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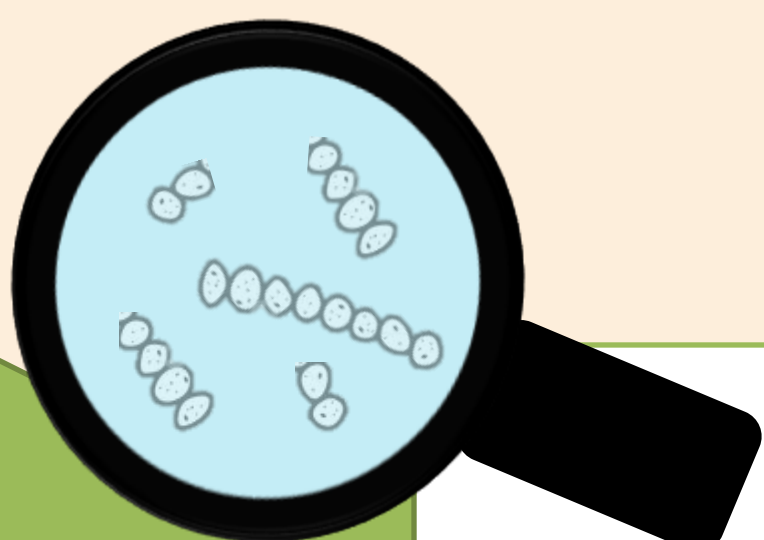
# Screening of *Lactococcus lactis* starters with Absorbance Reduction Activity Method (ARAM)

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Context

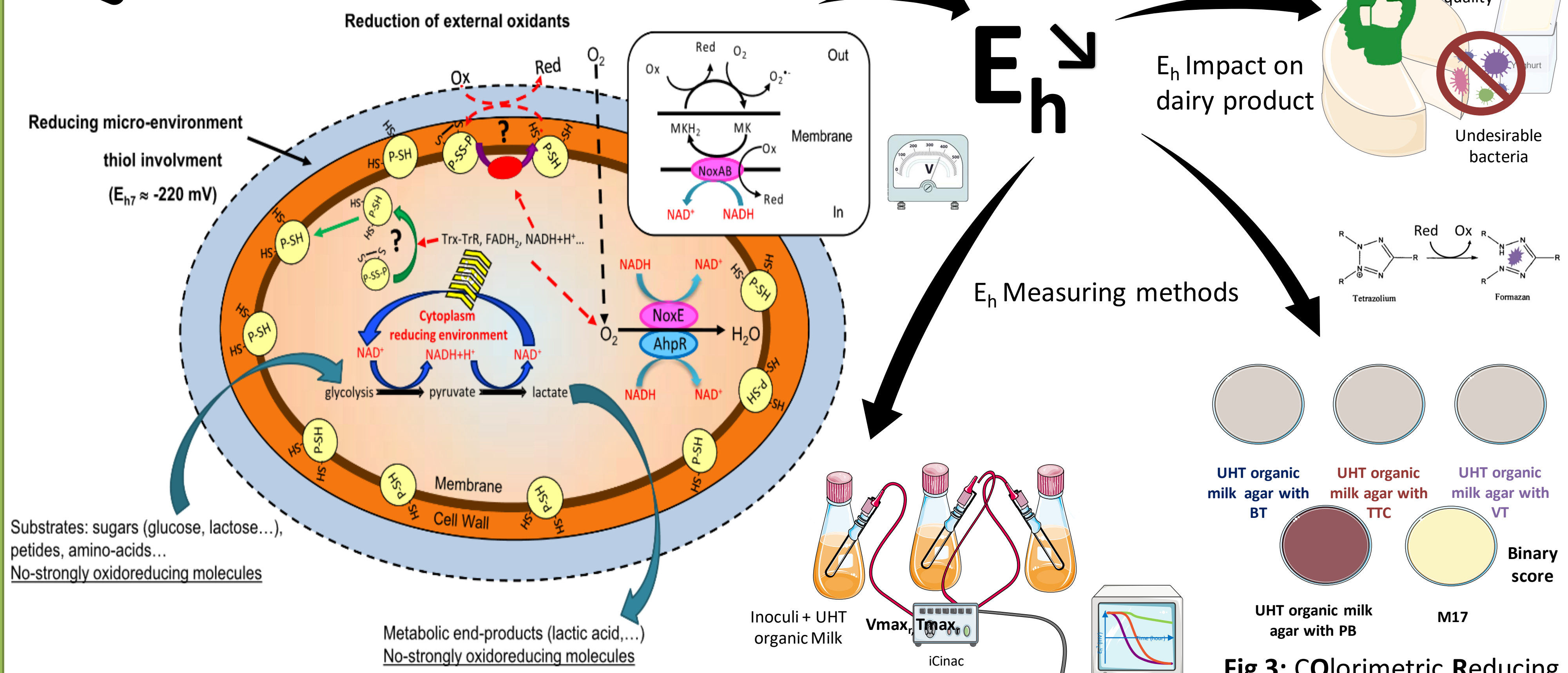


Fig 1: Cell functions involved in the reducing activity of *Lactococcus lactis* subsp. *lactis*<sup>[1]</sup>

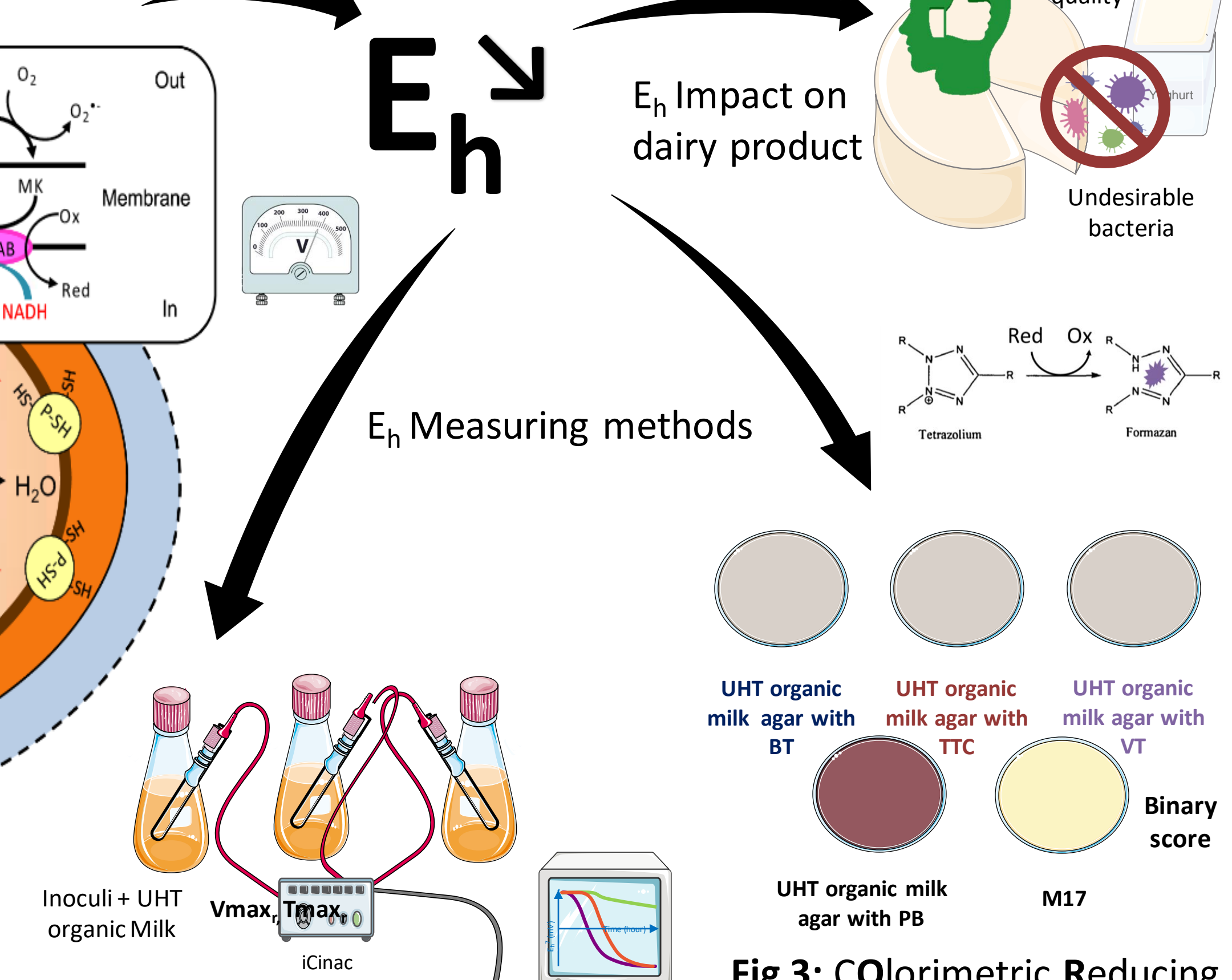


Fig 2: Potentiometric Reducing Activity Method (PRAM)<sup>[2]</sup>

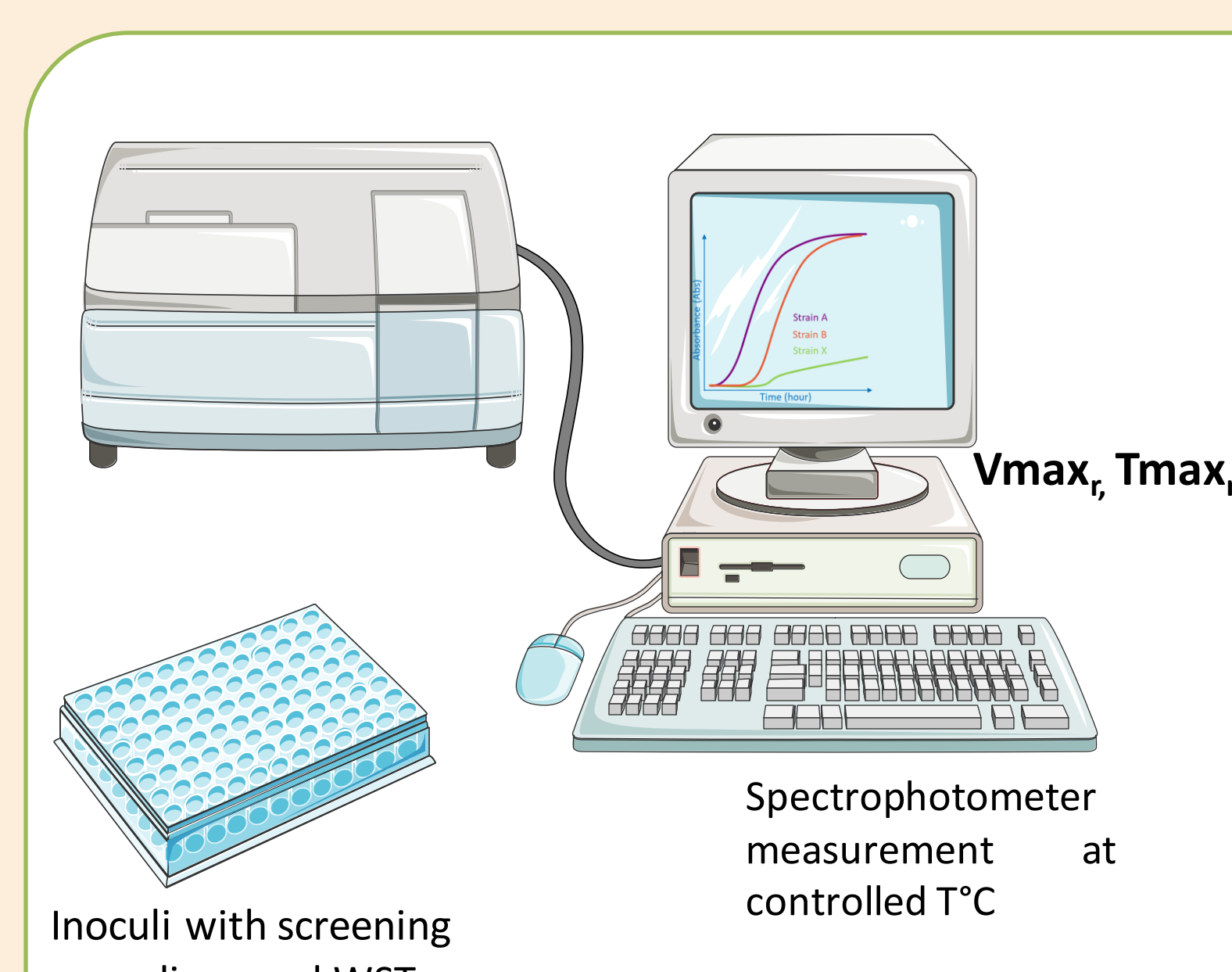


Fig 4: Absorbance Reducing Activity Method (PRAM)

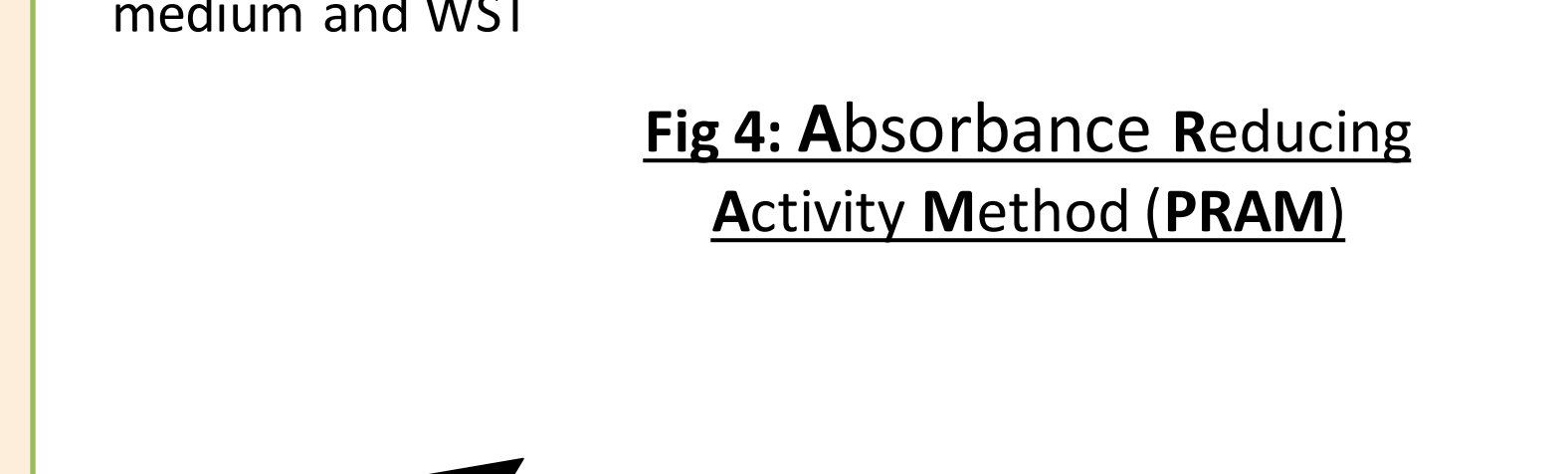


Fig 3: Colorimetric Reducing Capacity Method (ORCAM)<sup>[3]</sup>

Tab 1: Comparative table of the three methods according to acquisition, measurement and their characteristics

Method name	PRAM <sup>[2]</sup>	ORCAM <sup>[3]</sup>	ARAM This work
Sources			
Method	Potentiometric	Colorimetric	Spectrometric (Absorbance)
Time	15 to 24 hours	24 to 48 hours	16 hours
Material	Interface + probes + bottles	Petri dish + anaerobic chamber + gaz	Microplate + spectrometer
Cost	+	++	-
Implementation	Long and thorough preparation	Fast	Fast
Definition	Reducing activity and acidification	Reducing capacity and acidification	Reducing activity
Type	Kinetic	Binary score	Kinetic
Parameters	pH & Eh	pH & Eh	Eh
Values	Raw data + Vmax <sub>a</sub> + Tmax <sub>a</sub>	Visual observation	∅
Fiability	Repeatable	Repeatable	Repeatable
Differentiation	Inter & Intra-species	Inter-species	Intra-species
Yield	1 probe per strain	8 Petri dishes per strain	2 wells per strain
Repeatability	-	Analyst-dependent	-
Constraints	Probe calibration	Gaz & results interpretation	Small volumes
Risk	Glass probe	Gaz	-

Methods

Results

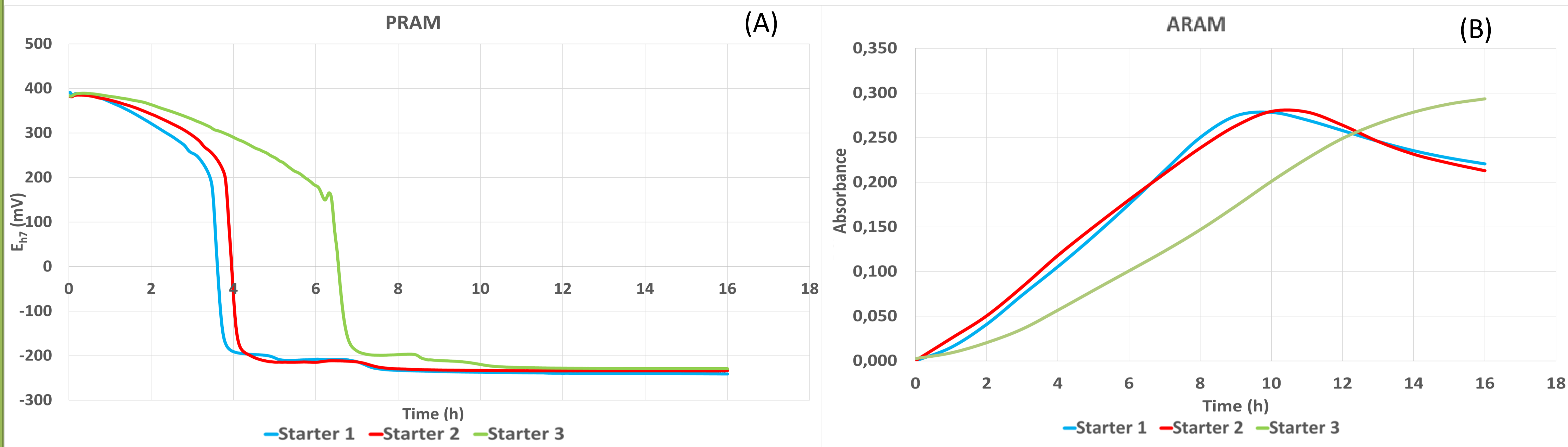


Fig 5: Typical curves of commercial cheese starters with PRAM (A) and ARAM (B). Vmax<sub>r</sub>: Maximal reducing rate; Abs: Absorbance

Tab 2: Table summarizing the results of the three methods. (a), (b) = significantly different, ANOVA α=0,05 with Tukey comparison; N = 3

	Starter 1	Starter 2	Starter 3
ARAM Vmax <sub>r</sub> (Abs.h <sup>-1</sup> )	0,0410 (a)	0,0392 (a)	0,0286 (b)
PRAM Vmax <sub>r</sub> (mV.h <sup>-1</sup> )	-1596 (a)	-1526 (a)	-1049 (b)
ORCAM Score	31	31	31

Thus ARAM:

- allows intra-species starter comparison
- is applicable from frozen or freeze-dried bacteria
- discriminates strains on their reduction kinetics
- compares until 30 strains simultaneously
- combined with ORCAM, allow to compare larger quantities of starters before using PRAM to get more accurate results on reducing activity

References:

[1] Roussel et al. 2022. Food Res Int 156,1111-54  
 [2] Cachon et al., 2002. Lait 82,281-8  
 [3] Michelon et al. 2013. J Biosci Bioeng 115,229-32

Conclusion