Promoter-Driven GUS Reporter Gene Expression

Summary: This set of 11 stocks can be used to demonstrate the use of native promoter-driven reporter gene expression. Students will be able to observe distinct Beta-glucuronidase (GUS) expression patterns determined by the promoters of 11 genes with a well-known function.

Recommended Grade Level: College/University

Seed Strain Details

ARR5:GUS (Catalog # CS25261) – The transgene in this strain represents a transcriptional fusion of the ARR5 (ARABIDOPSIS THALIANA RESPONSE REGULATOR 2) promoter with the beta-glucuronidase (GUS) reporter. The strain is segregating for the transgene and kanamycin resistance. In the absence of cytokinin the reporter is primarily expressed in the root and shoot meristems. Reporter activity increases in the presence of cytokinin. The addition of 10nM benzyladenine (BA) causes the expression region to enlarge to include the tissues around the shoot meristematic region, and strong expression is seen in all tissues in the root.

KAT1: GUS (Catalog # CS3763) – The transgene in this strain represents a transcriptional fusion of the KAT1 (POTASSIUM CHANNEL IN ARABIDOPSIS THALIANA 1) promoter with the GUS reporter. The strain is homozygous for the transgene. The reporter is expressed in the guard cells of the hypocotyl, cotyledons and leaves of young plants.

CPC:GUS (Catalog # CS6497) – The transgene in this strain represents a transcriptional fusion of a fragment of the CPC (CAPRICE) promoter with the GUS reporter. The strain is homozygous for the transgene. The CPC protein moves to the hair-forming cells where it represses GL2 expression. The reporter is expressed in root epidermal cells without root hairs.

LFY:GUS (Catalog # CS8849) – The transgene in this strain represents a transcriptional fusion of a 2.3 kb genomic fragment spanning the LFY (LEAFY 3) promoter with the GUS reporter. The strain is segregating for the transgene and kanamycin resistance. Reporter activity is detected in the shoot meristem before floral determination, with gradual changes occurring during the vegetative phase, and in young flowers with quantitative changes occurring during the photoinduced transition to flowering.

GA3ox1-TL-GUS (Catalog # CS16358) – The transgene in this strain represents a translational fusion of the intergenic sequence upstream of the GA3ox3 (GIBBERELLIN 3-OXIDASE 3) gene, including an intron-containing 5'-segment of the coding region, with the GUS reporter. The transgene confers kanamycin resistance. Reporter activity is seen in the anthers and developing embryos.

KNAT1:GUS (Catalog # CS6141) – The transgene in this strain represents a transcriptional fusion of the KNAT1 (KNOTTED-LIKE FROM ARABIDOPSIS THALIANA) promoter with the GUS reporter. The strain is segregating for the

transgene and kanamycin resistance. The reporter is expressed in the hypocotyl, stem, and shoot meristems. No expression is seen in the leaves.

CESA2:GUS (Catalog # CS70756) – The transgene in this strain represents a transcriptional fusion of the CESA2 (CELLULOSE SYNTHASE 2) promoter with the GUS reporter. The transgene confers basta resistance. The reporter is highly expressed in the roots, rosette, cauline leaves, stems, and flowers, with lower expression in zones that are expanding less rapidly.

GL2-GUS (Catalog # CS8851) – The transgene in this strain represents a transcriptional fusion of the GL2 (GLABRA 2) promoter with the GUS reporter. The strain is homozygous for the transgene. The reporter is expressed in shoots with varying levels of expression in leaves and trichomes. Reporter activity is seen in developing trichomes and surrounding cells during the early stages of trichome development and persists in mature trichomes.

ARR6:GUS (Catalog # CS25262) – The transgene in this strain represents a transcriptional fusion of the ARR6 (REPSONSE REGULATOR 6) upstream region with the GUS reporter. The strain is segregating for the transgene and BASTA resistance. The reporter is expressed in the shoot meristematic region and cotyledon vasculature. The addition of cytokinin results in higher levels of expression and expansion of the region of expression to the hypocotyl and root tissues excluding the root tip.

PR1/GUS (Catalog # CS6357) – The transgene in this strain represents a translational fusion of the entire coding region of the PR1 (PATHOGENESIS RELATED 1) gene with the GUS reporter. The strain is homozygous for the transgene. Reporter activity is seen in response to pathogens.

CESA10:GUS (Catalog # CS70764) – The transgene in this strain represents a transcriptional fusion of the CESA10) (CELLULOSE SYNTHASE 10) promoter with the GUS reporter. The transgene confers BASTA resistance. The reporter is expressed in ovules.

Summary of Expression Patterns

STOCK	EXPRESSION PATTERN
ARR5:GUS (CS25261)	Root and shoot meristems
KAT1: GUS (CS3763)	Guard cells
CPC:GUS (CS6497)	Roots
LFY:GUS (CS8849)	Young flowers
GA3ox1-TL-GUS (CS16358)	Anthers
KNAT1:GUS (CS6141)	Hypocotyl, stem and shoot meristem
CESA2:GUS (CS70756)	Throughout the plant
GL2:GUS (CS8851)	Trichomes
ARR6:GUS (CS25262)	Shoot meristem and cotyledon vasculature
PR1/GUS (CS6357)	Response to pathogen
CESA10:GUS (CS70764)	Ovules

Suggested Reading

Geisler, M., Jablonska, B., & Springer, P. S. (2002). Enhancer trap expression patterns provide a novel teaching resource. *Plant Physiology, 130,* 1747-1753. http://www.plantphysiol.org/content/130/4/1747

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Wada, T., Tachibana, T., Shimura, Y. & Okada, K. (1997). Epidermal cell differentiation in Arabidopsis determined by a *Myb* homolog, *CPC. Science*, *277(5329)*, 1113-1116. https://doi.org/10.1126/science.277.5329.1113