A step forward for unveiling the molecular mechanism of programmed cell death in plant sexual reproduction

Plant eliminates unwanted cells by means of programmed cell death (PCD) in many developmental processes including suspensor degeneration during early embryogenesis. Suspensor is an important and terminally differentiated structure that connects the embryo to maternal tissues during embryogenesis in seeds, which was discovered almost 170 years ago. How the suspensor is eliminated and how the elimination is triggered have been attractive questions to plant scientists for many decades. Funded by NSFC and 973 project, Prof. Sun's group at Wuhan University have proved that suspensor PCD occurred in a gradient-like fashion (Figure **A**) and uncovered a key switch controlling suspensor PCD—a cysteine protease inhibitor NtCYS dependent cathepsin H-like protease NtCP14 proteolytic pathway (Figure **B**). This work has recently been published in *PLOS Biology* (**2013**, 11(9): e1001655).

The researchers discovered that the mechanism of triggering suspensor PCD in tobacco suspensor is based on the antagonistic action of two proteins: a protease inhibitor, cystatin NtCYS, and its target, cathepsin H-like protease NtCP14 (Figure **B**). The pair of proteins antagonistically balance life and death of the plant embryo's suspensor, with NtCYS preventing death and cathepsin H-like protease NtCP14 spurring it. NtCYS, a basal cell which exclusively located cysteine protease inhibitor, exerts its anti-cell death effect by directly inhibiting cathepsin H-like protease NtCP14 to protect the basal cell lineage from precocious activation of PCD in early embryogenesis, and relieves its inhibition effect after the 32-celled embryo stage. NtCYS acts as a reversible inhibitor for regulating the activity of cathepsin H-like proteases NtCP14, which displayed a preference for Bz-FVR-AMC, a substrate of cathepsin H-like proteases, differing from the proteases with caspase-like activities identified in plant cells. And the increasement of cathepsin H-like activity achieved through genetic intervention in the NtCYS-NtCP14 module is accompanied by a corresponding increase in caspase-like activities. Therefore, the cathepsin H-like protease NtCP14 seems to occupy an apical position in the PCD signaling pathway, upstream to the proteases with caspase-like substrate specificity.

The finding mentioned above reveals a basic molecular switch that controls the initiation of PCD in suspensor cells. This opens a new window to peep inside the regulatory pathways of suspensor degeneration and its impact in embryogenesis or seed formation. Obviously, more interesting findings can be expected in the near future.

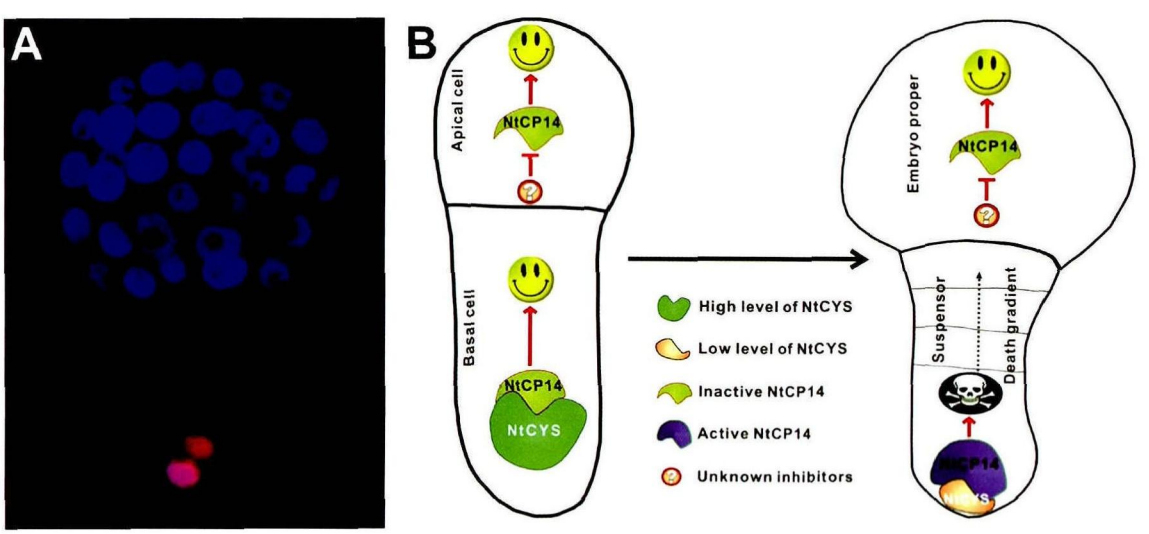

Figure **A** Suspensor PCD occurred in a gradient-like fashion as revealed by TUNEL. **B** Molecular switch behind PCD of the plant embryo suspensor.