**Text for editing, demo edit 5**

Reactive oxygen species (ROS) are highly reactive chemicals often associated with escalating warfare between pathogens and their hosts. For example, ROS are integral to biological defenses—such as the respiratory burst in phagocytes of animals and programmed cell death in plants—that ward off microbial invaders. In a landmark 2006 study, published in the journal Plant Cell, Tanaka and colleagues uncovered an additional role for ROS as “regulators of symbiosis.”

The team studied a symbiosis between perennial rygrass (Lolium perenne) and a fungus (Epichloë festucae) that lives inside the grass. The funguss, colonizing all its leaves, but never breaching its cell walls or membranes,. This plant, in turn, directs resources to the fungal which produces toxins that protect both species from herbivores. But until Tanaka, the mechanisms underlying this exquisite harmonization have remained a mystery.

To address this question, Tanaka and coworkers randomly inserted pieces of DNA into the fungal genome (a method called insertional mutagenesis), i in the hopes of disrupting genes critical to symbiosis. IThey found a mutant strain with a highly unusual growth pattern: the mutant fungal cells grew profusely throughout the grass, whereas infected plants grew poorly and often died.

Using molecular genetics tools, the researchers found that an insertional event in a single gene had caused the aberrant growth —The researchers named the gene noxA. When they compared its sequence with those of enzymes with known activities,they noticed that NoxA was very similar to NADPH oxidases, enzymes that generate ROS.

Further testing revealed that ROS accumulates in plants infected by the wild-type fungus, but not those infected by the noxAmutants . The scientists concluded that ROS a critical player in the symbiosis.

How ROS enables symbiosis remaines an open question. Tanaka’s team speculated that ROS may be involved in establishing physical connections between the cell walls of the plant and fungus. Alternatively, ROS may play a role in symbiotic signaling; their short half-life predisposes them for cellular communication, perhaps facilitating an interspecies “Morse code” that helps maintain the symbiosis. If so, identifying the plant sensor and signaling pathways involved could provide deeper insights into how plants recognize and interact with beneficial symbionts and can distinguish them from pathogens.