Combined Transcriptome and Proteome Analysis Identifies Pathways and Markers Associated with the Establishment of *Brassica napus* Microspore-derived Embryo development

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Microsp**or**e-derived embryo (MDE) cultures are used as a model system to study plant cell totipotency **and** as an *in vitro* system to study embryo development. We characterized **and** compared the transcriptome **and** proteome of *Brassica napus* MDEs from the few-celled stage to the globular-heart stage using two MDE culture systems: conventional cultures in which MDEs initially develop as un**or**ganized clusters that usually lack a suspens**or**, **and** a novel suspens**or**-bearing embryo culture system in which the embryo proper **or**iginates from the distal cell of a suspens**or**-like structure **and** undergoes the same **or**dered cell divisions as the zygotic embryo. The improved histodifferentiation of the suspens**or**-bearing MDEs suggests a new role f**or** the suspens**or** in driving embryo cell identity **and** patterning. An MDE culture cDNA array **and** 2-D gel electroph**or**esis **and** protein sequencing were used to compile global **and** specific expression profiles f**or** the two types of MDE cultures. Analysis of the identities of 220 c**and**idate embryo markers, as well as the identities of 32 sequenced embryo-upregulated protein spots, indicate general roles f**or** protein synthesis, glycolysis **and** asc**or**bate metabolism in the establishment of MDE development. A collection of 135 robust markers f**or** the transition to MDE development was identified, a number of which may be c**or**egulated at the gene **and** protein expression level. Comparison of the expression profiles of preglobular stage conventional **and** suspens**or**-bearing MDEs identified genes whose differential expression may reflect the improved histodifferentiation of suspens**or**-bearing embryos. This collection of early embryo-expressed genes **and** proteins serves as a starting point f**or** future marker development **and** gene function studies aimed at unders**and**ing the molecular regulation of cell totipotency **and** early embryo development in plants.