

T14: Metabolism, transport, and action of auxin in bryophytes

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Our laboratories are attempting to characterize the metabolism, transport, and action of the hormone auxin (indole-3-acetic acid, IAA) in the entire charophyte lineage, including stoneworts (the closest algal relatives to land plants), bryophytes (the earliest diverging land plant lineages), pteridophytes (vascular non-seed plants), and seed plants. What emerges from this survey is the surprising perspective that the physiological mechanisms for regulating cellular IAA levels and IAA-mediated responses in seed plants may also be operating in stoneworts and bryophytes. For example, the evidence available from gas chromatography-mass spectrometry suggests that the apical regions of both stoneworts and liverworts synthesize IAA via a tryptophan-independent pathway, with IAA levels being regulated via the balance between the rates of biosynthesis and degradation. The apical regions of other bryophytes and vascular plants utilize the same class of biosynthetic pathway, but they have an enhanced potential to utilize IAA conjugation and conjugate hydrolysis reactions to achieve more precise spatial and temporal control of IAA levels. Judging from the results from agar-block assays, bryophyte sporophytes utilize different mechanisms for IAA transport, with hornworts and liverworts carrying out apolar IAA movement via simple diffusion and facilitated diffusion, respectively. Moss sporophytes exhibit polar IAA transport, much like the process occurring in vascular plants. Additional work is needed to characterize auxin transport in stoneworts and bryophyte gametophytes. Although virtually nothing is known about the effects of IAA on the development of stoneworts and hornworts, many developmental responses, including tropisms, apical dominance, and rhizoid initiation, in liverworts and mosses are subject to IAA regulation, which appears very similar to the hormonal control over corresponding responses in pteridophytes and seed plants. Thus, it appears that the seed plants did not evolve *de novo* mechanisms for mediating IAA responses, but they are instead using modified pre-existing mechanisms already operating in the early land plants. We believe that this conclusion should encourage future efforts to find homologues of known auxin-regulatory genes in the bryophytes.