Growth as measurand for bacterial adhesion to food and feed ingredients

P.M. Becker[a], S. Galletti[a,b], P.J. Roubos-van den Hil[c], P.G. van Wikselaar[a]

[a]Animal Sciences Group, Wageningen UR

[b]Faculty of Veterinary Medicine, University of Milan

[c]Laboratory of Food Microbiology, Wageningen University

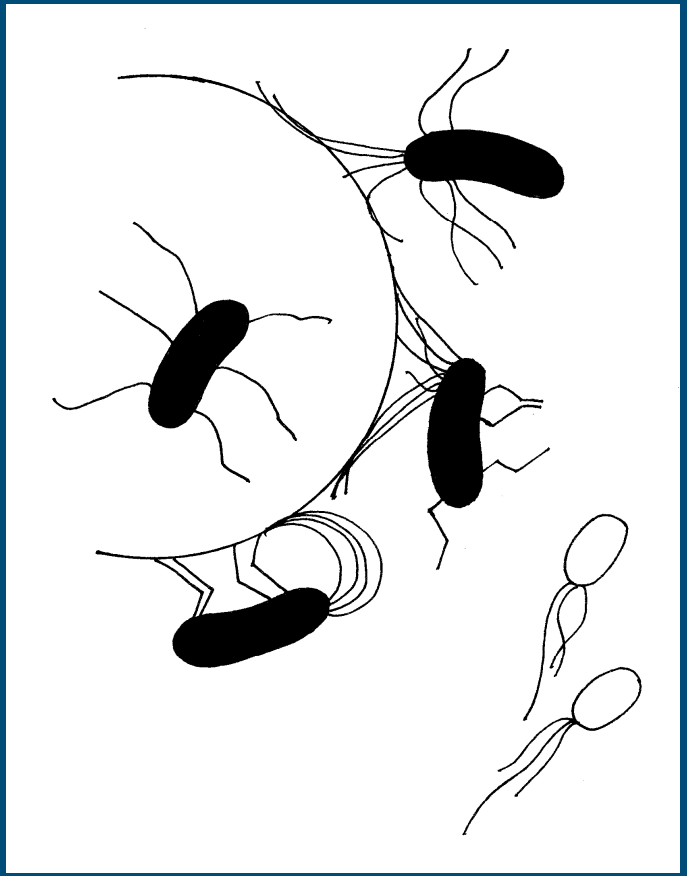
ANIMAL SCIENCES GROUP
WAGENINGEN UR

Darmendag 2007

Aim: Anti-adhesion therapy

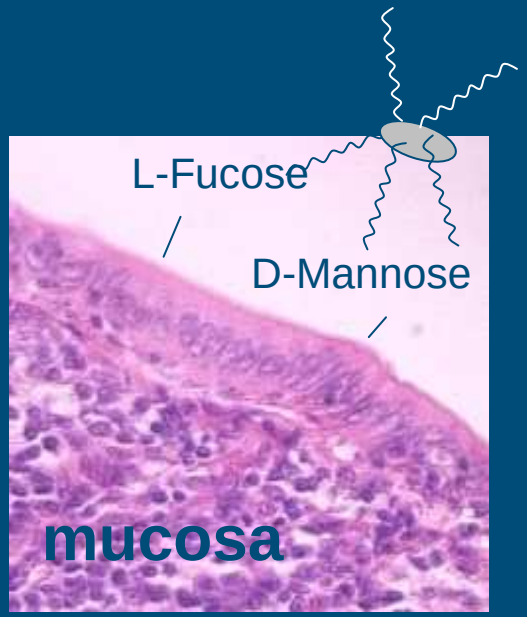
Provision of alternative adhesion sites for enteropathogenic bacteria

to prevent their adhesion on gut epithelial cells



Becker (2005) CIIM 6: 31-54

Pathogenic bacteria bind to specific receptors



Misdirection possible by food + feed components?

Development of method
to study adhesion of bacteria
to complex plant materials:

- Microtitration plates for high throughput
- Coating with raw plant materials
- Reading of adhesion results

Quantity of retained bacteria???

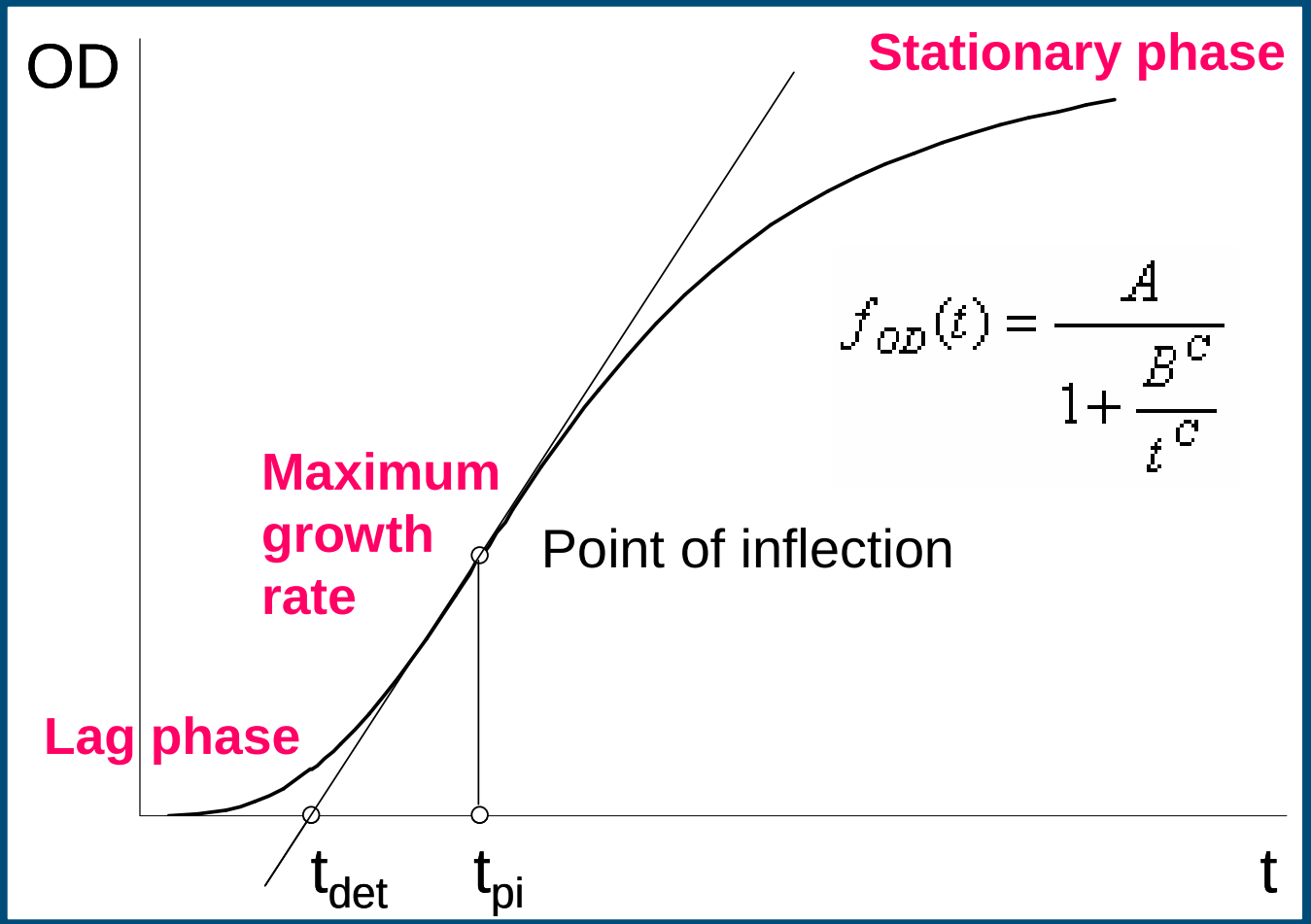
↓

Multiply

↓

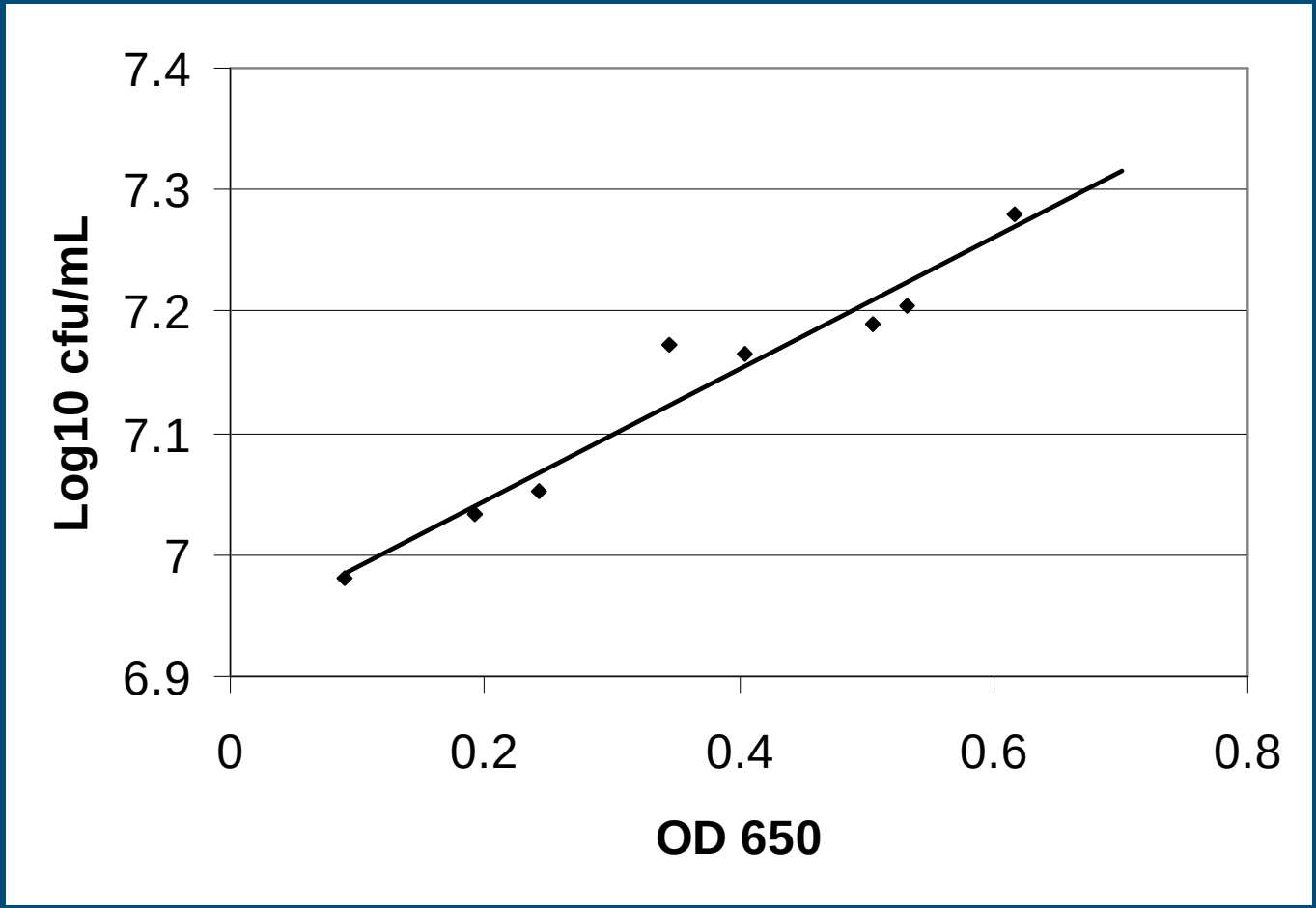
Visualize

Growth as measurand for bacterial adhesion



t_{det}: apparent lag time or detection time

Perceptibility range of *E. coli* ATCC 25922



ANIMAL SCIENCES GROUP
WAGENINGEN UR

- True lag phase t_{lag}:
  = Recovery or adaptation period
  Independent of inoculum level

- Apparent lag phase t_{det}:
  = Detection time
  Depends inversely on starting cell concentration

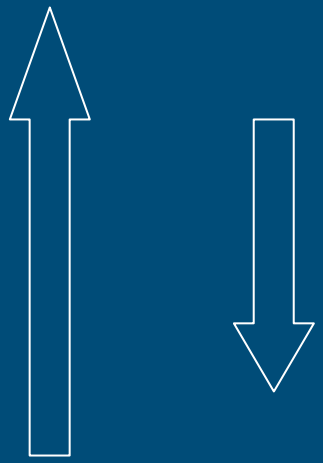
$$t_{det} = t_{lag} \frac{\ln(N_{det}) - \ln(N_0)}{\mu}$$

Baranyi & Pin (1999) Appl. Environ. Microbiol. 65:732-736

Test principle

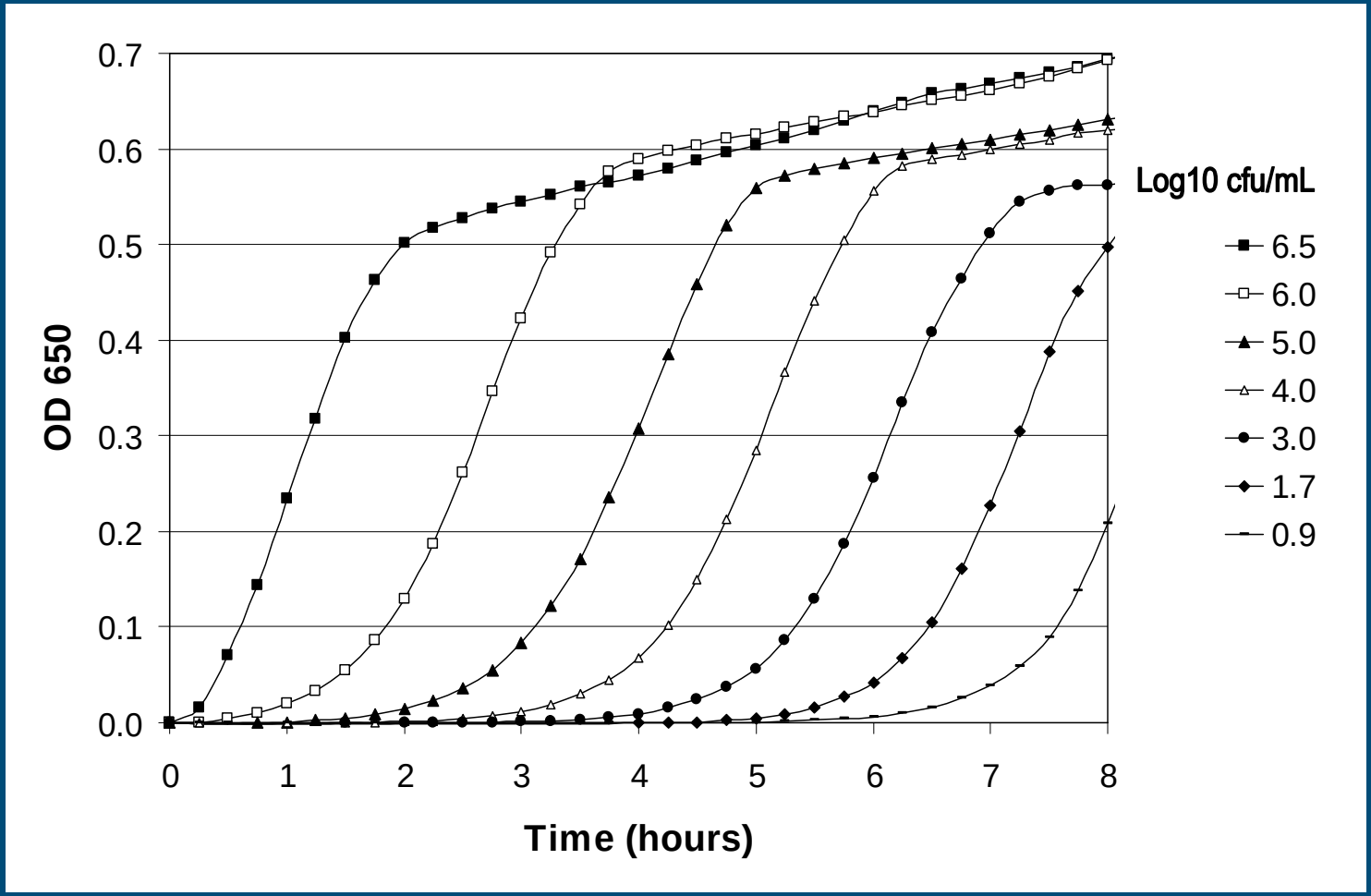
Inverse relationship between initial cell densities and appearance of growth:

The higher the adhering cell numbers



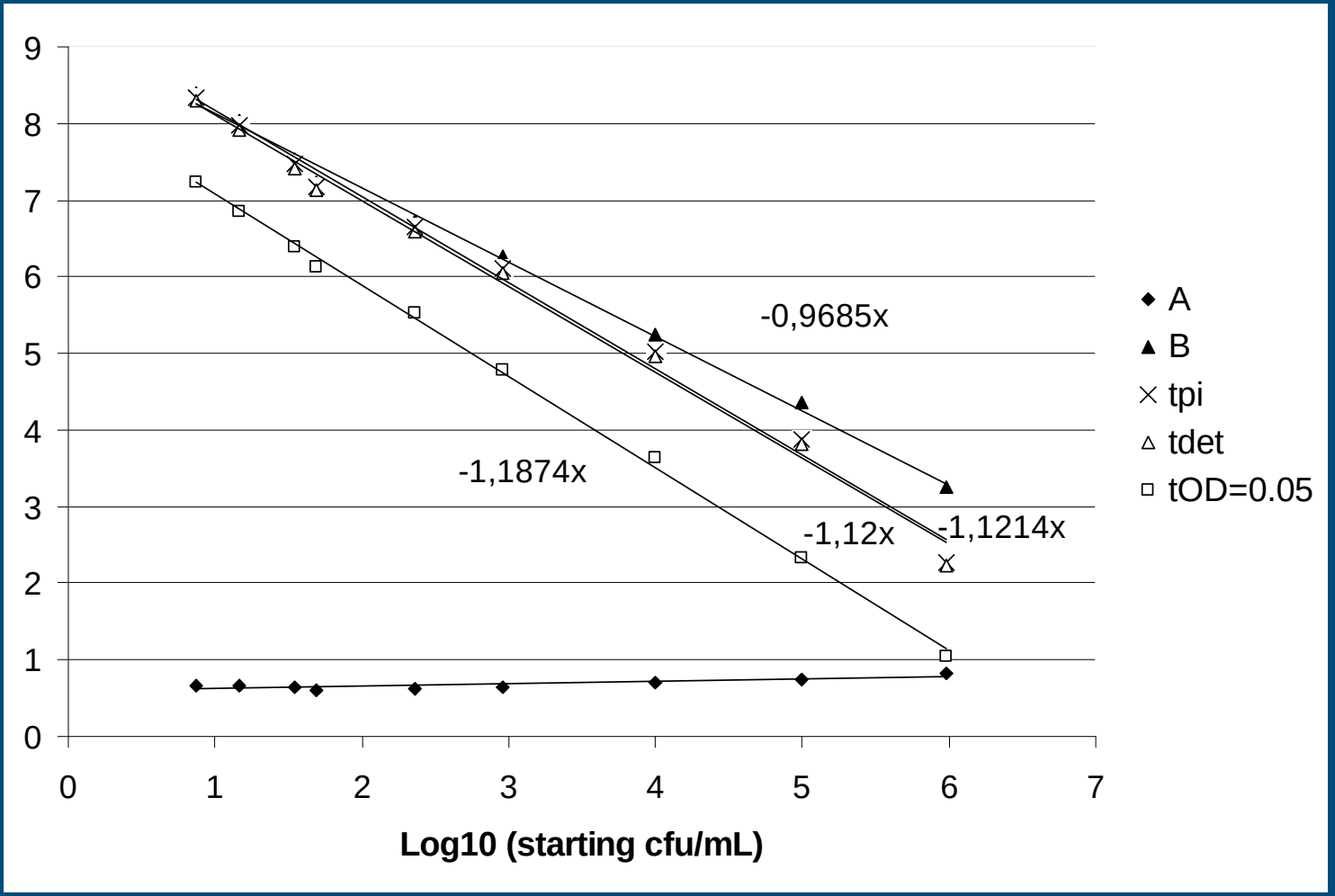
The shorter the detection times of growth

Time-dependent appearance of *Salmonella enterica* sv. Typhimurium ATCC 13311



ANIMAL SCIENCES GROUP
WAGENINGEN UR

Correlation between starting cell density and growth parameters



Adhesion of bacteria to complex materials

e.g. mannan-oligosaccharids, plant extracts

WASHING

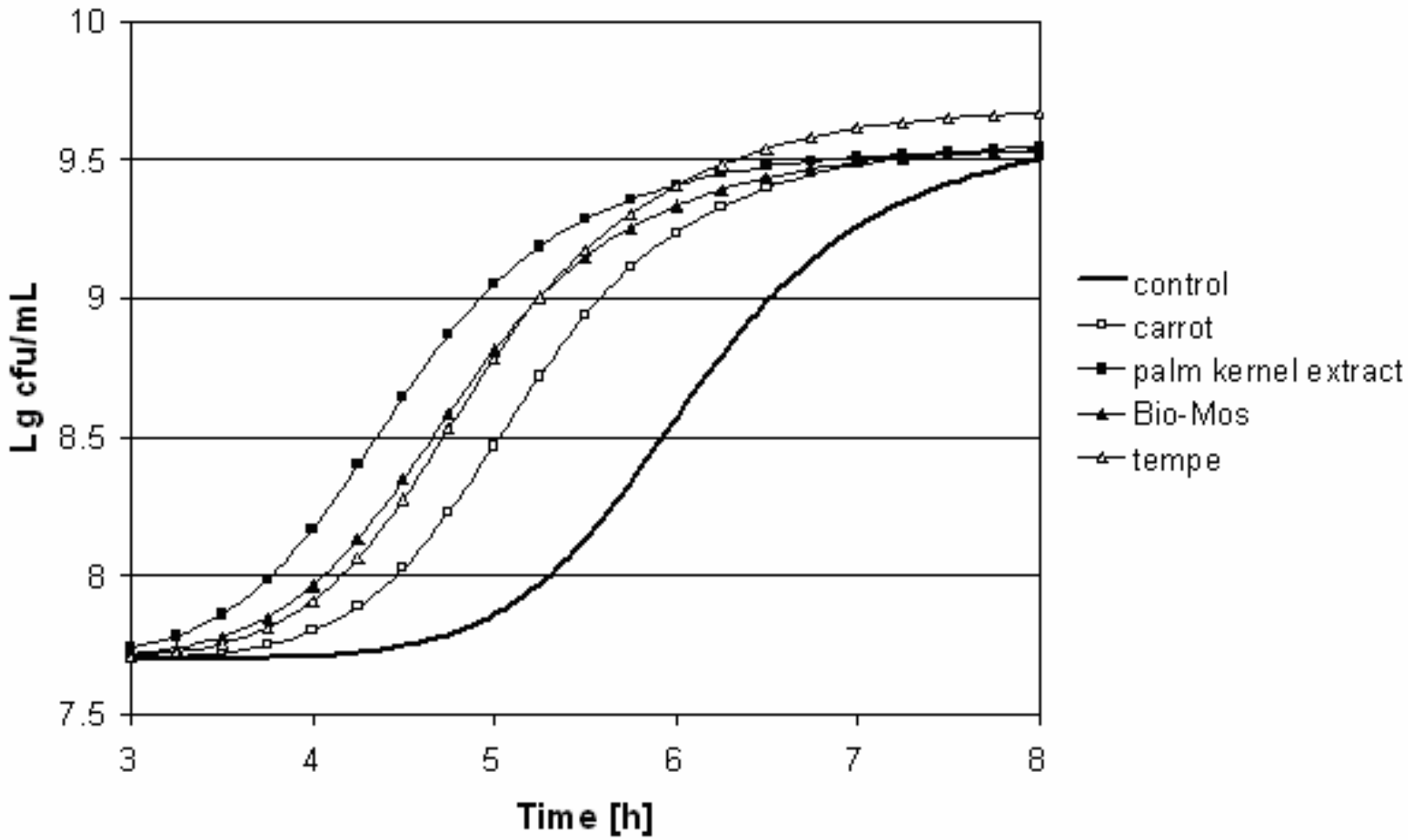
Coating with material

Blocking of uncovered binding sites of plate

Addition of bacteria

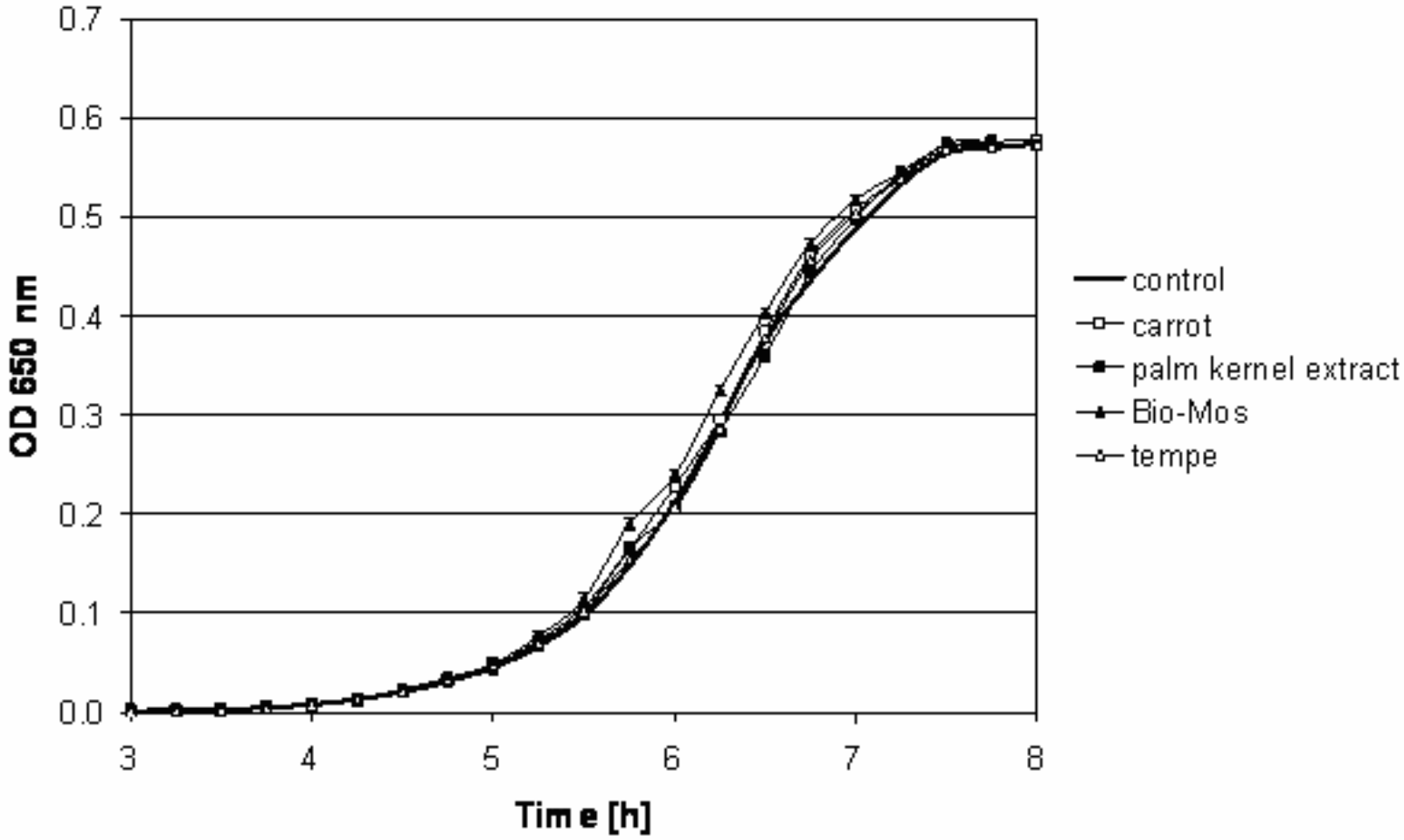
Addition of growth medium, incubation

Adhesion curves of *Salmonella enterica* sv. Typhimurium ATCC 13311



ANIMAL SCIENCES GROUP
WAGENINGEN UR

Homogeneous suspension of *Salmonella enterica* sv. Typhimurium ATCC 13311 in coated MT plate

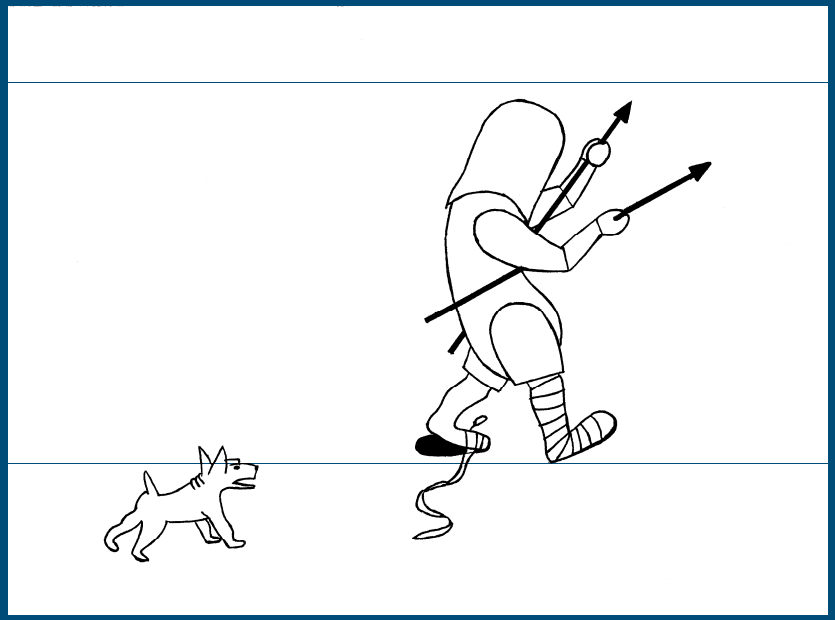


ANIMAL SCIENCES GROUP
WAGENINGEN UR

Conclusions

- **Simple, high-throughput method** for huge numbers of different materials and bacteria
- **Highly sensitive and discriminating** for different materials
- Different ranking orders of materials with different bacteria provided confidence in the method
- Differences between bacterial strains underline **importance of extensive testing**

This study was funded by the Product Board Animal Feed (PDV) and by SAFEWASTES (EU project no. 513949)



For details, contact
petra.becker@wur.nl

Becker et al. (2007)
Validation of growth as measurand for bacterial adhesion to food and feed ingredients.
J. Appl. Microbiol. (in press, doi:10.1111/j.1365-2672.2007.03524.x)

ANIMAL SCIENCES GROUP
WAGENINGEN UR