

T15: Spiral growth of gravitropic protonemata in microgravity

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Tip cells of filaments of *Ceratodon* grow upward in the dark via the oriented polar deposition of extracellular matrix (negative gravitropism). Tips can also align towards or away from a light source (positive and negative phototropism). Thus, these moss cells can sense and respond to both the light and gravity vectors. Dark-grown roots and stems are essentially randomly oriented in space as would be expected for gravitropic organs. By contrast, moss cultured in the dark onboard the space shuttle *Columbia* grew non-randomly. Although some filaments grew in different directions, cultures overall showed net clockwise spirals. Non-random growth in the dark also occurred from previously light-aligned cultures. Non-random patterns were also found when cultures were rotated using a clinostat on earth. Spirals thus result when a constant *g*-stimulus is disrupted by dose reduction in space or by a continuously changing position on earth. This suggests that there is an endogenous growth polarity in *Ceratodon* that is normally suppressed by gravitropism. A working hypothesis is that the spirals represent a residual spacing mechanism for controlling colony growth and the distribution of side branches.