ESALQ
Luiz de Queiroz College of Agriculture
University of São Paulo

FAPESP Week CHINA 2024, June 28 - 29

Foodomics: new insight in food science and nutrition

Dr. Aline Cesar

Department of Food Science and Technology

Department of Food Science and Technology



Food Security
Food Technology
Food Safety
Nutrigenomics
Functional Food Development

Functional Food Discovery
Circular Economy – Waste → Bioenergy
Education and Training
Extension

FAPESP
SÃO PAULO RESEARCH FOUNDATION

FAPESP Week CHINA 2024, June 28 - 29

Challenge – Food Security and Nutrition



Goal



“Healthy and sustainable diets with low environmental impacts, which contribute to food and nutrition security and to healthy life for present and future generations”.

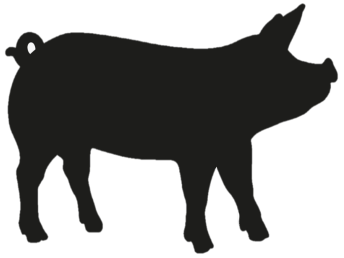
Tools



Theodoridis et al., 2021 - https://doi.org/10.3390/metabo11020074

Research and Solutions – Functional food/Nutrigenomics

Animal model for metabolic diseases in human



Immunocastrated males

Breed Large White

Experimental period - 98 days

Fatty acids – functional component

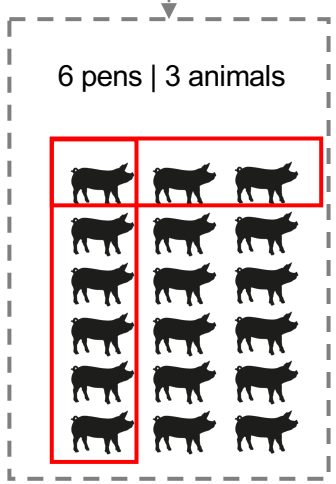
n-3 n-6 n-9

SOY1.5 - Soybean oil 1.5%

SOY3.0 - Soybean oil 3.0%

CO3.0 – Canola oil 3.0%

FO3.0 – Fish oil 3.0%







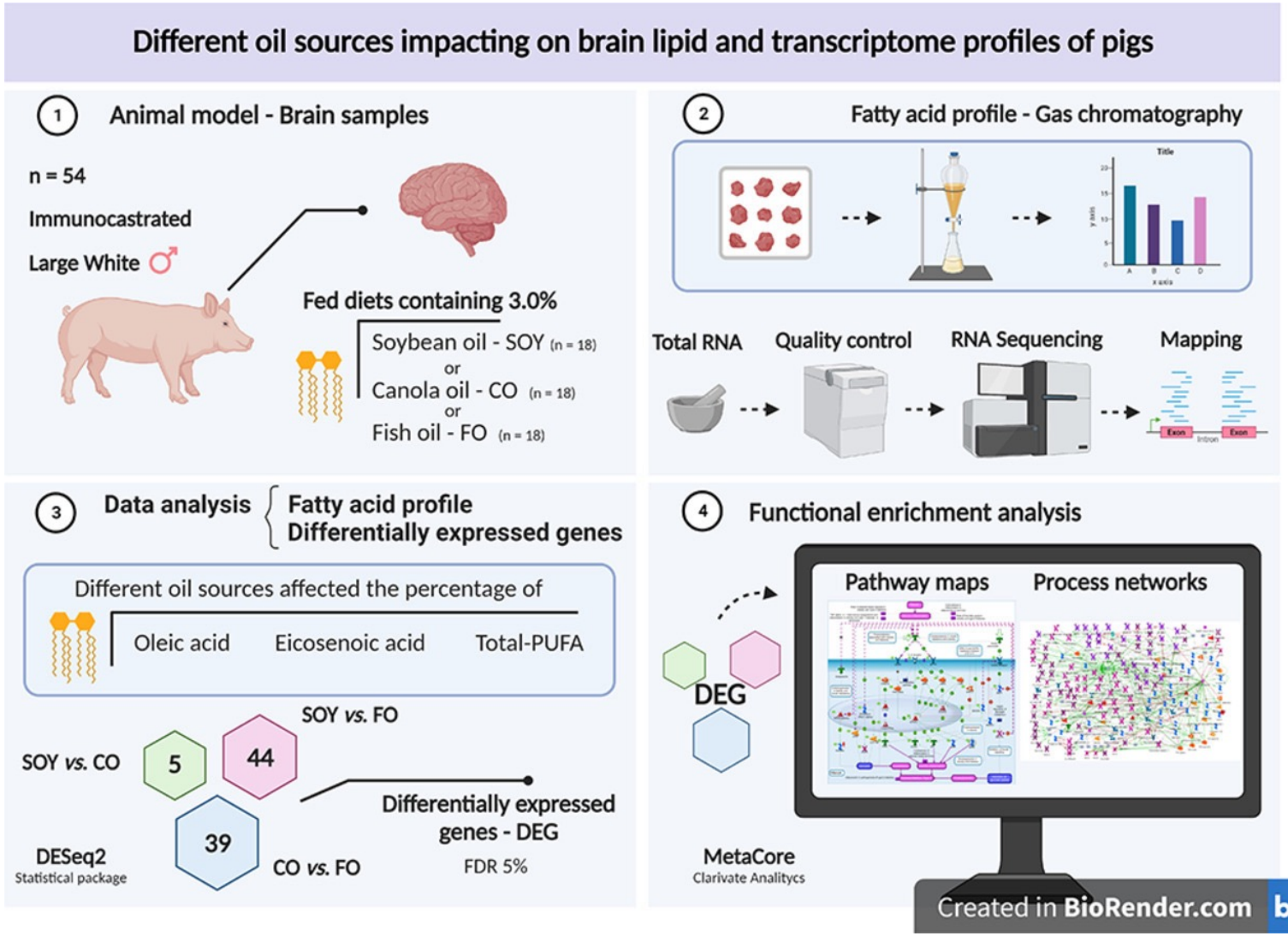


Fanalli et al., 2022a, 2022b, 2023 and 2024

FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – Nutrigenomics/RNASeq

FA increased
n3 - increased



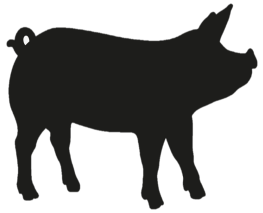
Da Silva et al., 2023 and 2024

Fanalli et al., 2022a, 2022b, 2023 and 2024 → **muscle and liver**

FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – lncRNA/cytokines

Animal model for metabolic diseases in human



Immunocastrated males

Breed Large White

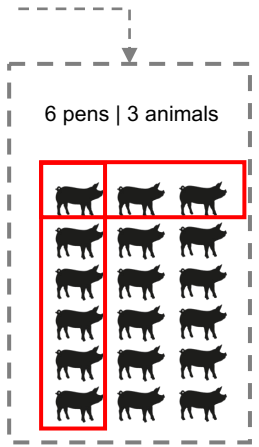
Experimental period - 98 days

SOY1.5 - Soybean oil 1.5%

SOY3.0 - Soybean oil 3.0%

CO3.0 – Canola oil 3.0%

FO3.0 – Fish oil 3.0%



Fatty acids – functional component

n-3 n-6 n-9

- ✓ lncRNA – regulator
- ✓ Antioxidant activity
- ✓ Cytokines – inflammatory reponse
- ✓ Co-expression. Analysis
- ✓ System Biology



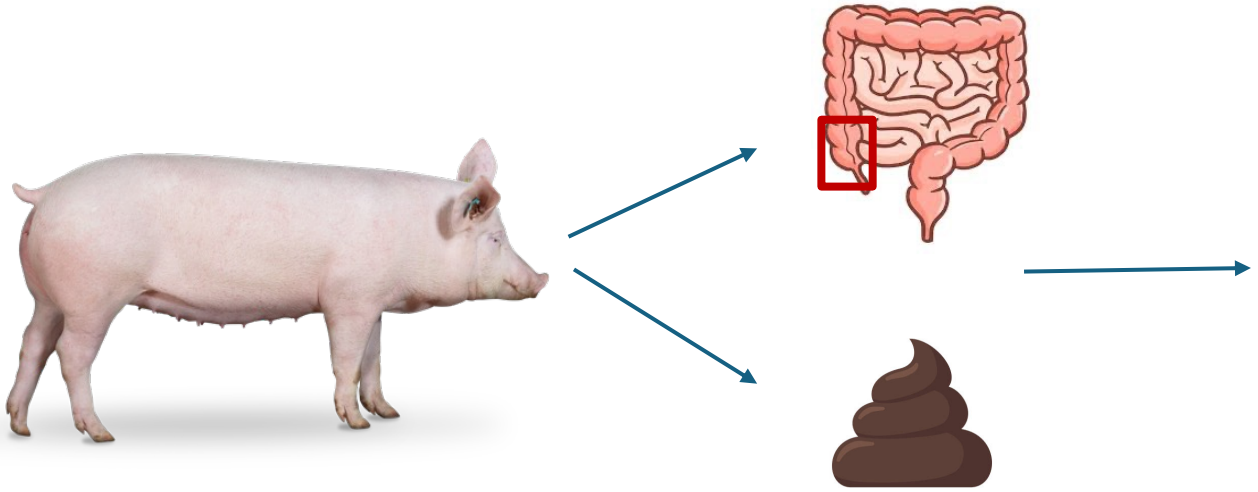




da Silva et al., 2024 - Project

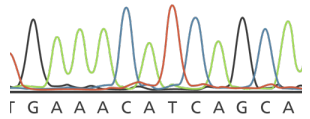
FAPESP Week CHINA 2024, June 28 - 29

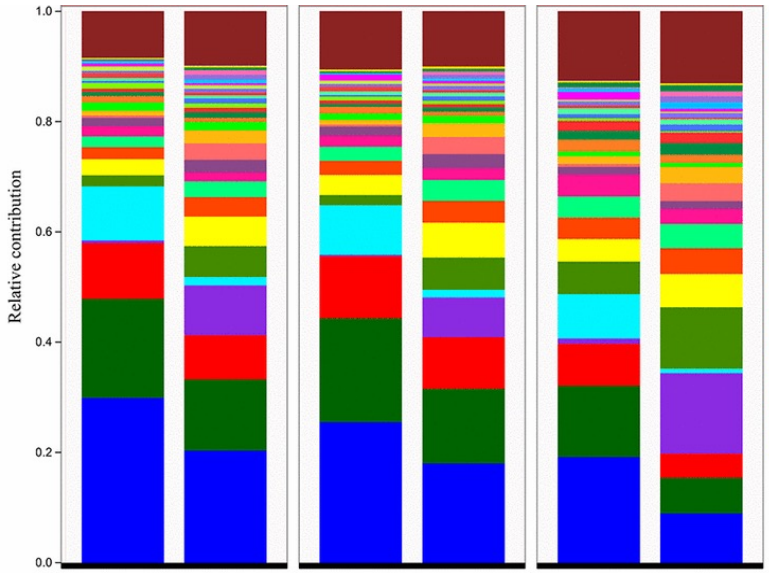
Research and Solutions – Nutrigenomics/Microbiome



16S rRNA sequencing







n-3 n-6 n-9

X

Health
Food efficiency
Production performance
Carcass/Meat quality

dos Santos et al., 2024 - Project

FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – Nutrigenomics/eQTL



Large White
72 male pigs



Longissimus lumborum

RNASeq and
Genotyping
(50K)

SNP: call SNP
and chip

Quality Control:
MAF 0.05
call rate < 0.95

Matrix eQTL
(fixed linear model)

Cis-eQTL
identification
FDR 5%

Significant eQTL +
Oleic Acid Content
(OAC)

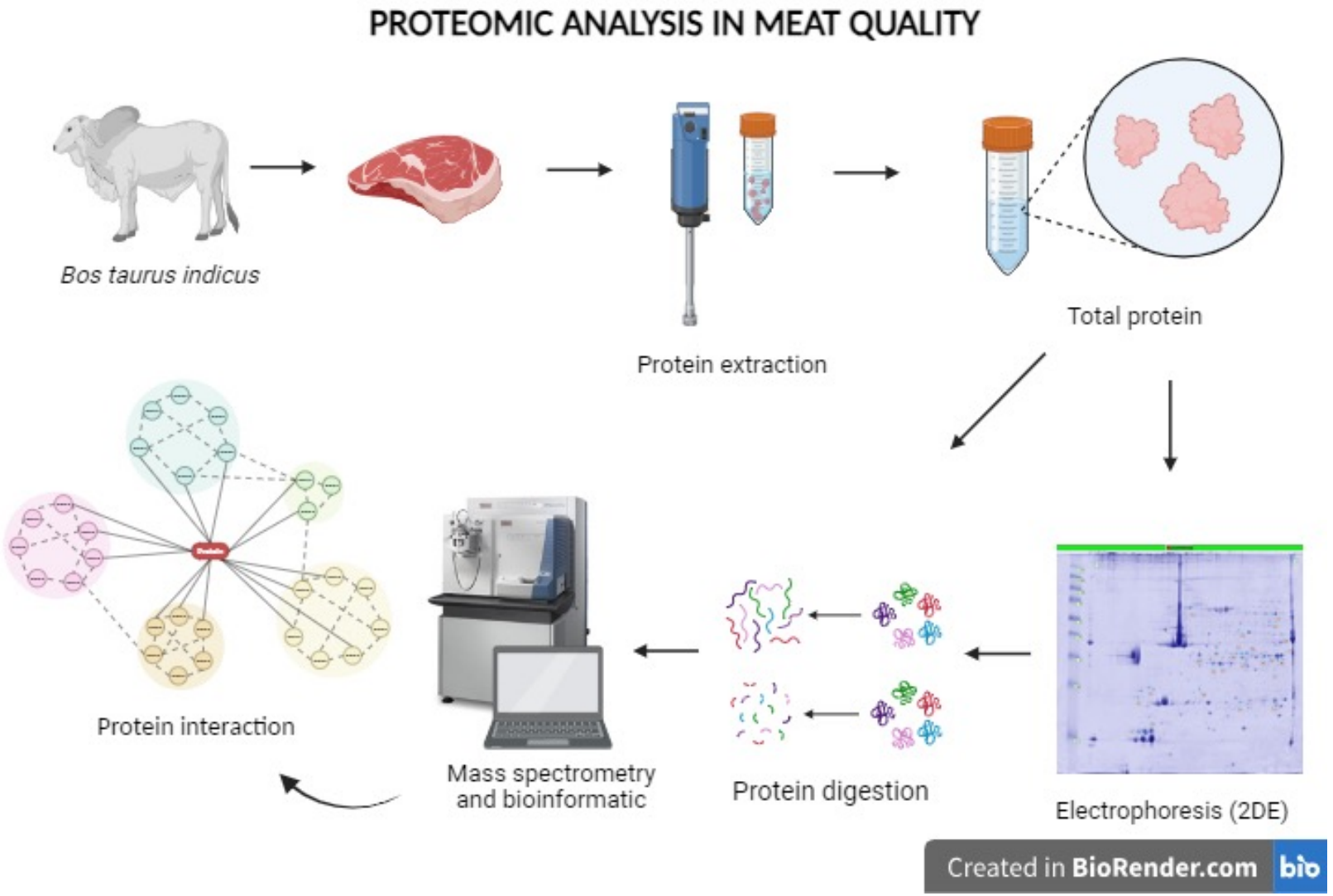
GWAS
BLUPF90+
GIBBsf90

eQTL associated
with OAC

BioMart by
Ensembl

FAPESP Week
CHINA 2024, June 28 - 29

Research and Solutions – Proteomics



Moncau., 2024 - Project

FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – Functional food/Development

Cambuci – Tropical fruit → rich in vitamin C and phenolics

- **Isolation/Identification**
- **Antioxidant activity**
- **Development/Sensorial**



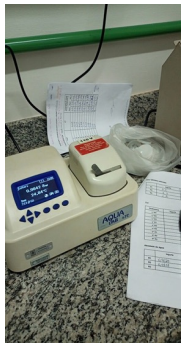


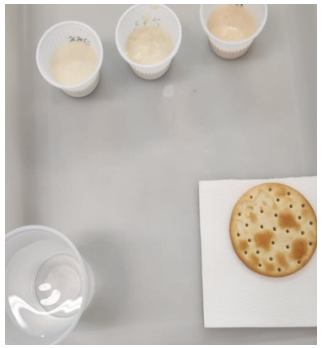


















Batista et al., 2024 - Project

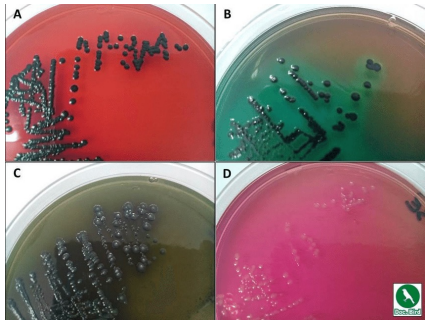
FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – Food Safety

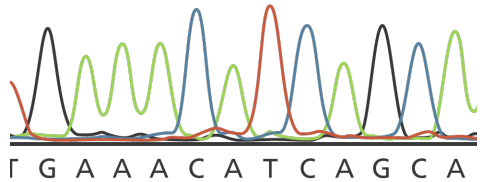
→ Conventional and Organic Production



Isolated



Sanger sequencing
16S rRNA



Identification of Salmonella serotypes

→ important for clinical or epidemiological investigations

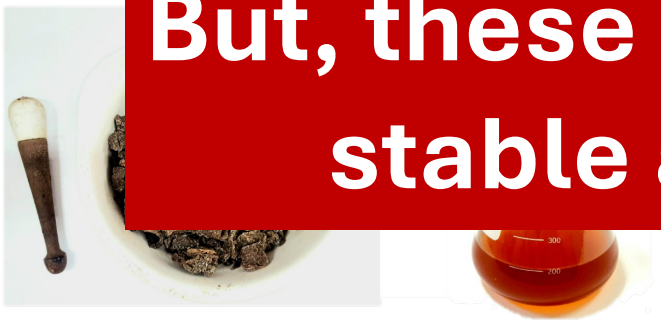
Santos et al., 2024 - Project

FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – Functional food

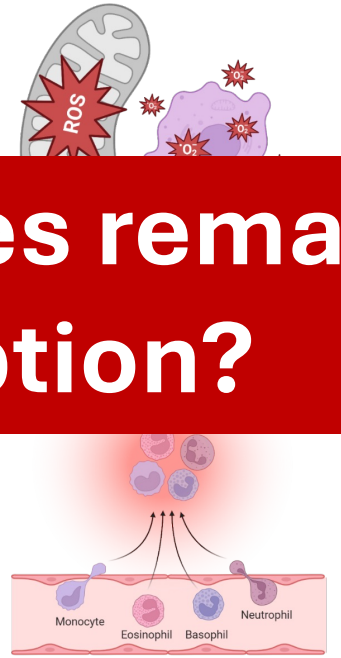
Many biological properties of propolis, including antibacterial, antifungal, antioxidant, anti-inflammatory, and anticancer have been described in the literature.

But, these biological activities remain stable after the consumption?



Ethanolic Extract of Propolis





Antioxidant activity

Saliba et al., 2024 - Project

FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – Functional food



Organic propolis - type 1



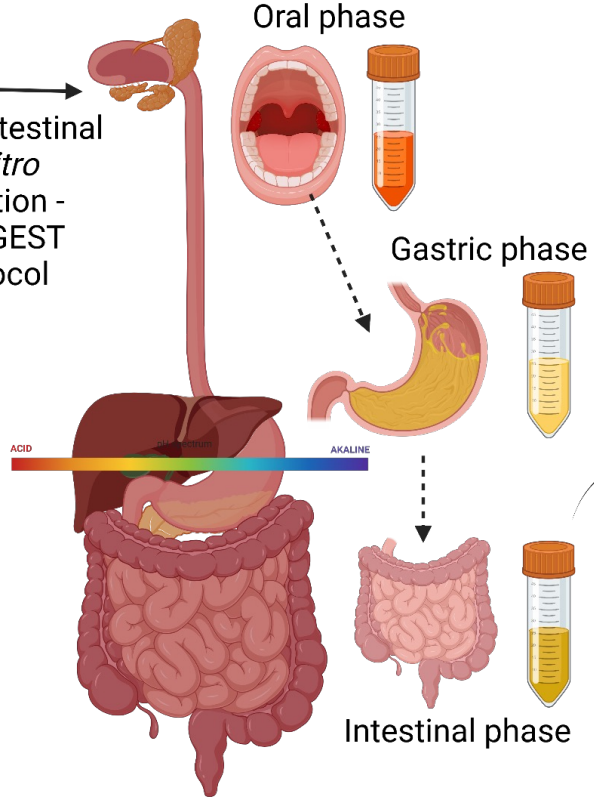


Ethanolic extract



in vivo toxicity

Gastrointestinal *in vitro* digestion - INFOGEST protocol

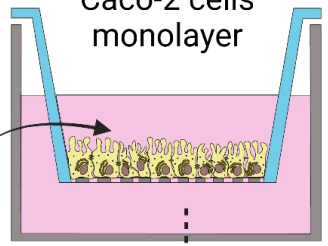


Oral phase

Gastric phase

Intestinal phase

Caco-2 cells monolayer



Basolateral fraction

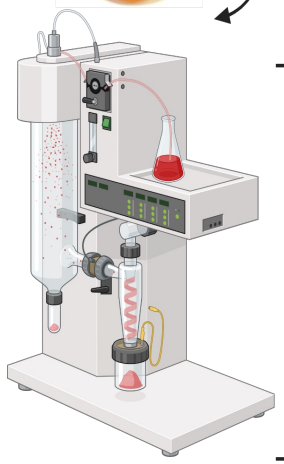
Saliba et al., 2024 - Project

FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – Functional food



Ethanolic extract of Brazilian organic propolis

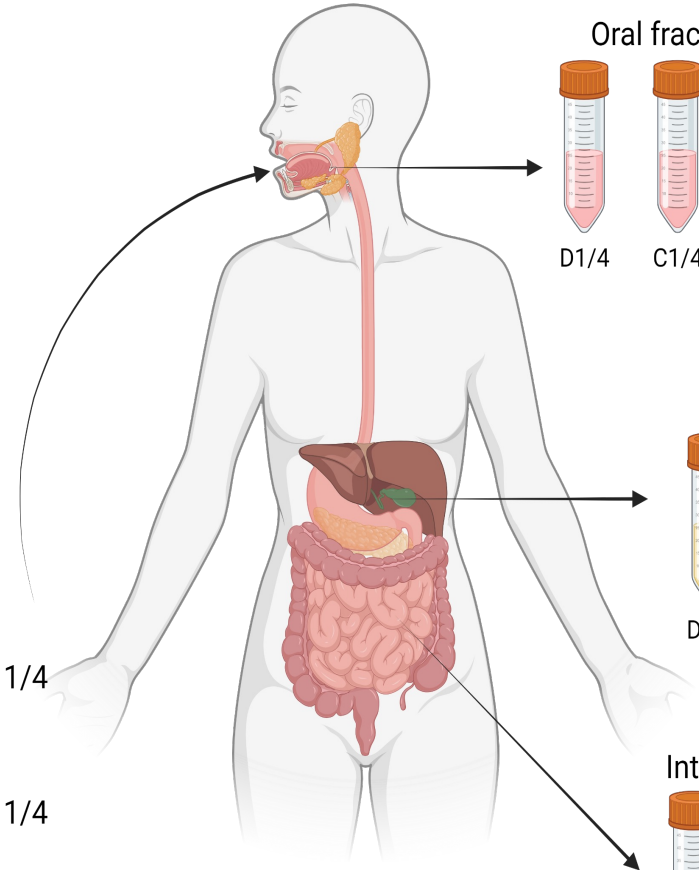


D 1/4

C 1/4

GG 4%

Spray-dryer and Spray-chilling



Oral fractions

D1/4 C1/4 GG 4%

Gastric fractions



D1/4 C1/4 GG4%

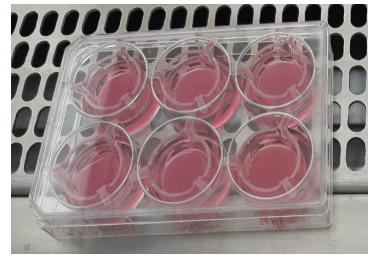
Intestinal fractions

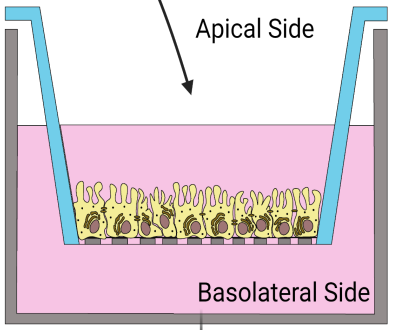


D1/4 C1/4 GG 4%

Reduce bitterness

Encapsulated







D1/4 C1/4 GG4%

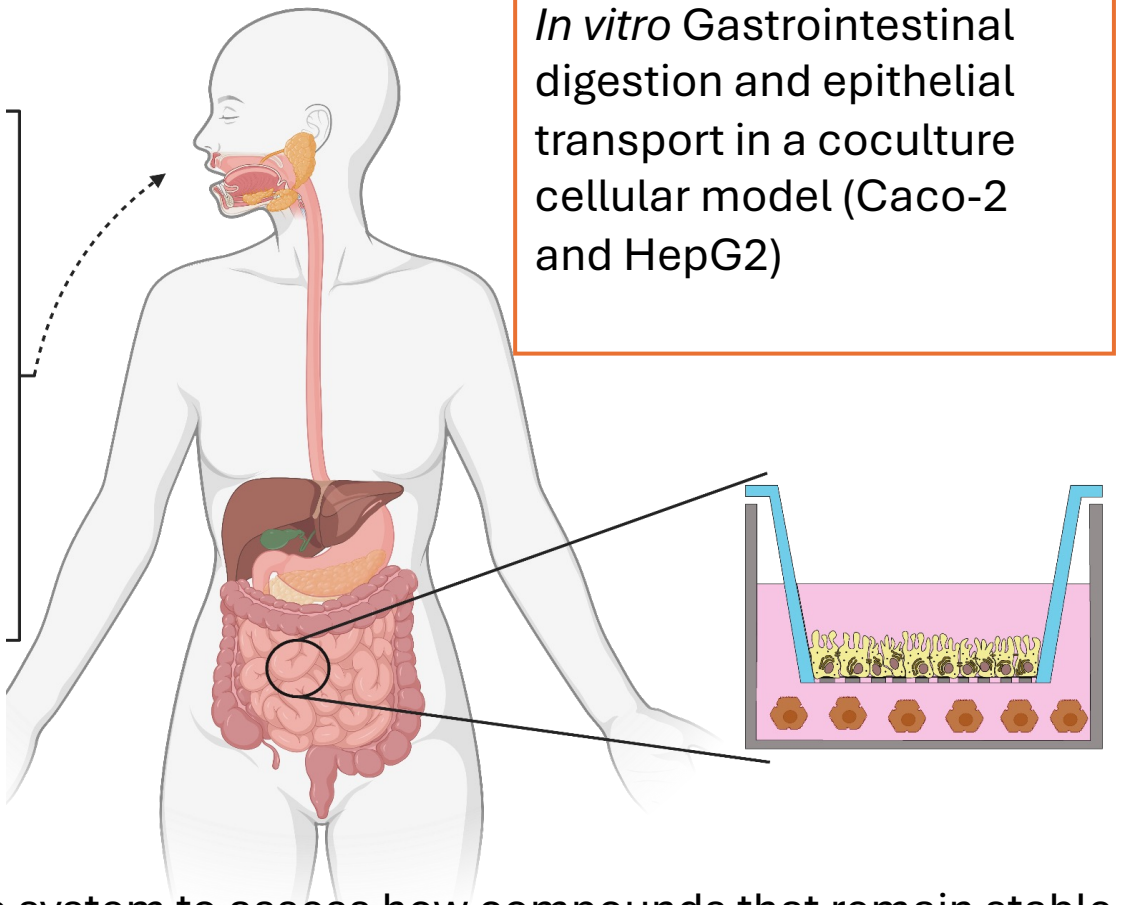
Saliba et al., 2024 - Project

FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – Functional food/Nutrigenomics

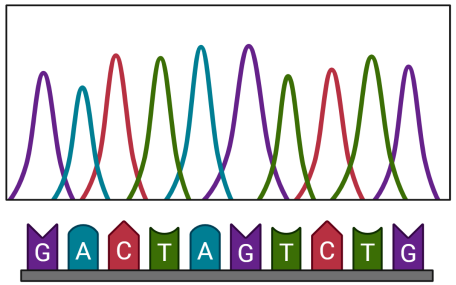


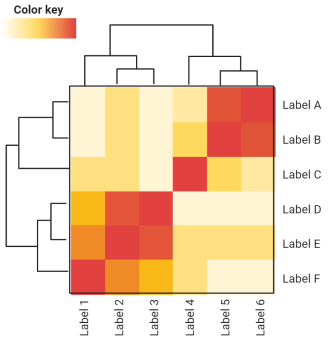
BLANK



In vitro Gastrointestinal digestion and epithelial transport in a coculture cellular model (Caco-2 and HepG2)

Saliba et al., 2024 - Project

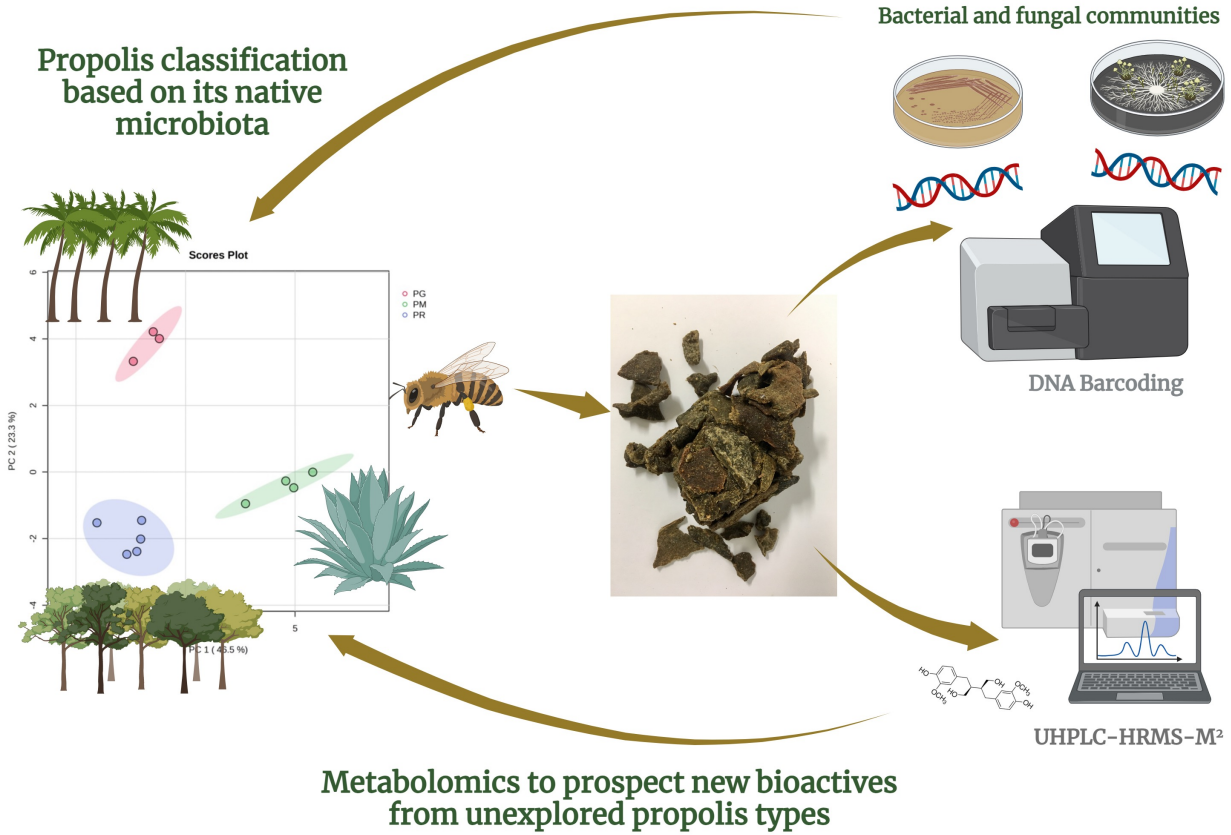




A co-culture system to assess how compounds that remain stable after in vitro digestion and cross the epithelial monolayer can modulate gene expression. This will be analyzed using RNA sequencing (RNAseq).

FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – Biodiversity/Sequencing ITS

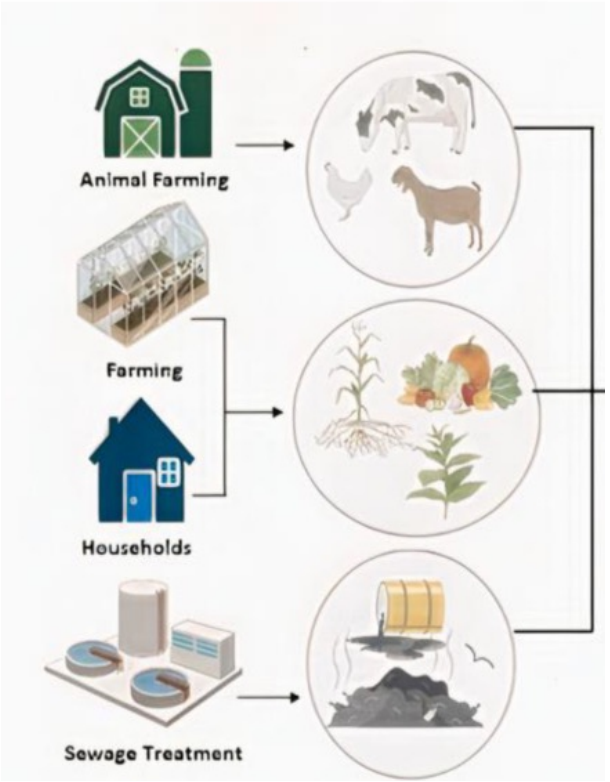


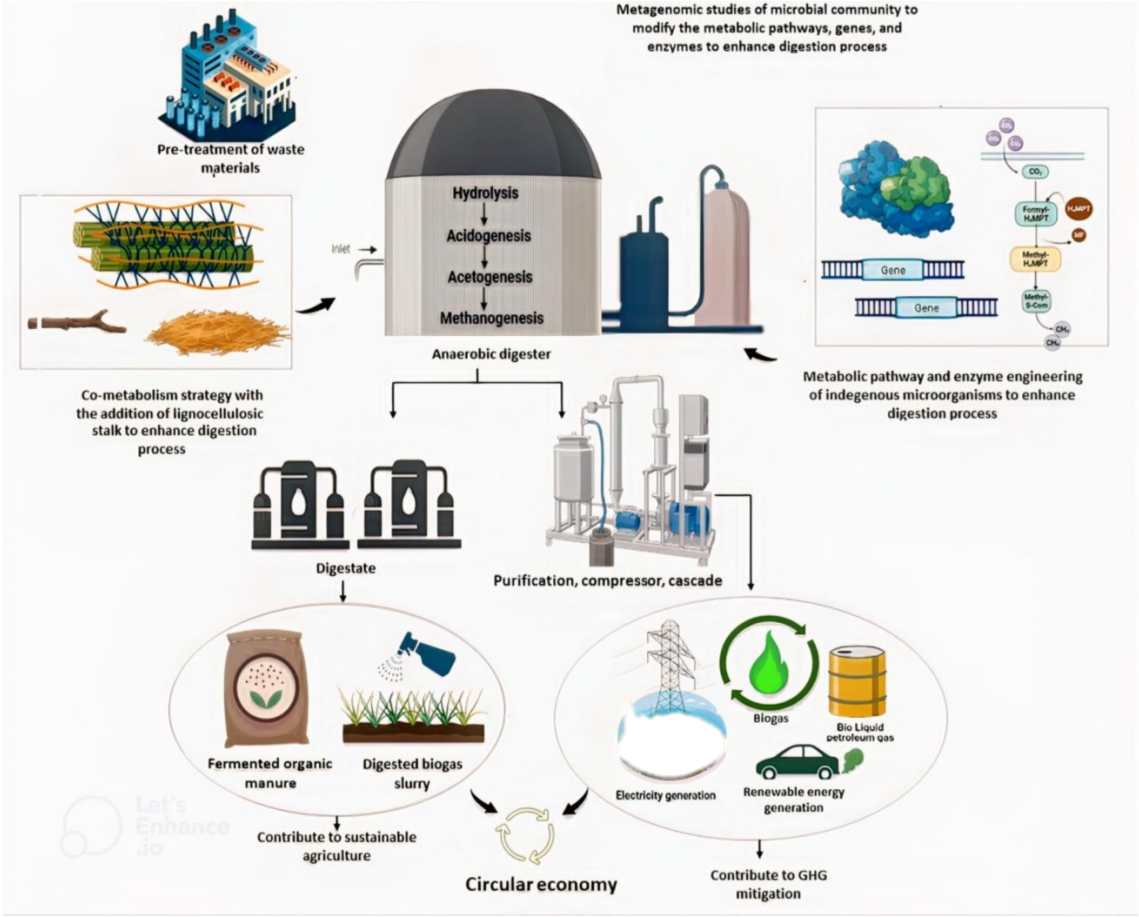
Certified as organically produced in permanent preservation areas of southern Brazil and have attracted attention due to their mild flavor and absence of heavy metals and pesticides.

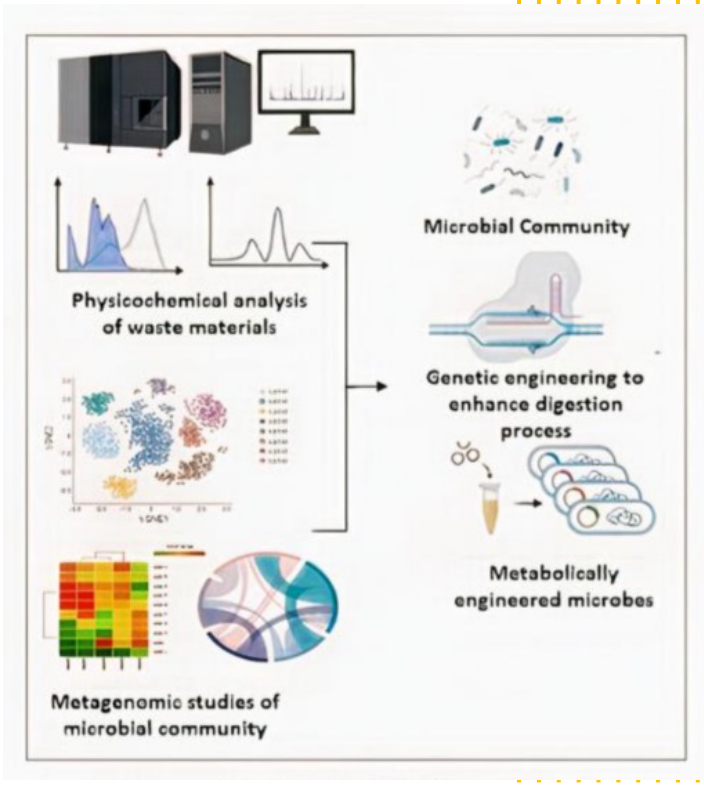
Sartori et al., 2022.

FAPESP Week CHINA 2024, June 28 - 29

Research and Solutions – Circular Economy/Biogas







Leite et al., 2024 - Project

FAPESP Week CHINA 2024, June 28 - 29

ESALQ
Luiz de Queiroz College of Agriculture
University of São Paulo

FAPESP
SÃO PAULO RESEARCH FOUNDATION

FAPESP Week CHINA 2024, June 28 - 29

Thank you for your attention!

Dr. Aline Cesar

alinecesar@usp.br

