



"Young People and Multidisciplinary Research in Applied Life Sciences", 16th-17th of November 2023



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Bioreactors – a new biotechnological tool for standardized production of plant bioactive compounds

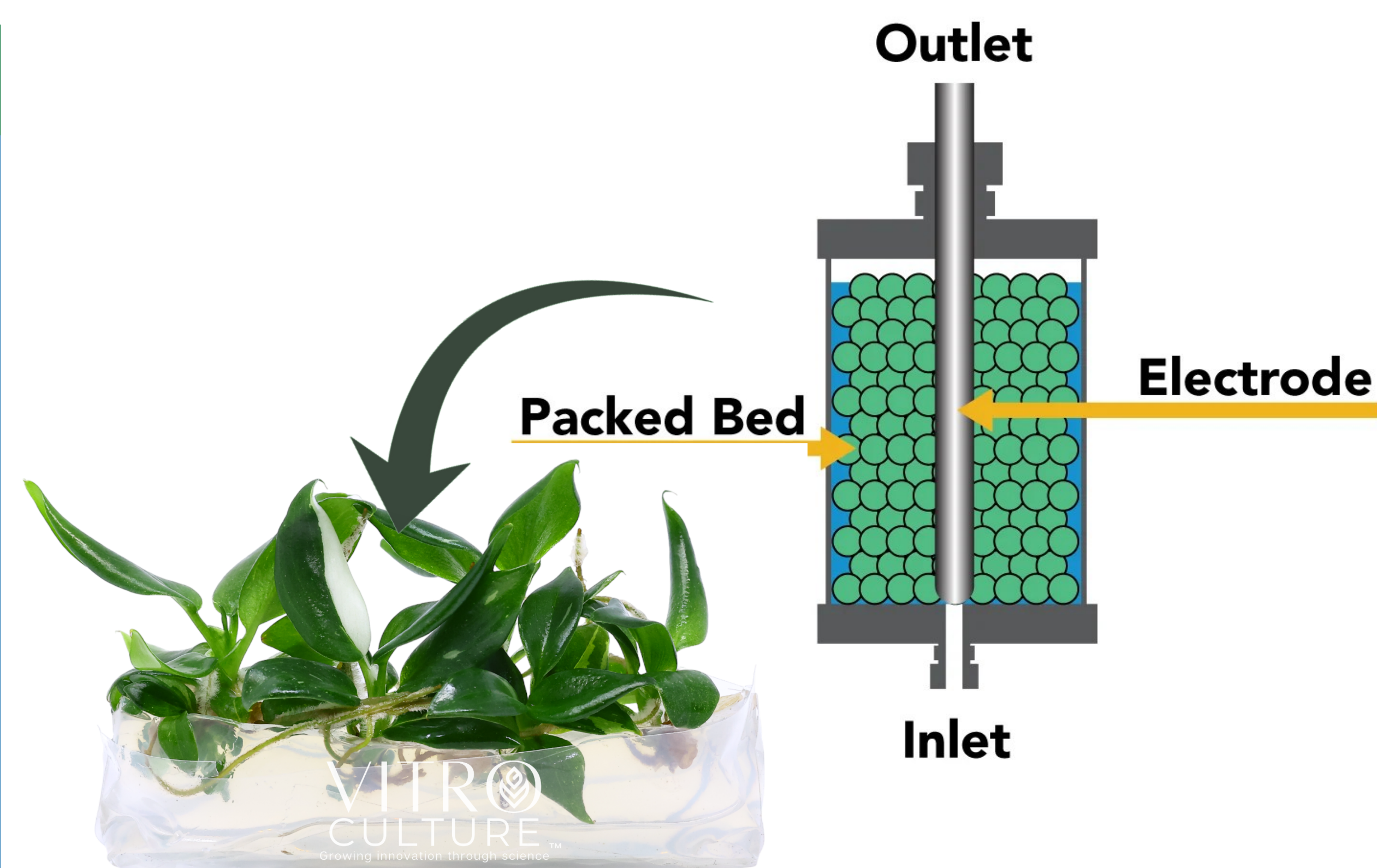
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Introduction

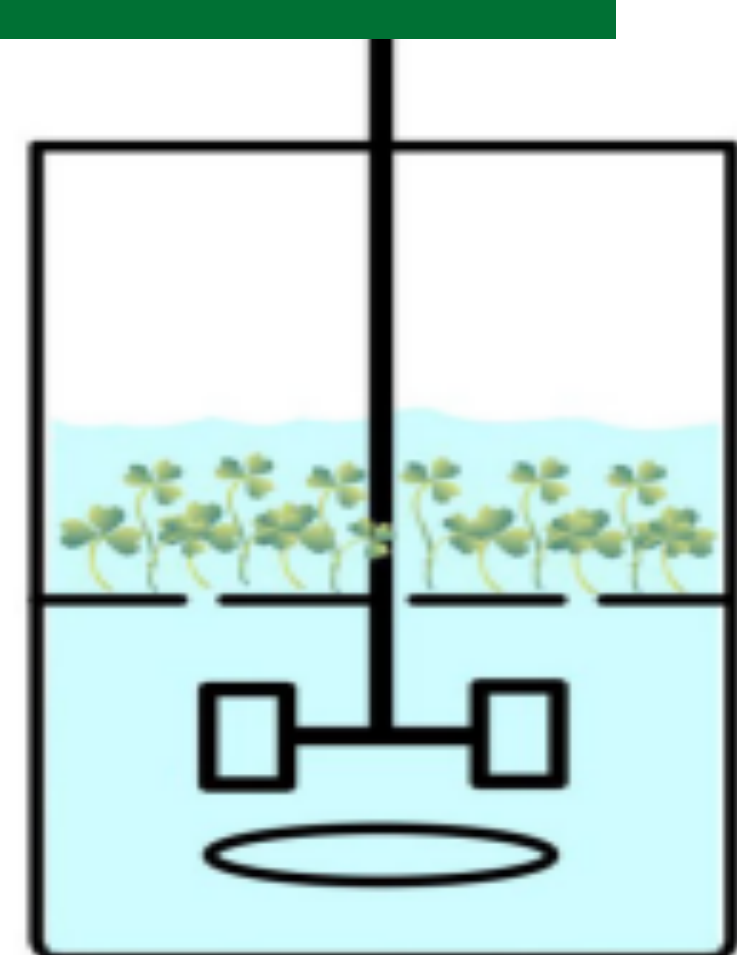
- ✓ bioreactors have been widely used in research on various species, such as plant cells, animal cells, and microorganisms or subcellular structures such as chloroplasts and mitochondria [1].
- ✓ bioreactors provide a rapid and efficient plant propagation system for many agricultural and forestry species, utilizing liquid media to avoid intensive manual handling as well as providing a standardized composition of produced biomass [2].
- ✓ thus, different culture types require different optimized design considerations [3].



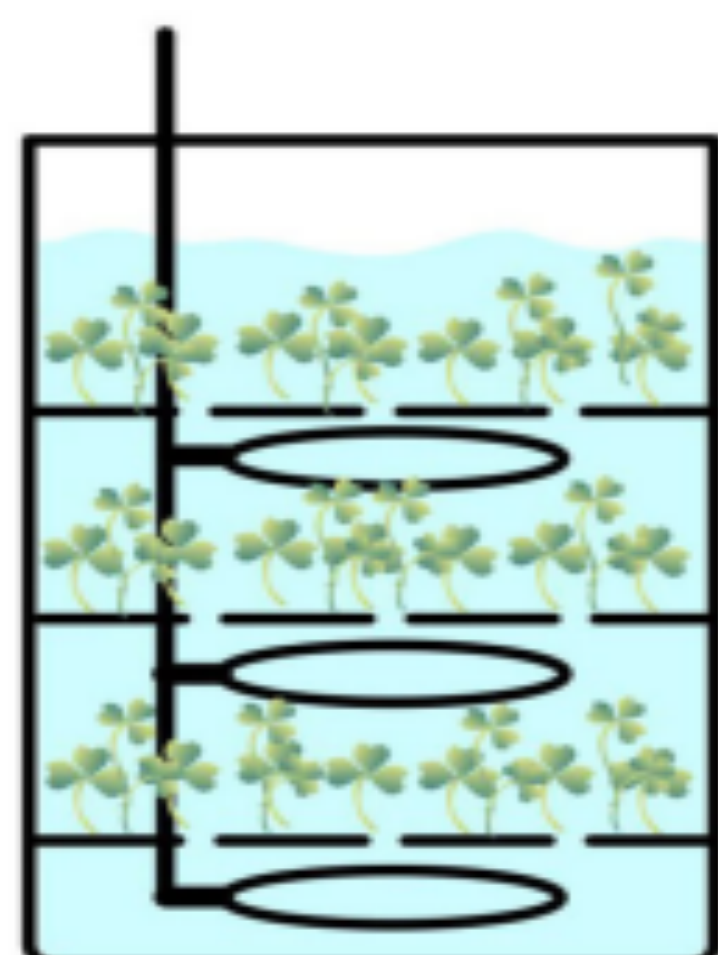
Bioreactors used in the micropropagation of plants and their bioactive compounds

A **bioreactor's** ability to create and regulate the ideal environment for efficient cell or root growth and secondary metabolite production has a major impact on the cultivation results. Furthermore, it is possible to monitor and regulate the critical process variables inside the bioreactor vessel, including pH, temperature, dissolved oxygen, and carbon dioxide evolution rate.[4]

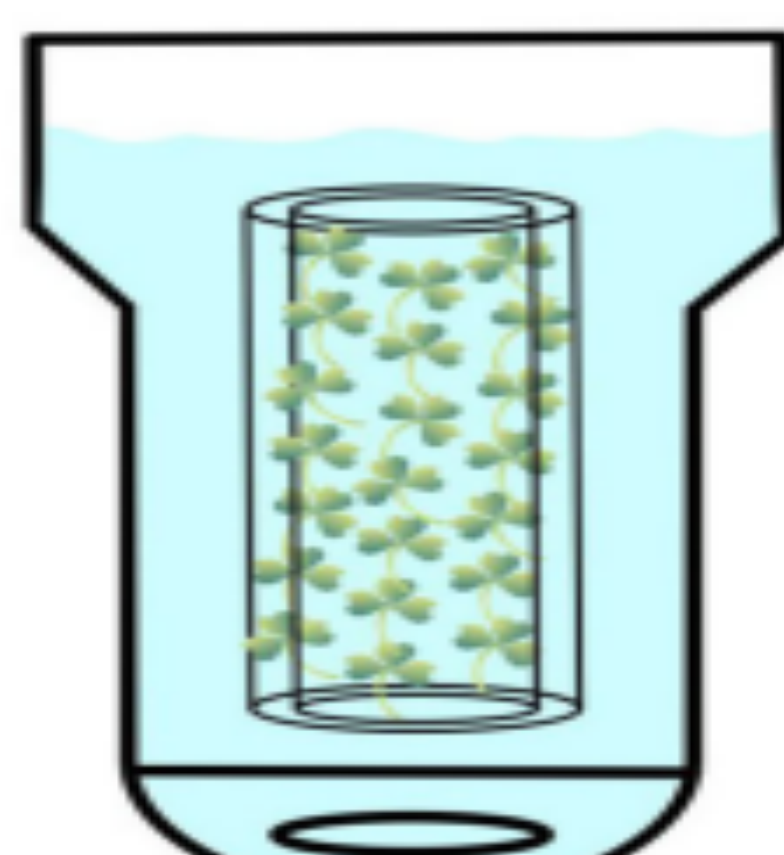
LPBs



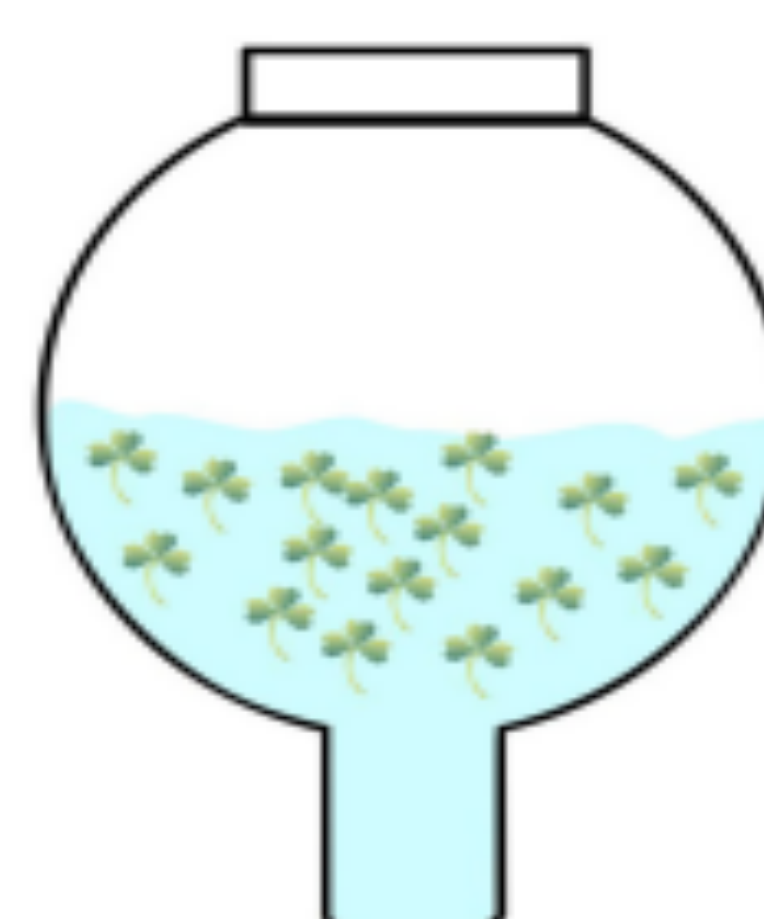
Stirred tank



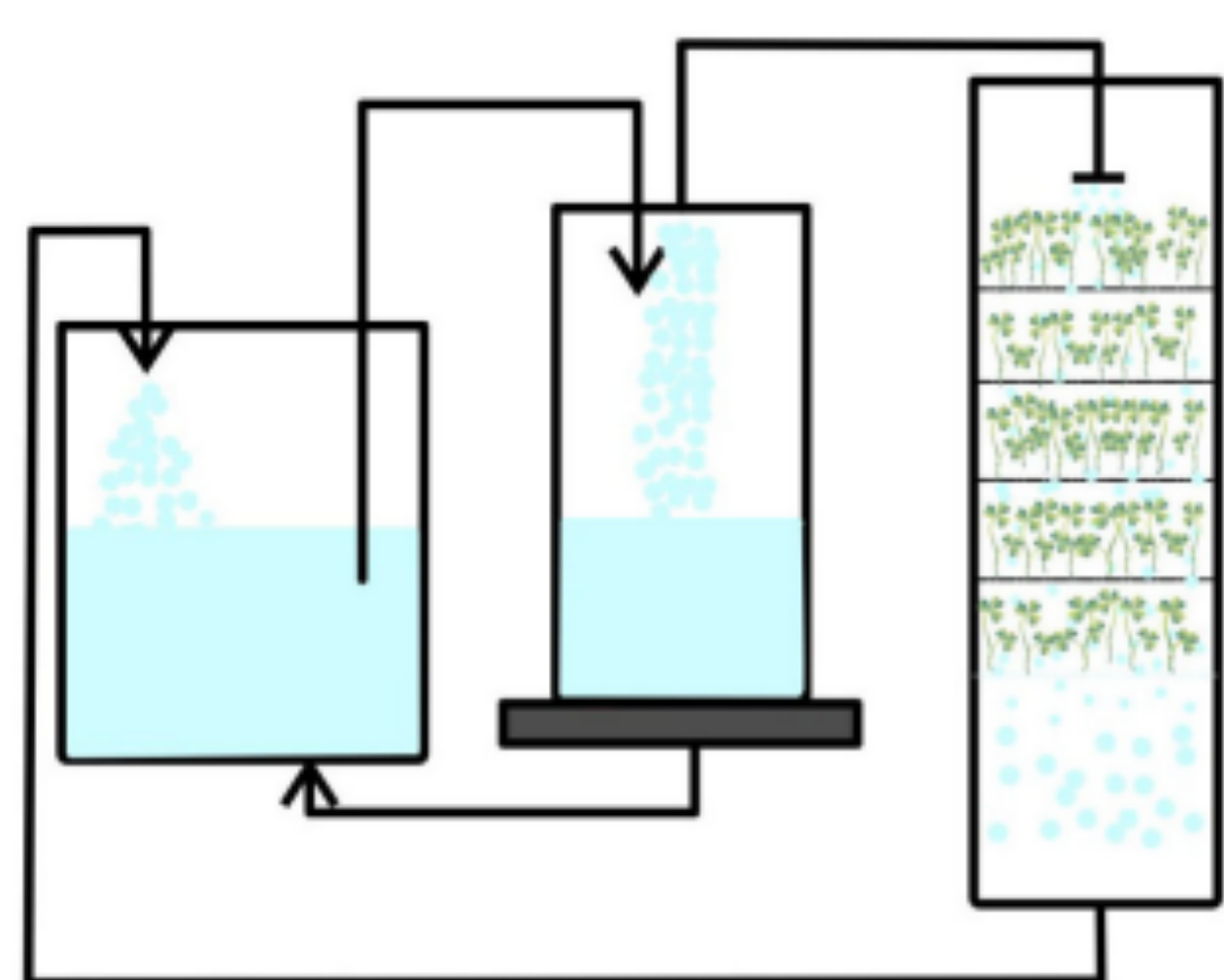
Bubble column



Air lift



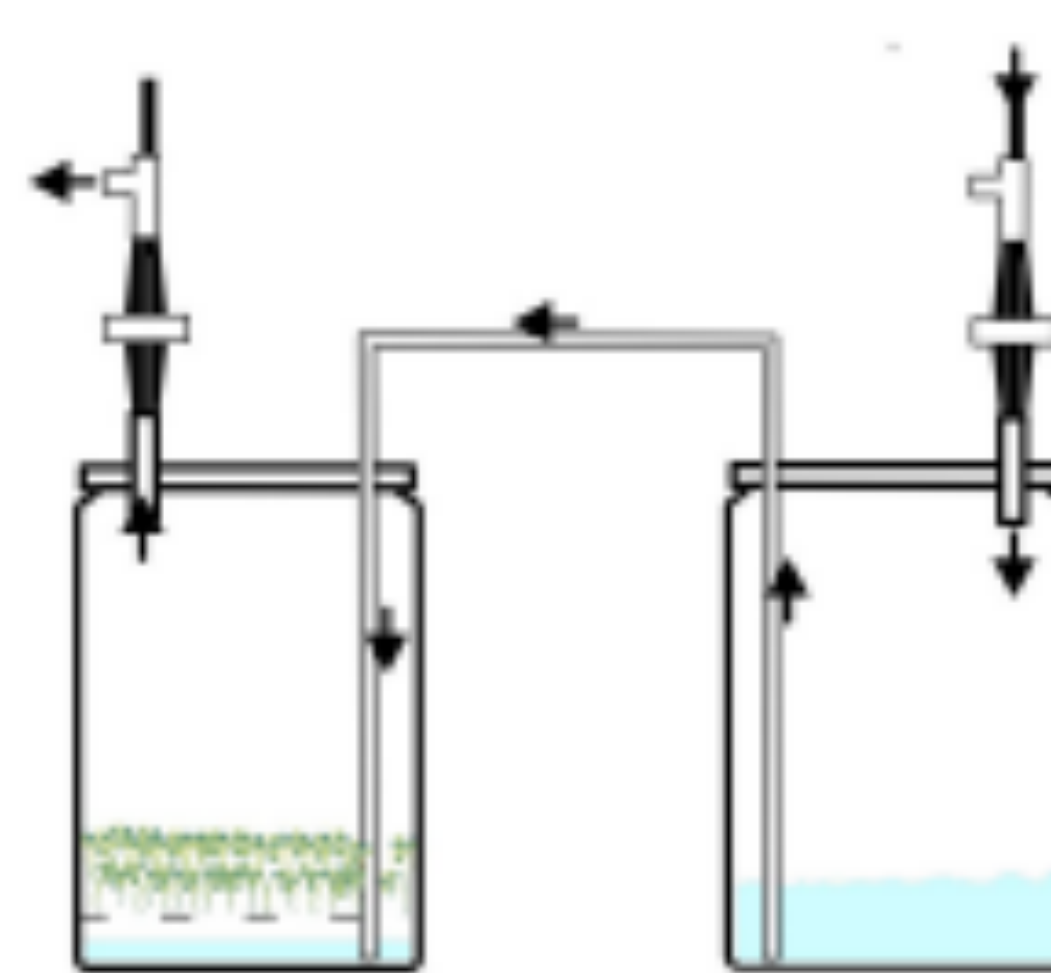
Balloon-type bubble



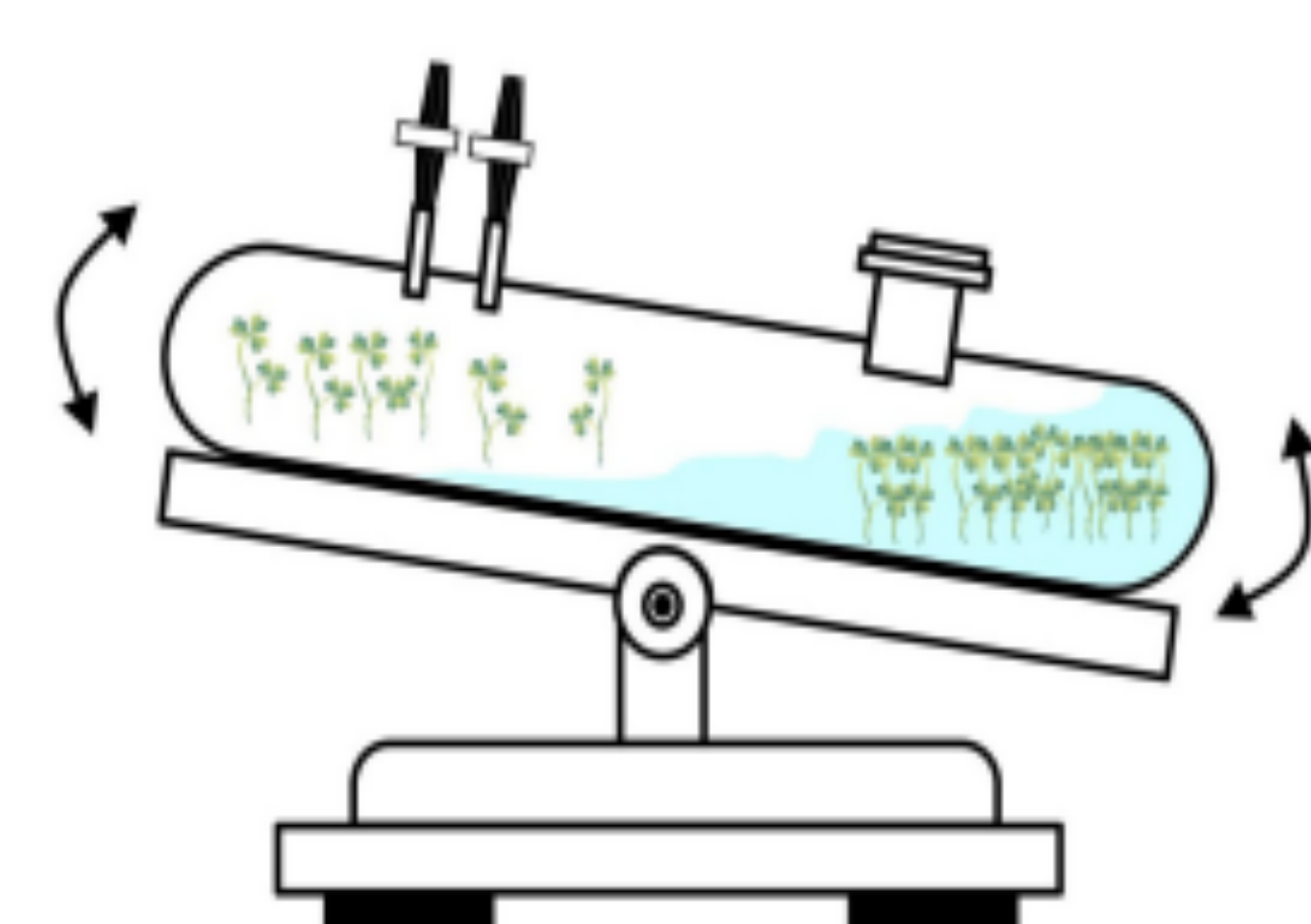
Nutrient mist



Trickle-bed



Temporary immersion



Wave

LPBs

Liquid phase bioreactors

Gas phase bioreactors

GPBs

GPBs

Conclusions

- ✓ The classification of bioreactors shows that there are **many types of bioreactors** each one is best for different biological cells.
- ✓ The **bioreactors provide control over all the parameters** that have an influence on cultured tissues growth and development.
- ✓ The majority of **plant cell suspension cultures** and hairy roots that are utilized **are cultivated in gas-phase bioreactors**, bubble columns, airlift reactors and their variations, and so-called hybrid systems.

References:

- [1] Afreen, F. (n.d.). Temporary Immersion Bioreactor. Focus on Biotechnology, 187–201. doi:10.1007/978-1-4020-3694-1_11
- [2] Ziv, M. (n.d.). Simple bioreactors for mass propagation of plants. Liquid Culture Systems for in Vitro Plant Propagation, 79–93. doi:10.1007/1-4020-3200-5_5
- [3] Zhong, J.-J. (2010). Recent advances in bioreactor engineering. Korean Journal of Chemical Engineering, 27(4), 1035–1041. doi:10.1007/s11814-010-0277-5
- [4] Baque Md. Abdullahil, Moh Sang-Hyun, Lee Eun-Jung, Zhong Jian-Jiang, Paek Kee-Yoeup. (2012). Production of biomass and useful compounds from adventitious roots of high-value added medicinal plants using bioreactor. Biotechnology Advances, 30(6), 1255–1267. Doi: 10.1016/j.biotechadv.2011.11.004

Acknowledgment: This research was conducted with technical support from the Antioxidant Systems Research Laboratory (A1c), ICBB, ULST.