



Plant Propagation PLS 3223/5222

Guest Web Lecture
Dr. Wagner Vendrame
Associate Professor
Tropical Research and Education Center

Somatic Embryogenesis



Dr. Wagner Vendrame
Environmental Horticulture Department
Tropical Research and Education Center

Why Tissue Culture?

Problems with conventional methods

Mass clonal propagation

Production throughout the year

Less space required

Production of pathogen-free plants

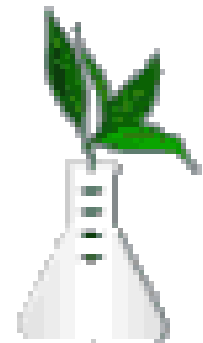
Production of new selections with limited material, and rare and endangered species

Somaclonal variation

Germplasm conservation

Application for gene transfer technology

Production of haploids



Tissue Culture Techniques

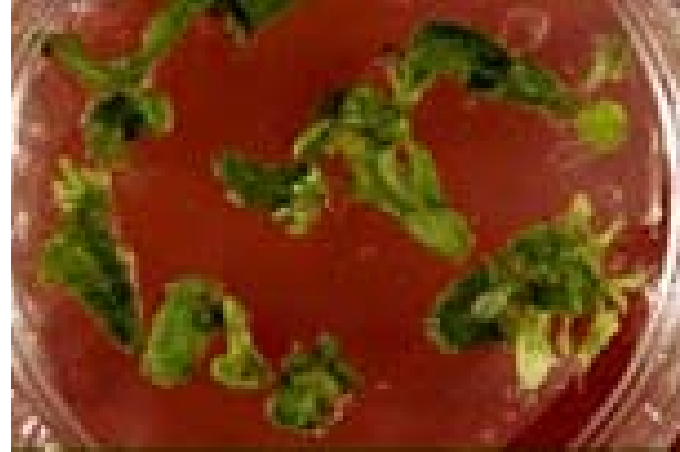
Meristem-tip culture

Axillary shoot proliferation

Adventitious shoot multiplication

Somatic embryogenesis

- process by which embryo-like
- structures similar to those in
- seeds are formed



Somatic Embryogenesis Applications

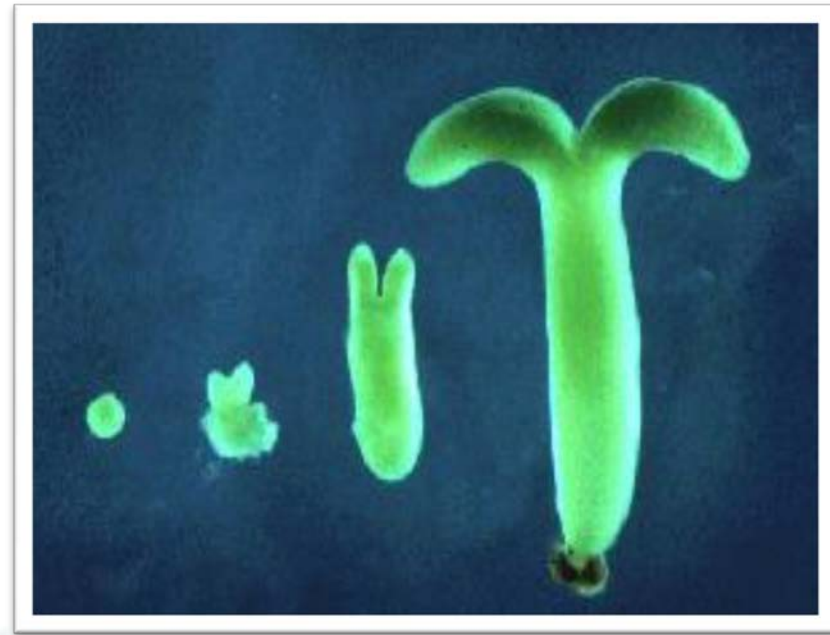
Propagation

- mass clonal propagation
- synthetic seed

Genetic transformation

Germplasm conservation

Model for embryo development



Somatic Embryogenesis

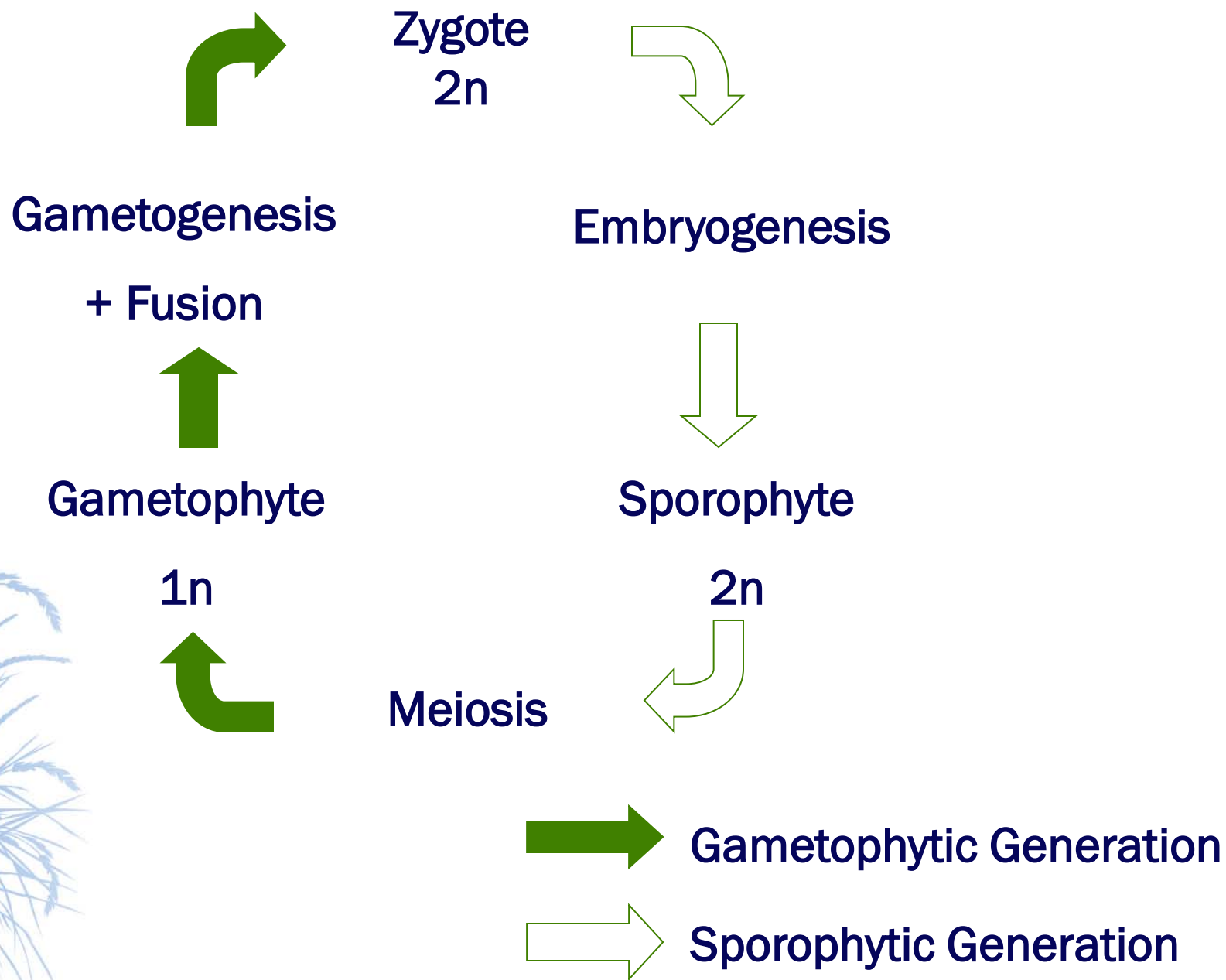
Brief History

Steward, F.C., M.O. Mapes, and K. Mears. 1958. Growth and organized development of cultured cells. II. Organization in cultures grown from freely suspended cells. *Amer. J. Bot.* 45:705-708.

- **First demonstration that plants could produce nonzygotic embryos**

Reinert, J. 1959. Ueber die Kontrolle der Morphogenese und die Induktion von Adventiveembryonen an Gewwebekulturen aus Karotten. *Planta* 53:318-333.

- **Observed bipolar embryos to differentiate in a culture of carrot roots**

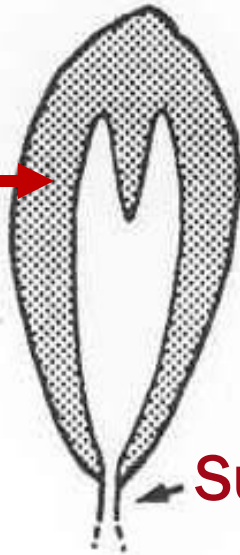


A. Zygotic embryo in seed

B. Somatic embryo from callus

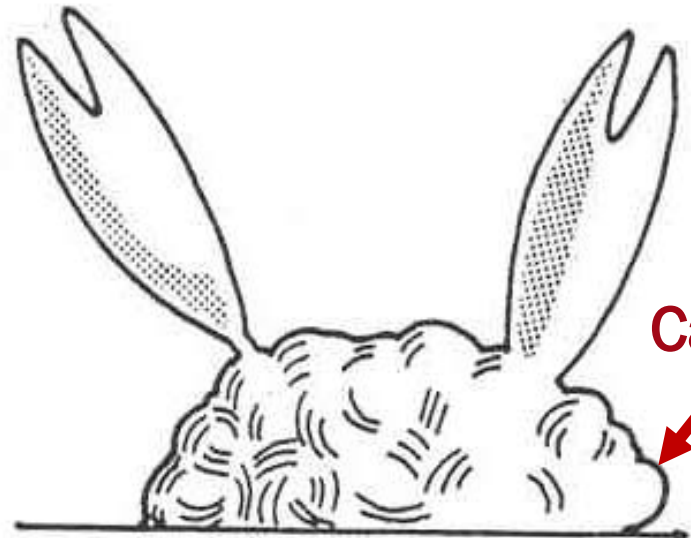
A.

Endosperm



Suspensor

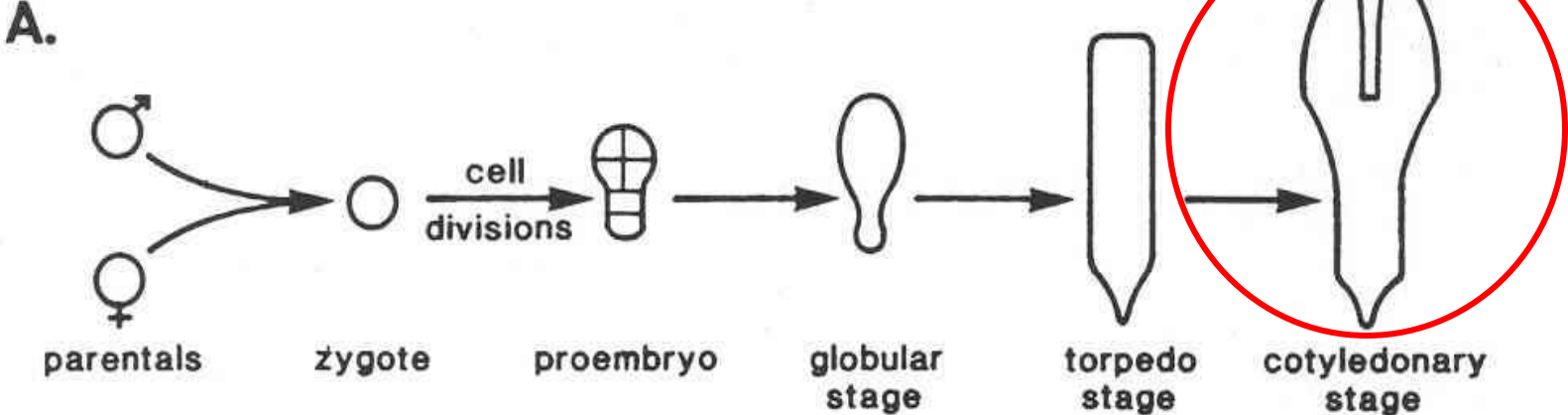
B.



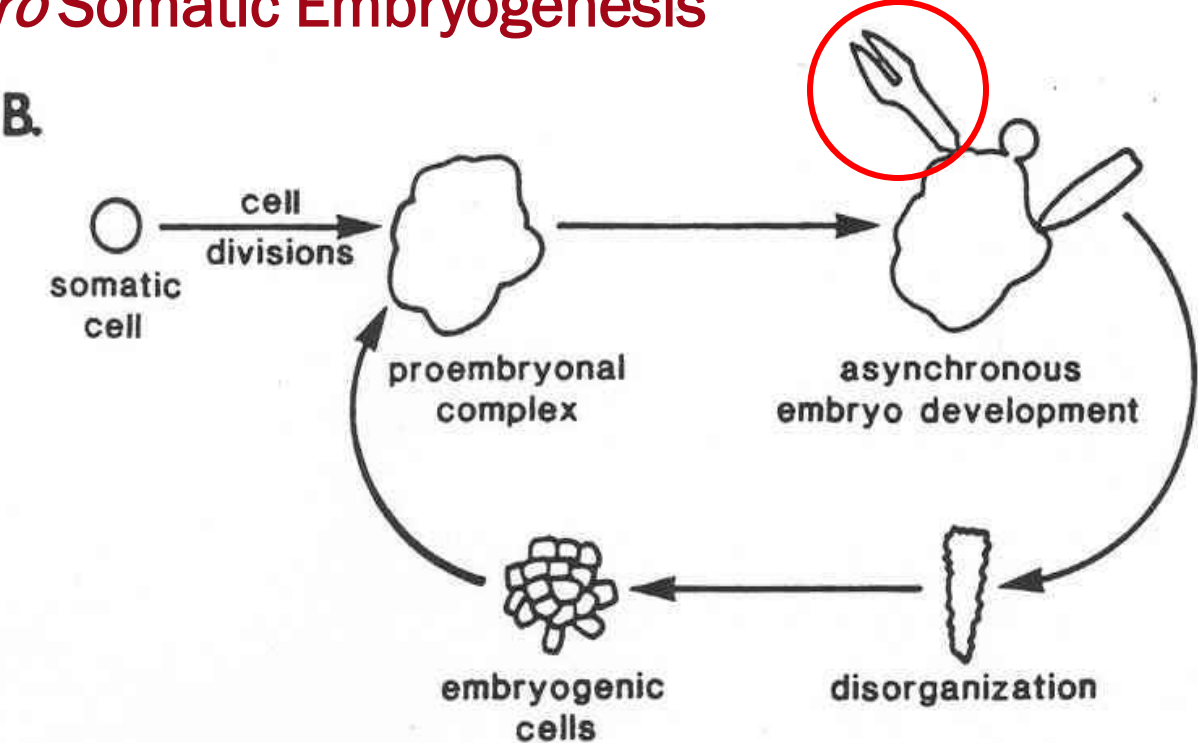
Callus



Zygotic Embryogenesis within seeds



In Vitro Somatic Embryogenesis



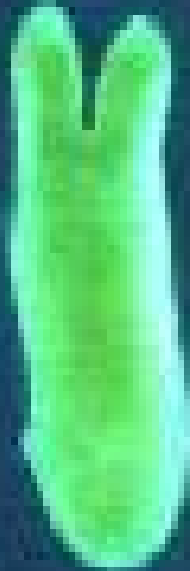
Somatic Embryo Stages



Globose



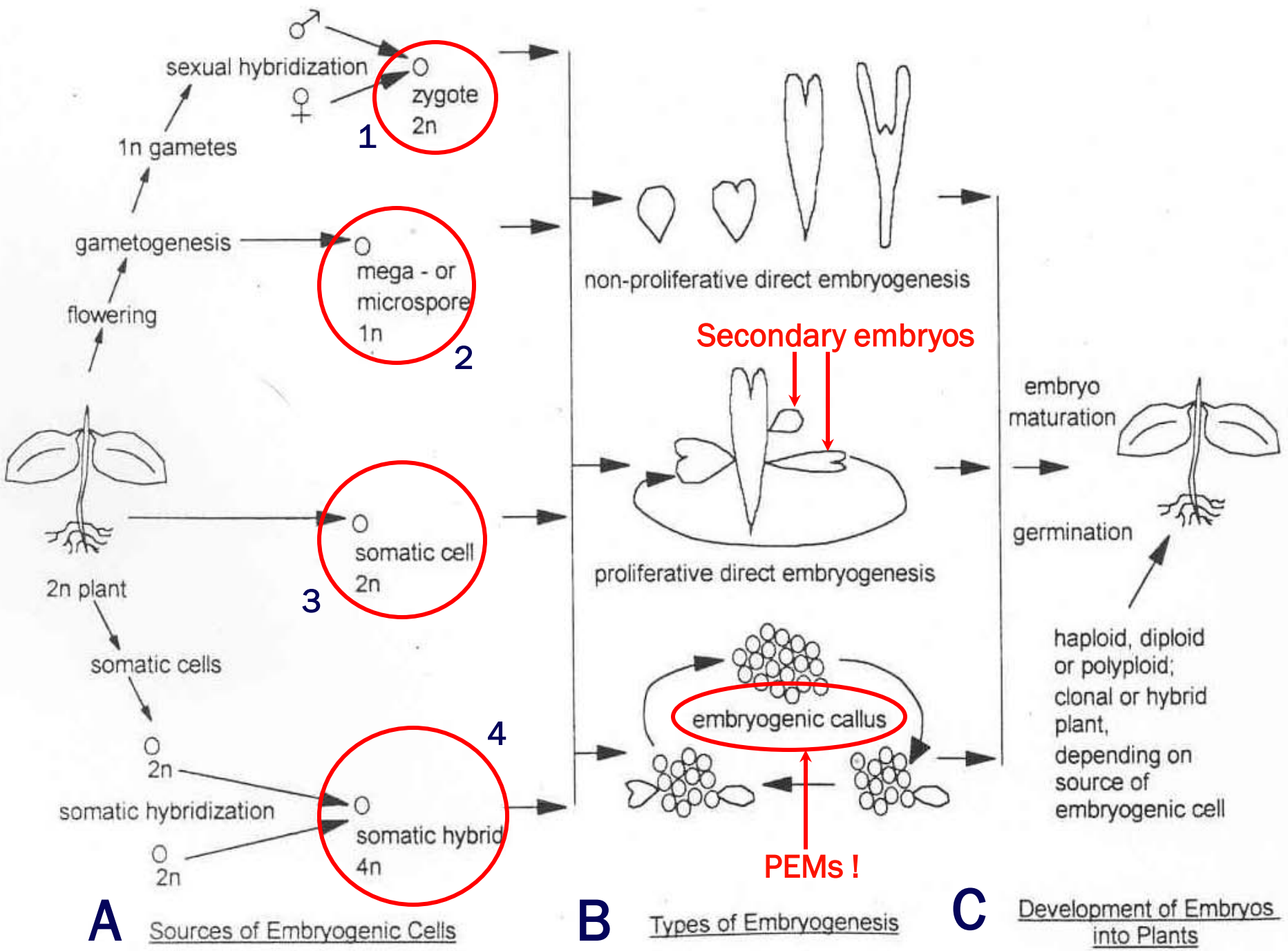
Heart-shaped



Torpedo



Cotyledonary



A Sources of Embryogenic Cells

B Types of Embryogenesis

C Development of Embryos into Plants

A.

- Monocotyledonous somatic embryo

B.

- Dicotyledonous somatic embryo

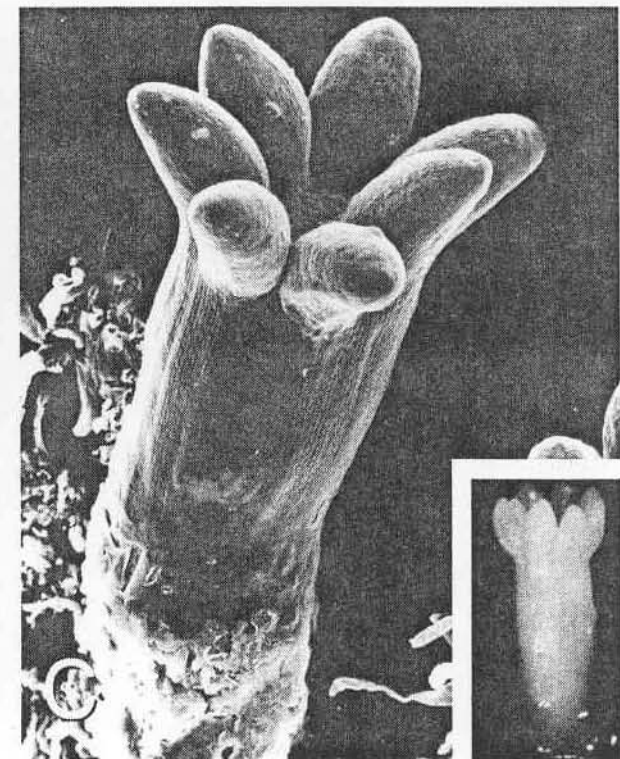
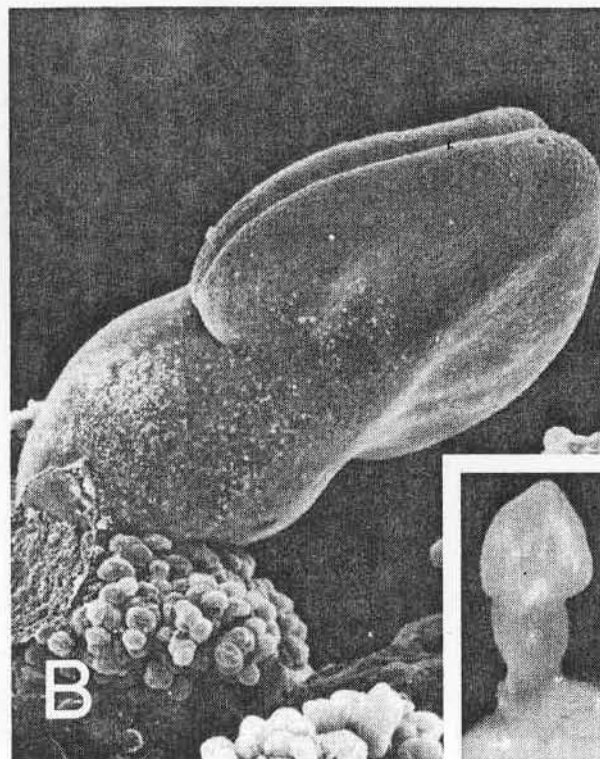
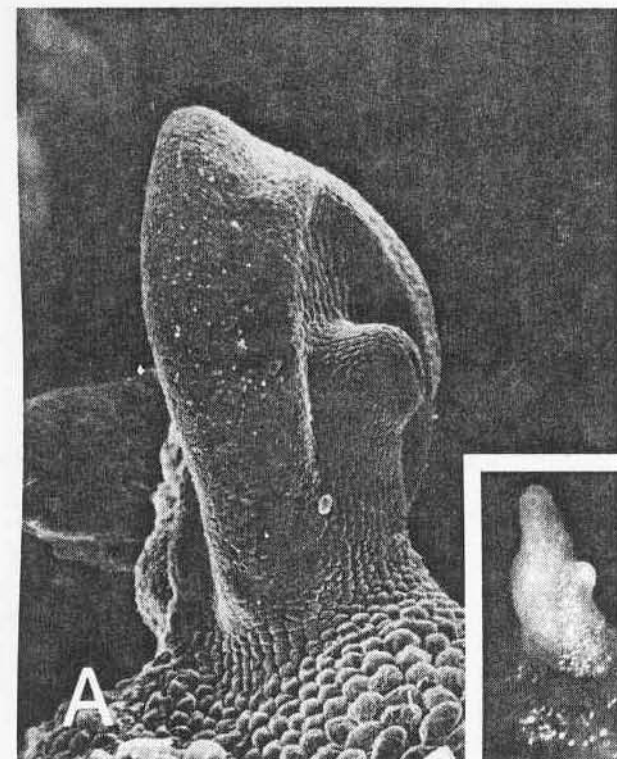
C.

- Gymnosperm somatic embryo

A. Orchardgrass

B. Grape

C. Norway spruce



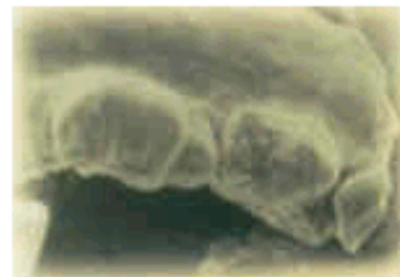
Pecan Somatic Embryogenesis



Tree



Immature Fruit Explant



**Embryo Induction
(SEM)**



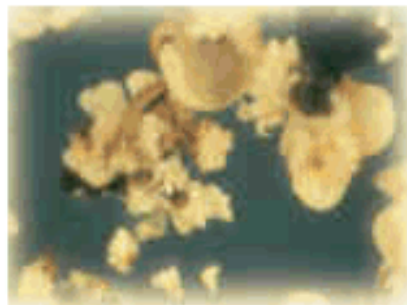
**Embryo Development
(SEM)**



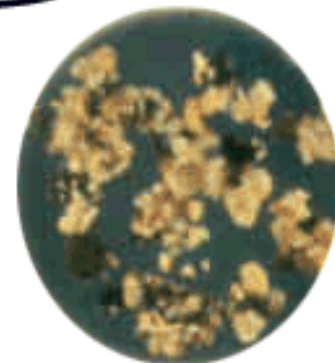
Plantlets in Soil

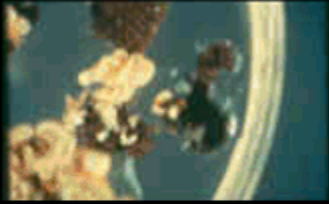


Conversion do Plantlets



Repetitive Culture





Embryo Conversion

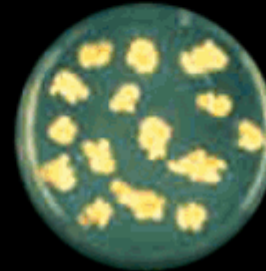
Embryogenic Culture



Somatic Embryos



Embryo Enlargement



Cold Treatment



Desiccation Treatment



Germinating Embryos



Converted Plantlets



Plants in Soil



Pecan Tree



A



B

A.

- Pecan plantlets under acclimatization

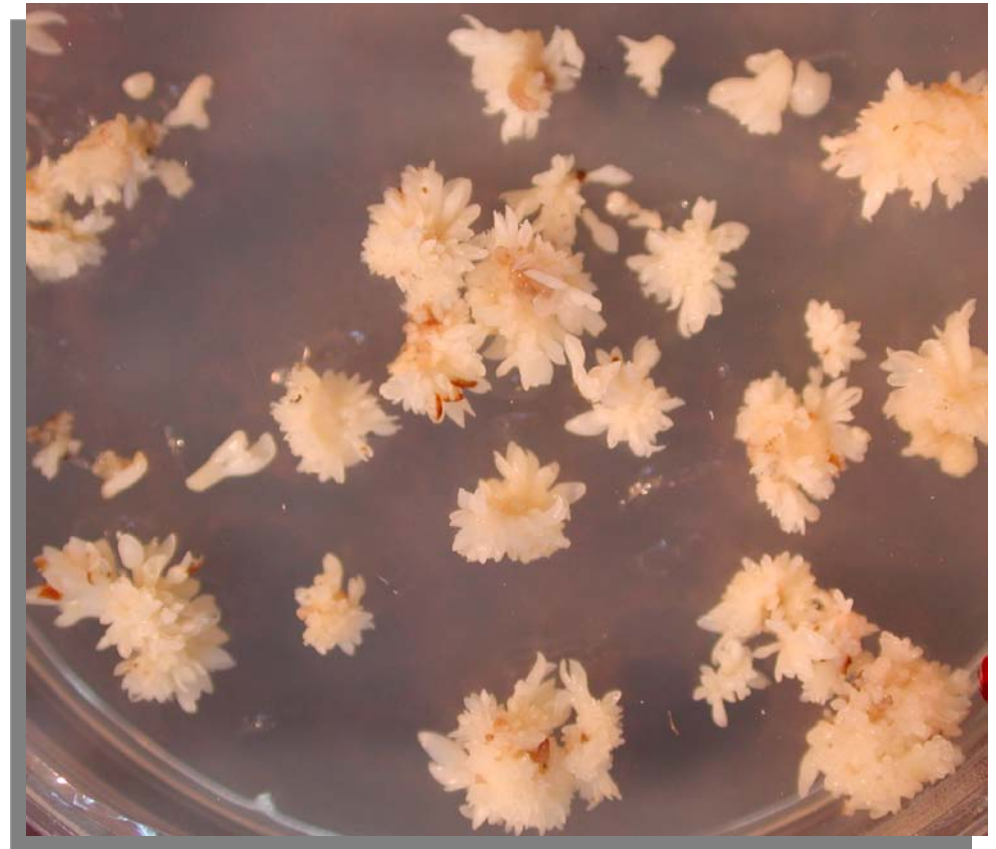
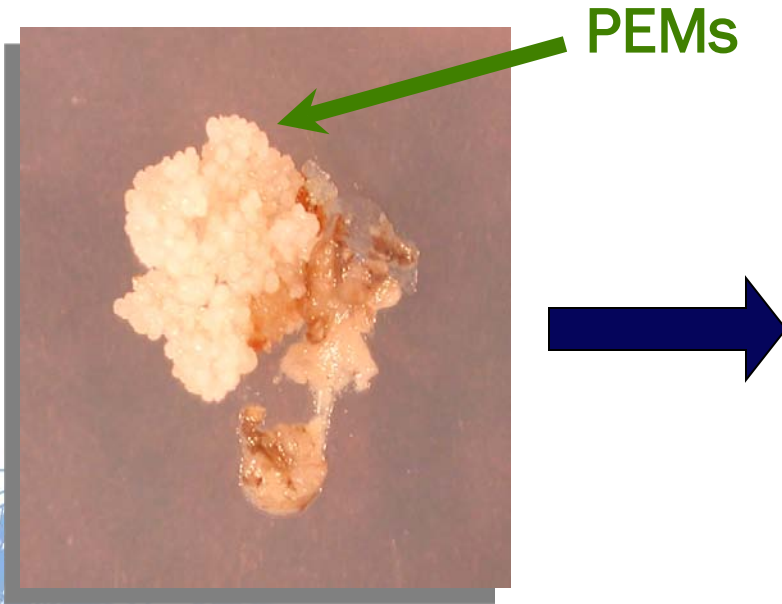
B.

- Pecan tree in field conditions

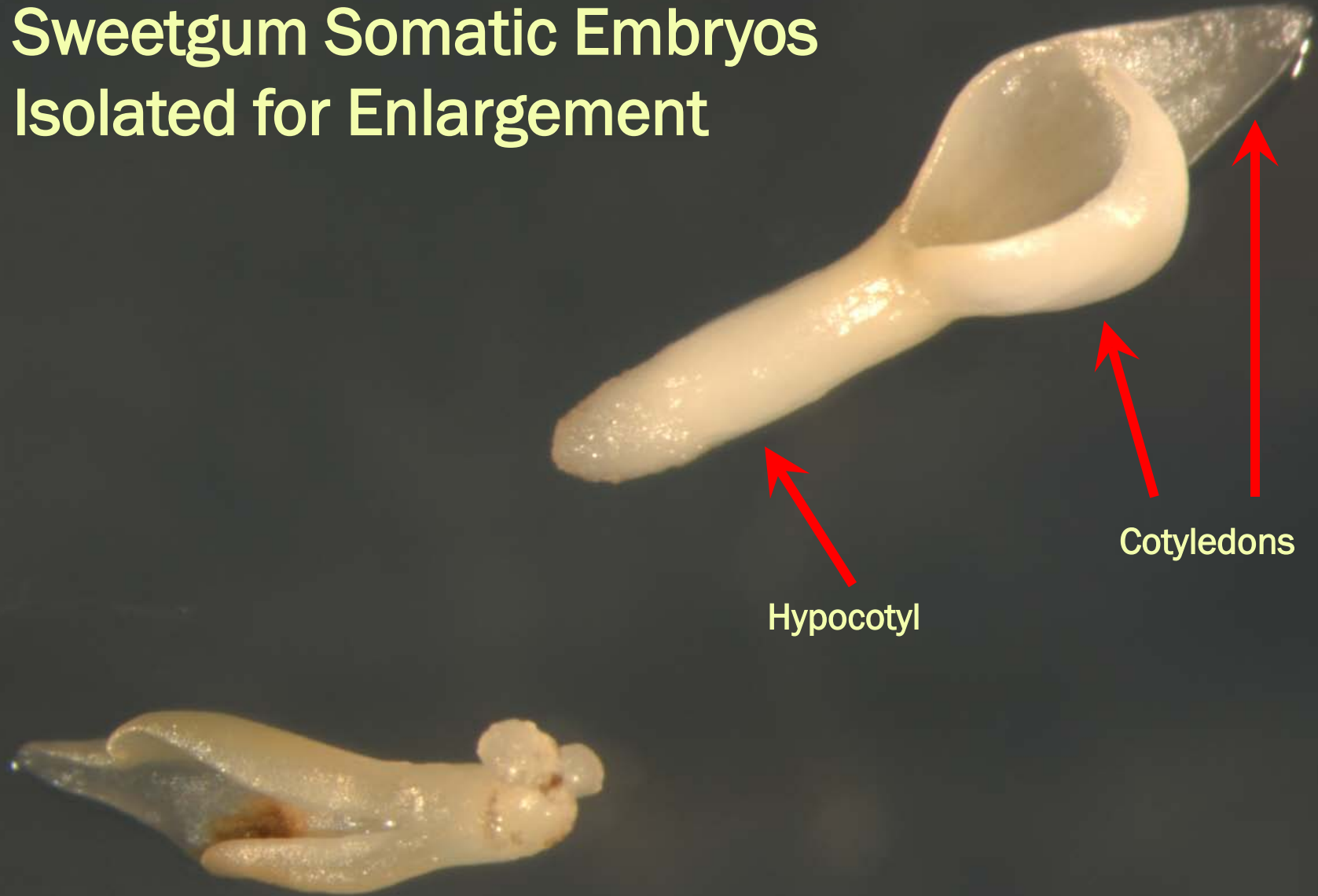
PEM Formation and Embryo Induction

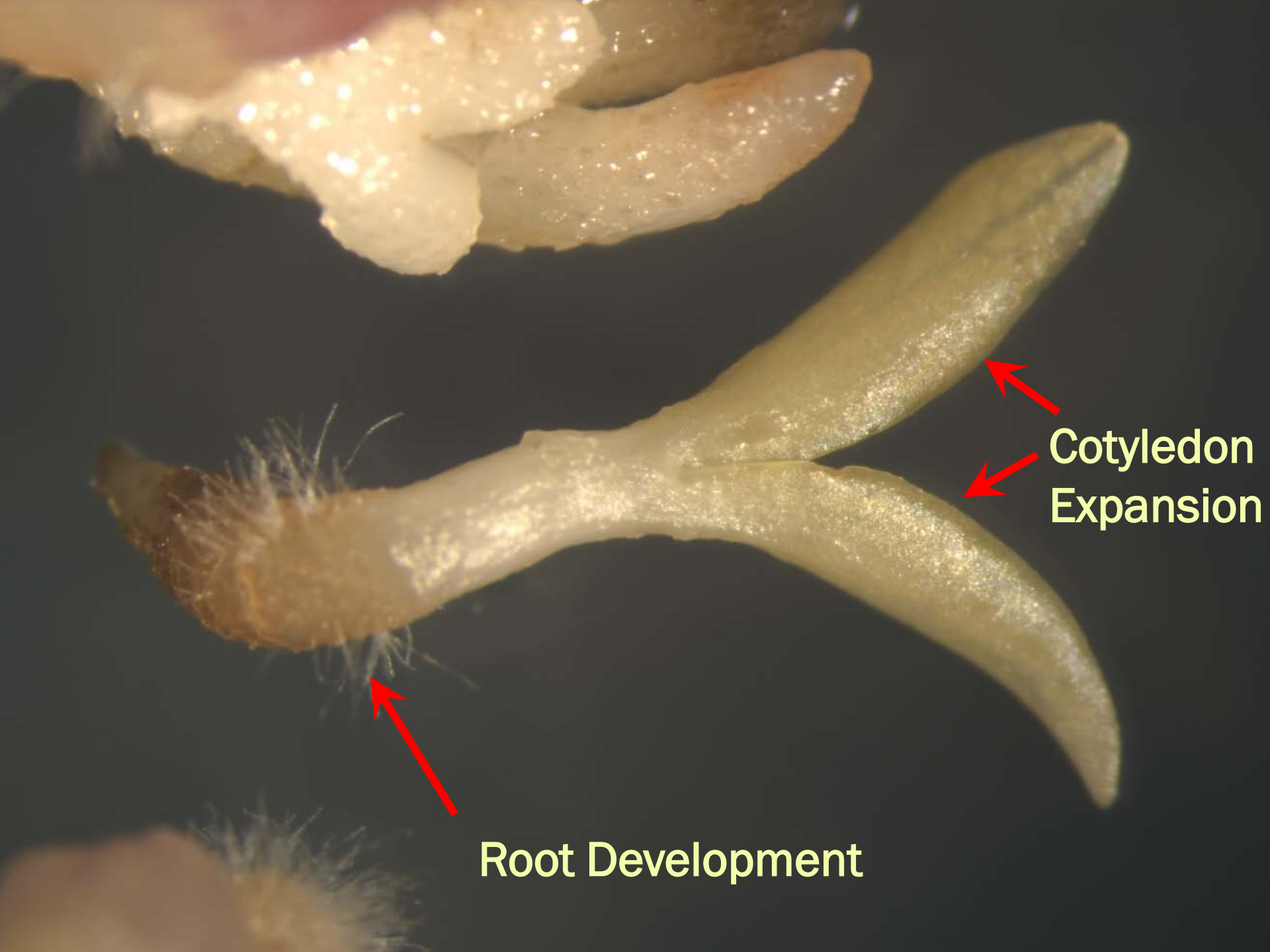
Hybrid Sweetgum

Liquidambar styraciflua x *Liquidambar formosana*



Sweetgum Somatic Embryos Isolated for Enlargement





Cotyledon
Expansion

Root Development

Germination



Plantlet Development from a Sweetgum Somatic Embryo





PEMs

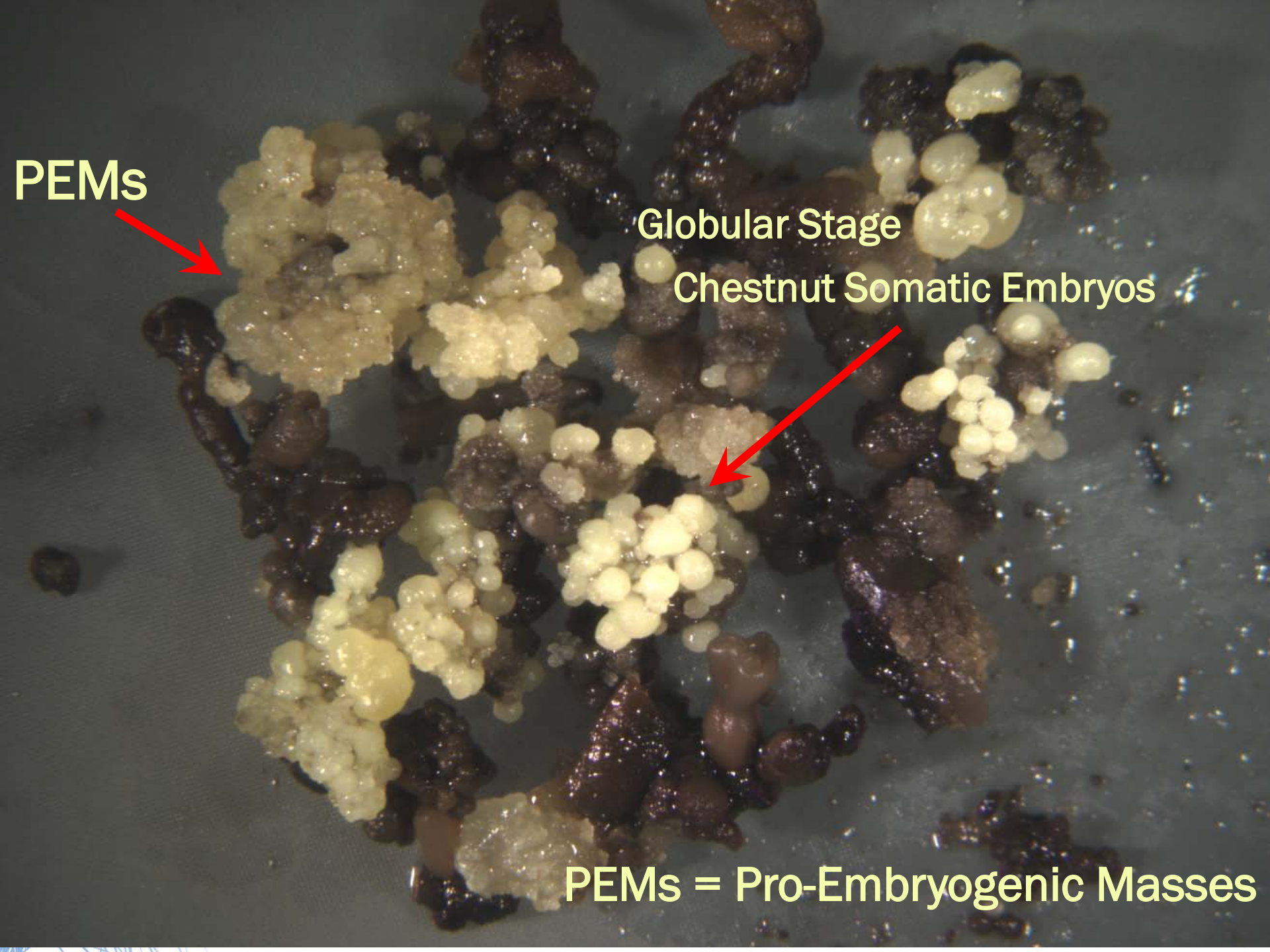


Globular Stage

Chestnut Somatic Embryos



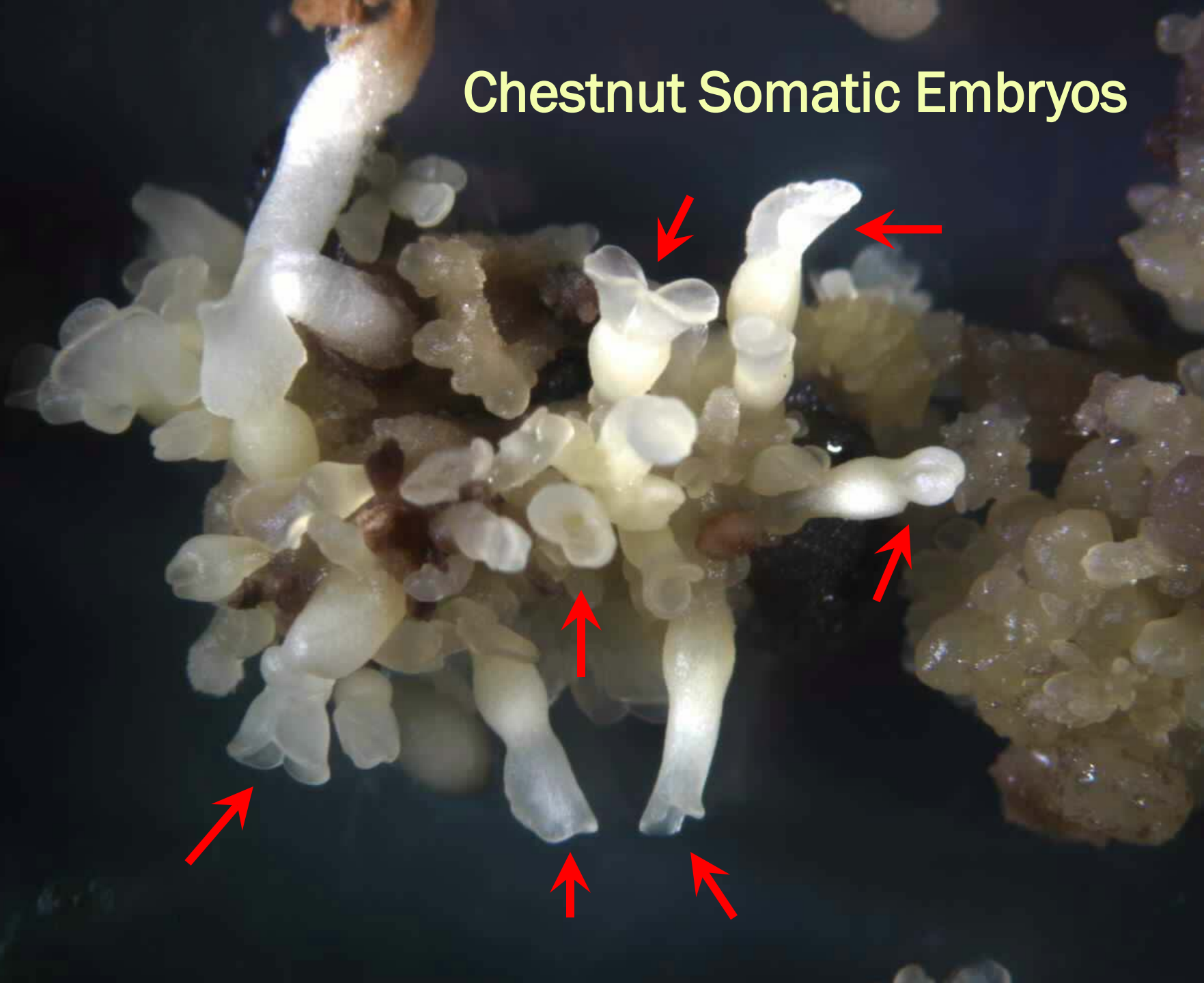
PEMs = Pro-Embryogenic Masses



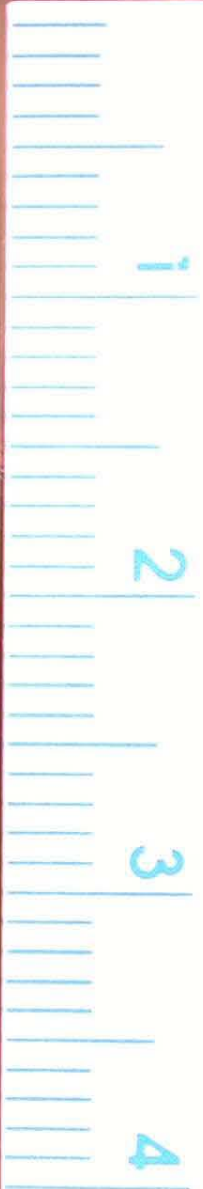


**Globular Stage
Chestnut
Somatic Embryos**

Chestnut Somatic Embryos



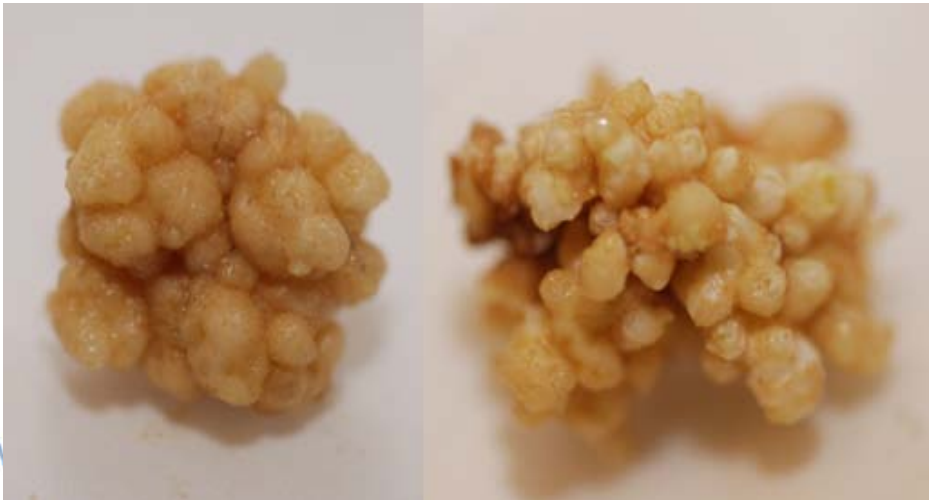
SCIENTIFIC INSTRUMENT



Somatic Embryogenesis in Space



ISS – National Laboratory Pathfinder – Cells



Pro-embryogenic masses (PEMs) of *Jatropha curcas*, a biofuel plant.



Jatropha seeds produce oil of exceptional quality for biofuel utilization, including biodiesel and jet fuels.



References

Gray, D.J. 2000. Nonzygotic embryogenesis. In: Trigiano, R.N. and D.J. Gray (ed.). *Plant Tissue Culture Concepts and Laboratory Exercises*, CRC Press, Boca Raton. pp. 175-189.

Wetzstein, H.Y., B.S. Jeyaretnam, W.A. Vendrame and A.P.M. Rodriguez. 2000. Somatic Embryogenesis in Pecan (*Carya illinoensis*). In: Jain, S.M. et al. (ed.). *Somatic Embryogenesis in Woody Plants*, vol. 6, Kluwer Academics, Dordrecht. pp. 391-414.

Vendrame, W.A., C.P. Holliday, and S.A. Merkle. 2001. Clonal propagation of hybrid sweetgum (*L. styraciflua* x *L. formosana*). *Plant Cell Reports*, 20: 691-695.



Wagner Vendrame, Ph.D., Associate Professor

TREC - IFAS - University of Florida

18905 SW 280th St, Homestead, FL 33031-3314

Phone: (305) 246-7001 ext. 210

E-mail: vendrame@ufl.edu

Website: <http://trec.ifas.ufl.edu/vendrame/>



Thanks!

UF UNIVERSITY of
FLORIDA
The Foundation for The Gator Nation

