

# Food Contaminants and Global Health Impact: an overview of recent intestinal *in vitro* models

Bruna Alves de Sousa<sup>1,2</sup> and Paula Alvito<sup>1,3</sup>

<sup>1</sup>Food and Nutrition Department, National Institute of Health Dr. Ricardo Jorge, Avenida Padre Cruz, 1649-016 Lisboa, Portugal; <sup>2</sup> Faculty of Sciences, Lisbon University  
<sup>3</sup>CESAM & Department of Biology, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal;

## GLOBAL HUMAN HEALTH AND FOOD CONTAMINANTS

Human health and food contaminants are interlinked through diet since food ingestion is one of the main routes of exposure to several contaminants. Common health problems from environmental contaminants include breathing problems, heart disease, and cancer.

## INTESTINE AND FOODBORNE DISEASES

The intestine is an important digestive organ of the human body. The impairment of the intestinal barrier is believed to be an important determinant in various foodborne diseases.

## IN VITRO MODELS TO PROMOTE HUMAN HEALTH

Understand the mechanisms of the impact of the food contaminants on intestinal barriers is essential for promoting human health. *In vitro* studies are a great option to predict the *in vivo* response.

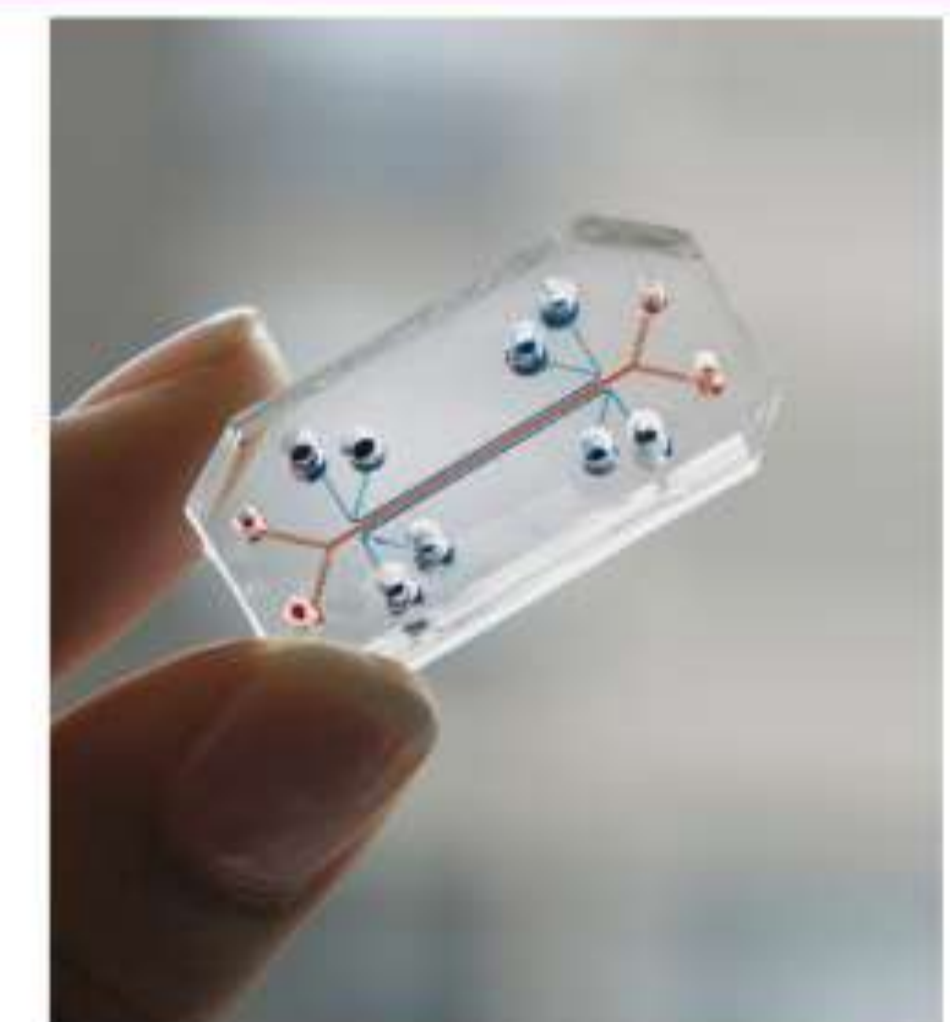
## RECENT IN VITRO MODELS

Cell lines are a great option to predict the *in vivo* response, however, nowadays there are other types of cell models with fewer limitations.

**Stem cell-derived 3D culture systems\*** and **organ-on-a-chip\*\*** models, has been used to study some intestine mechanisms once these models can recapitulate the physiological morphology of 3D intestinal cells. These *in vitro* models give us the possibility to have tiny replicas of our own organs in a laboratory. Human intestinal organoids has been used as an alternative to cell lines in the treatment of diseases (cancer, autism) in **personalized medicine**.



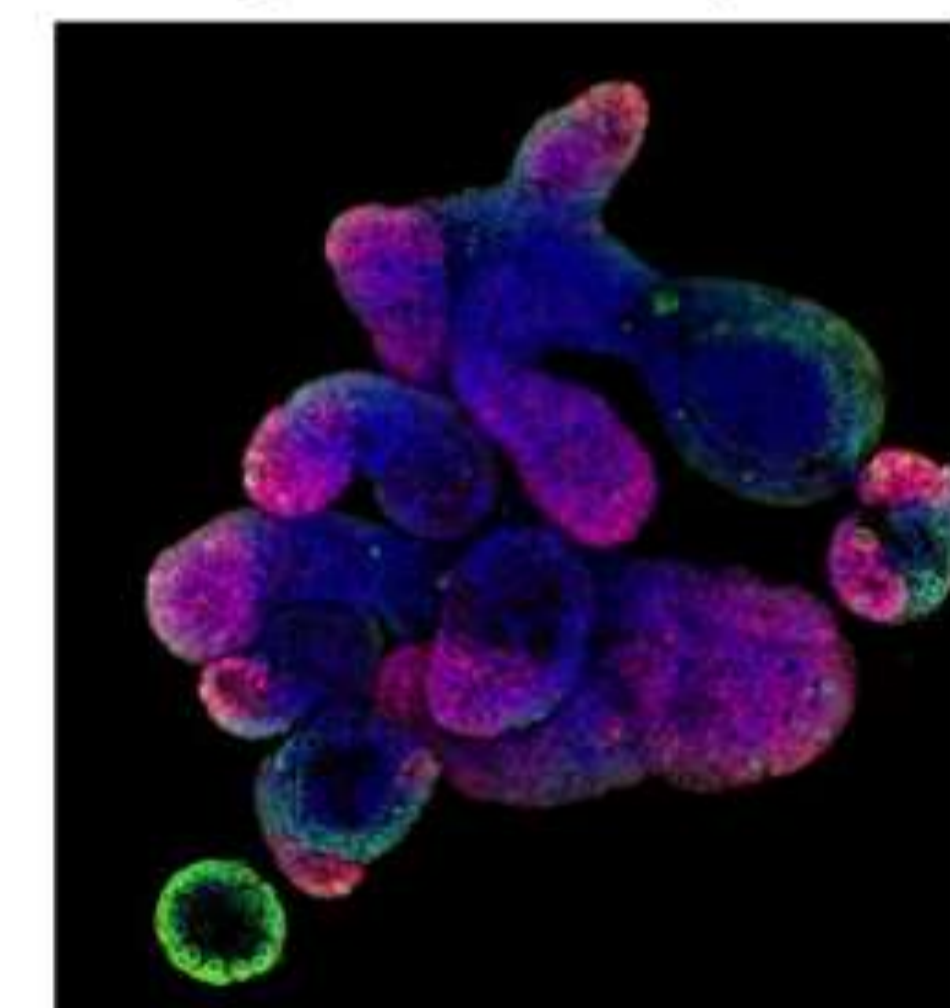
\*Organoid



\*\*Organ-on-a-chip

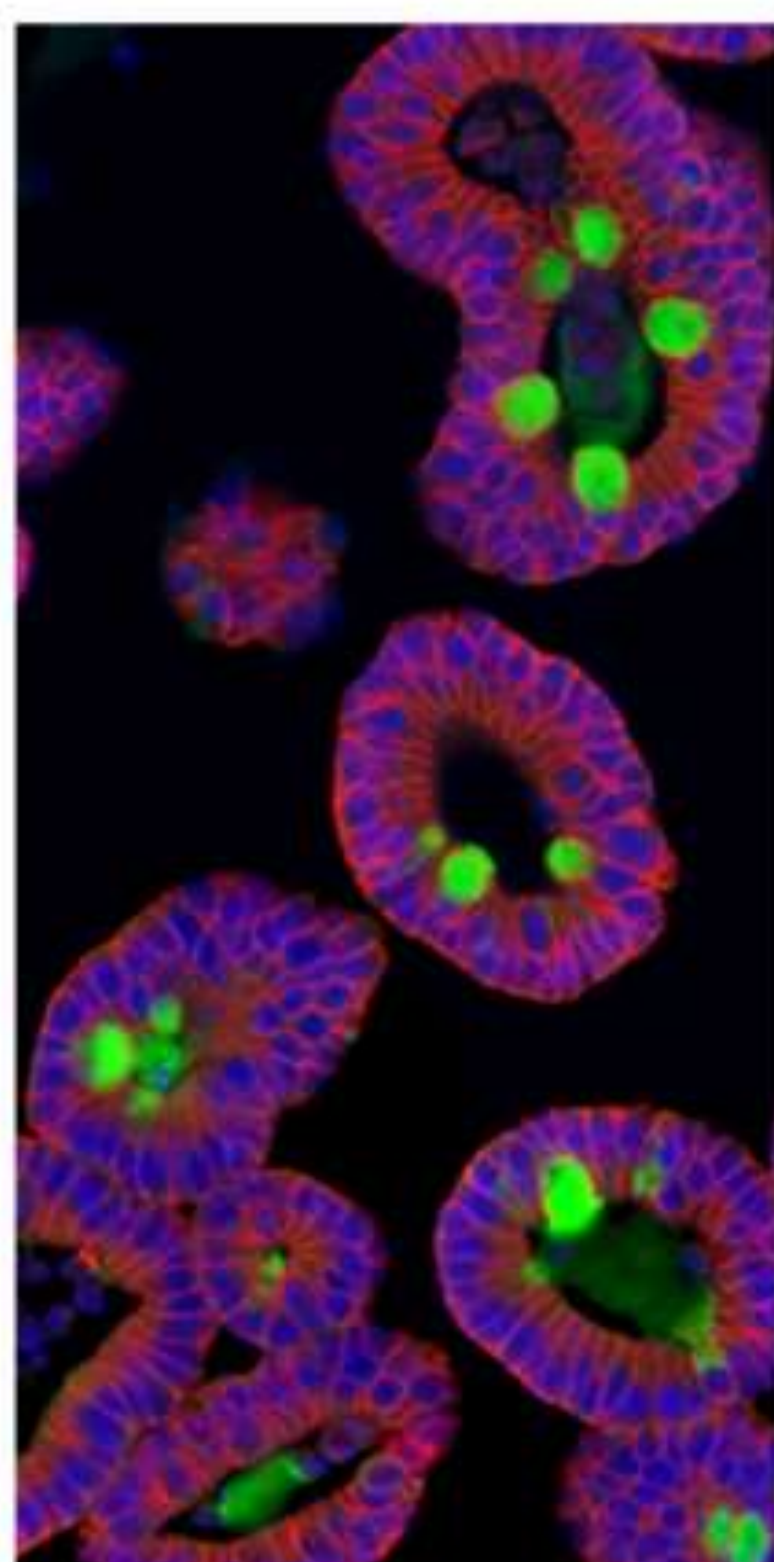


\*\*Organ-on-a-chip



\*Organoid

## FUTURE



\*Organoid

**Organoid** and **organ-on-a-chip** research has attracted increasing attention in areas such as disease modeling, drug development, regenerative medicine, and personalized medicine. Especially, in **toxicology**, where there are various traditional models, human organoids promise to break new ground in future research by overcoming current limitations, such as those related to differences in contaminants responses among humans.

Toxicological studies are essential for **promoting human health** and it is expected that in the future these models will be more used in toxicological studies.

## ACKNOWLEDGEMENTS

Thanks are due to FCT/MCTES for the financial support for the early MYCO project (PTDC/DTP-MEDTOX/28762/2017) and to CESAM (UIDP/50017/2020+UIDB/50017/2020 + LA/P/0094/2020), through national funds

## REFERENCES

·European Economic and Social Committee, Opinion (2021), Food security and sustainable food systems, NAT/844-EESC-2021  
·Li X., Tan C.P., Liu Y.F., and Xu Y.J. (2020), Interactions between Food Hazards and Intestinal Barrier: Impact on Foodborne Diseases, J. Agric. Food Chem., 68, 50, 14728-14738 <https://doi.org/10.1021/acs.jafc.0c07378>  
·Bein A., Shin W., Jalili-Firoozinezhad S., Park M.H., Sontheimer-Phelps A., Tovaglieri A., Chalkiadaki A., Kim H.J., Ingber D.E. (2018), Microfluidic Organ-on-a-Chip Models of Human Intestine. Cell Mol Gastroenterol Hepatol. 24;5(4):659-668. doi: 10.1016/j.jcmgh.2017.12.010.