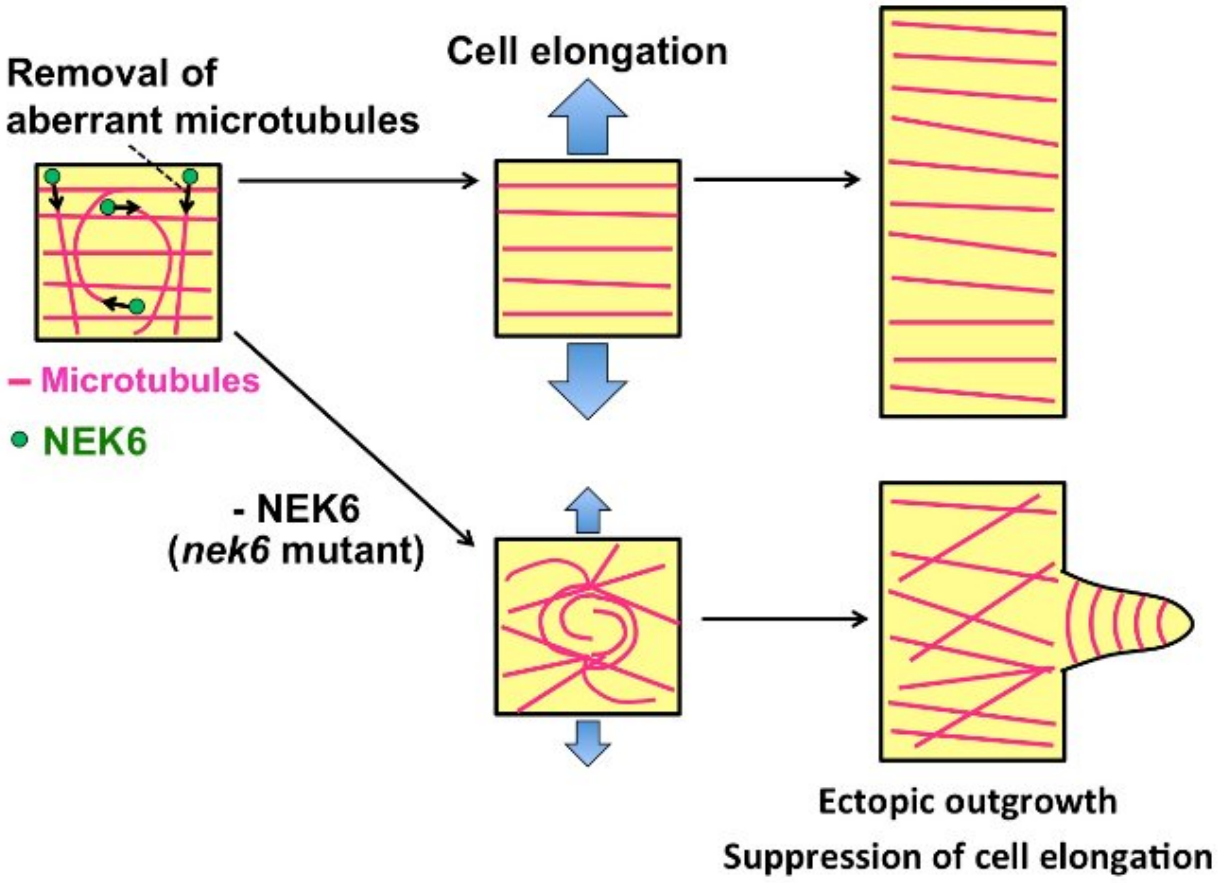

Figure 2. NEK6 removes aberrant microtubules to align microtubules. Credit: Okayama University

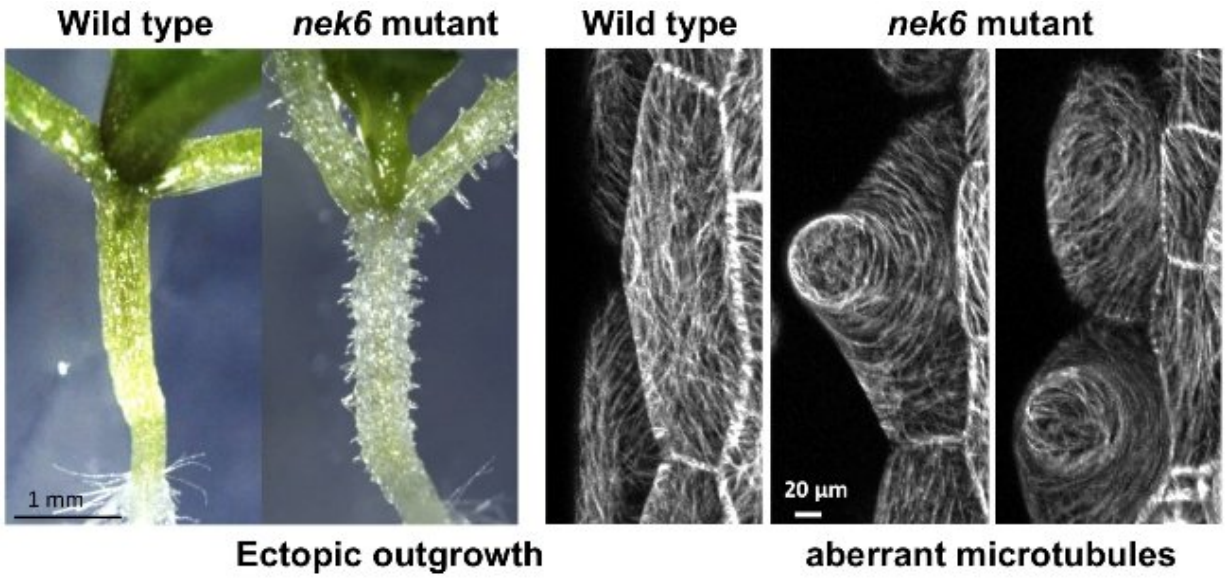

Figure 3. Arabidopsis nek6 mutant exhibits ectopic outgrowth and aberrant microtubules. Credit: Figure 3. Arabidopsis nek6 mutant exhibits ectopic outgrowth and aberrant microtubules. Credit: Okayama University

More information: Shogo Takatani et al. Directional cell expansion requires NIMA-related kinase 6 (NEK6)-mediated cortical microtubule destabilization, *Scientific Reports* (2017). DOI: 10.1038/s41598-017-08453-5

Provided by Okayama University