学 位 論 文 の 要 約
Summary of Doctoral Dissertation

博士の専攻分野の名称　博士（生命科学）　氏　名　　バオ リャン

Degree requested　Doctor of Life Science　Applicant's name　Bao Liang

学 位 論 文 題 名
Title of Doctoral Dissertation

Study of light mediated-tropism and chloroplast movement in protonemata and gametophores in the moss *Physcomitrella patens*
（コケ植物ヒメツリガネゴケにおける光屈性および葉緑体定位運動制御の研究）

Generally, plants cannot move and have to adapt to the environment where they germinate. Plants make food from capture of light that is one of the most variable environmental factors. Therefore, to optimize photosynthesis in changeable light conditions, plants have evolved sophisticated light sensing mechanisms to detect the quality, quantity, direction and duration of light by a variety of photoreceptors to control their growth and development.

Evolution of shoot phototropism in land plants

Shoot phototropism enables plants to position their photosynthetic organs in favorable light conditions and thus has many benefits for land plants. However, most of our knowledge of phototropism in shoots comes from studies of angiosperms; these studies provide only limited information for non-vascular plants, because gametophores develop in the haploid stage whereas shoots of vascular plants develop in the diploid stage. Non-vascular land plants, like mosses, lack a good experimental system and thus our knowledge of shoot phototropism in these systems, and our understanding of the evolution of phototropism in all plants, remain limited.

In my thesis, to understand shoot phototropism in non-vascular plants, I established a time-course system to examine the phototropism of gametophores in the moss *P. patens* and to quantitatively analyze the effectiveness of red, far-red, or blue light on gametophore phototropism. By time-course observation, I conclusively determined that red, far-red and blue light are effective for gametophore phototropism. These suggest that plants used a broad range of light wavelengths as phototropic signals during the early evolution of land

plants. In line with this, while blue light has well-known functions in inducing phototropic response in shoots of angiosperms, red and far-red light-mediated phototropism sometimes occurs in particular organs in specific conditions, such as in the mesocotyl of maize, light-grown cucumber hypocotyl and *A. thaliana* hypocotyl in microgravity conditions. So the modern angiosperms might have lost the use of red or far-red light as phototropic signals during evolution.