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Microbial control of jellyfish larval settlement

ミズクラゲポリプの微生物学的制御

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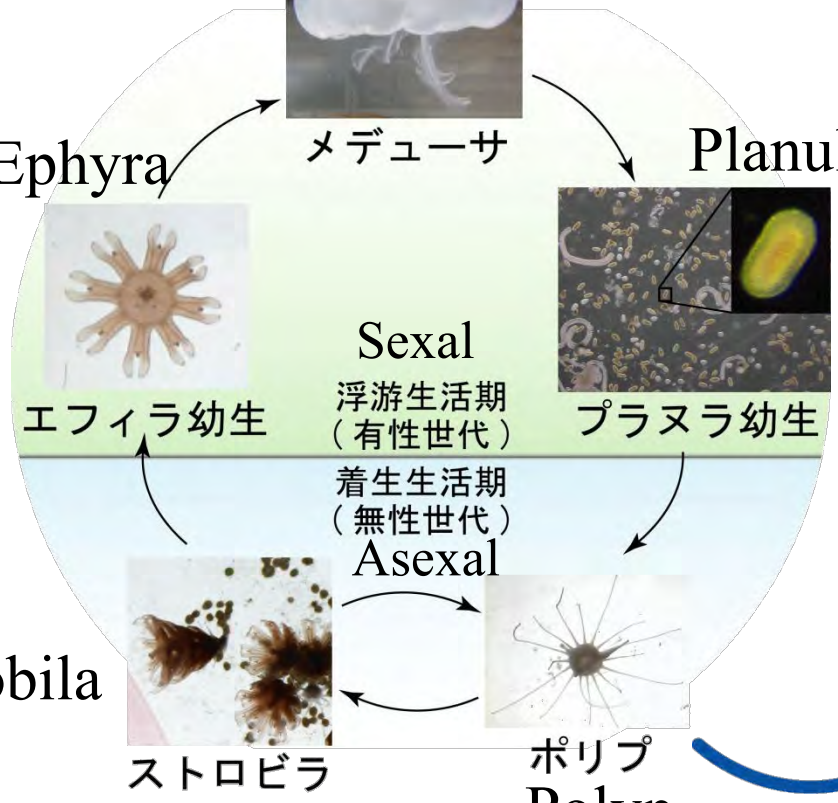
BIO-P-8709

Life cycle of *Aurelia aurita*

http://d.hatena.ne.jp/abalone/20060626



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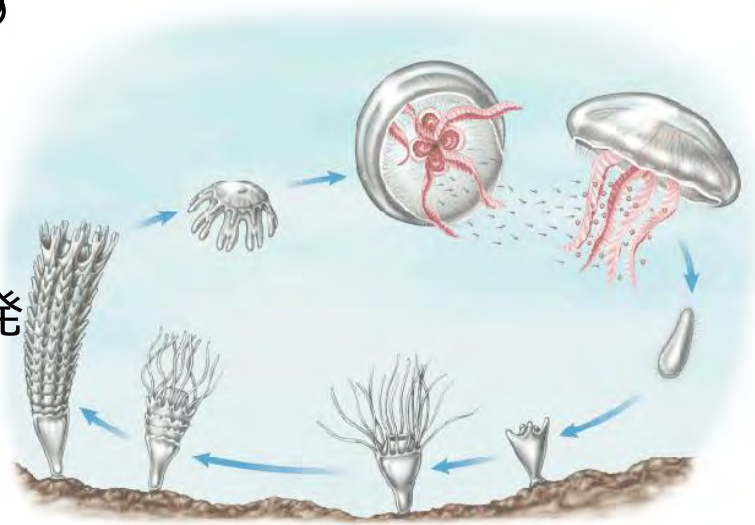
Aim

To develop a new technodology for either inducing or inhibiting larval settlement and metamorphosis of jellyfish using microbes and its products.

本研究では、クラゲの大量発生を制御するためには、その幼生期における生態を制御することが効果的であるという考えに基づき、特に幼生の着生あるいは変態を微生物学的に阻害もしくは 誘 引 する技術の開発を目指す。



(http://www.scientific-art.com/index.html)

Bacteria as “natural cues” of planula settlement/metamorphosis

Planula larvae	Bacteria	Effect
ヒドロ虫綱Hydrozoa ヒドラ*Hydractinia*	*Alteromonas* *Pseudoalteromonas*	Induction of metanorphosis
ヒドロ虫綱Hydrozoa オベリアクラゲ*Obelia loveni*	*Cobetia marina*	Inhibition of settlement
鉢虫綱Scyphozoa サカサクラゲ*Cassiopea andromeda*	*Vibrio alginolyticus*	Induction of metanorphosis
鉢虫綱Scyphozoa キタユウレイクラゲ*Cyanea capillata* ミズクラゲ*Aurelia aurita*	Mixed community	Induction of settlement
花虫綱Anthozoa ウミトサカ*Heteroxenia fuscescens* ミドリイシ*Acropora willisae*	*Pseudoalteromonas*	Induction of settlement and metamorphosis

“Natural cues”

Muller and Leitz (2002), Dobretsov (2005)

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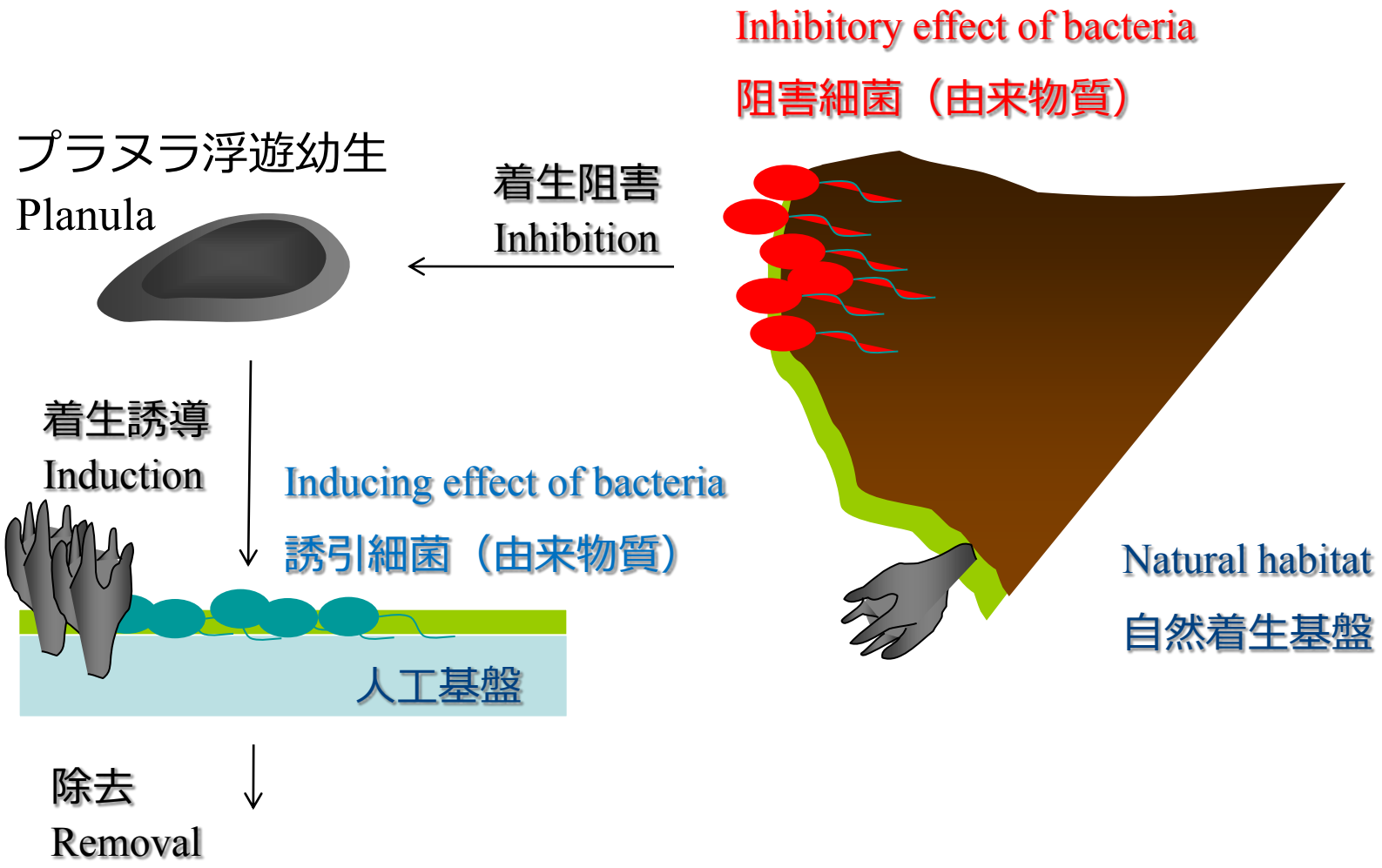
Microbial control of planula settlement



1. Isolation of bacteria inducing/inhibiting settlement of jellyfish planula larvae
2. Testing the “lectin hypothesis” to explain bacteria-planula interaction
3. Application of bacteria-coated plates for collecting planula larvae

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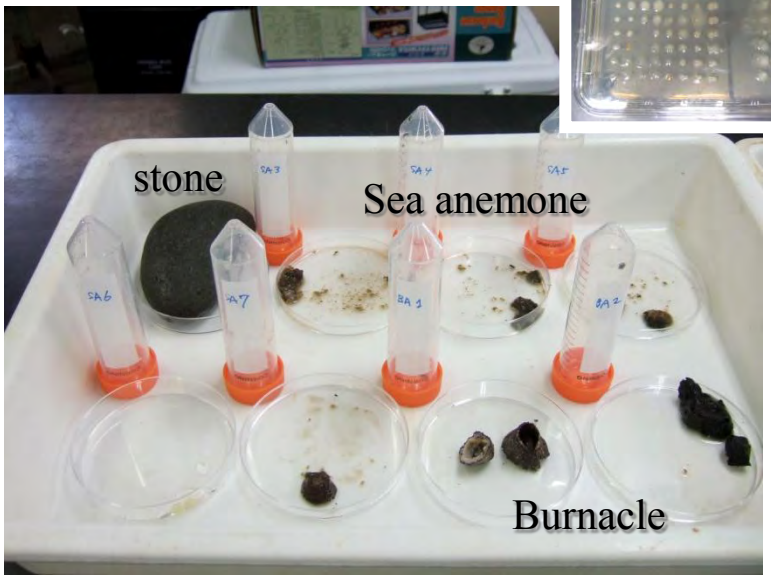
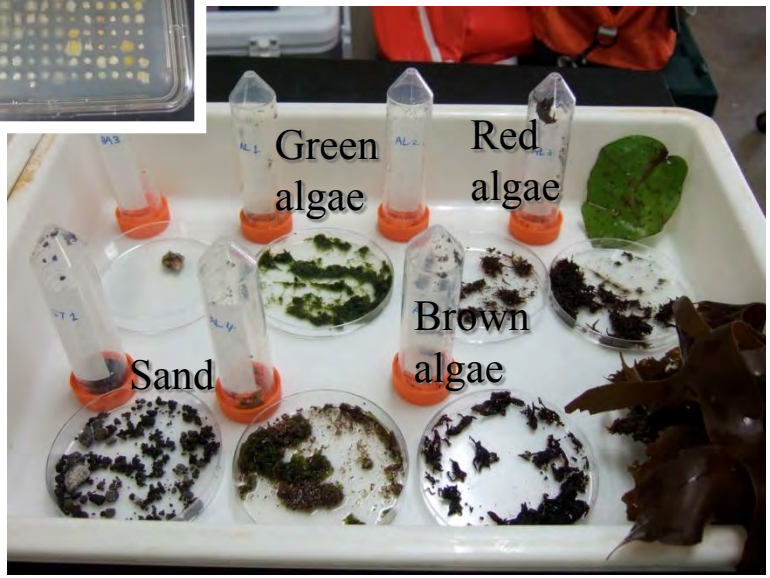
Bacterial isolation





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Planula settlement assay

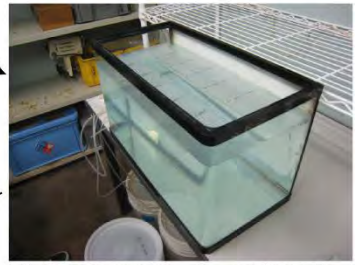
384 test isolates


クラゲ成体を優しく別の容器に移し、再度放出させる


クラゲ成体からプラヌラを放出させる (1 日飼育)


目合 100 μm プランクトンネットで海水を濾す


適当な容器に移し、プラヌラを計数する

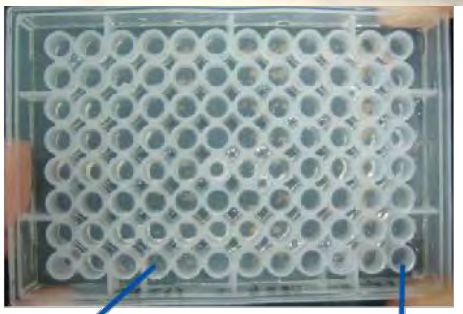

水道 40 L にプラヌラを加え、プレートを裏返しに浮かべアッセイを開始する

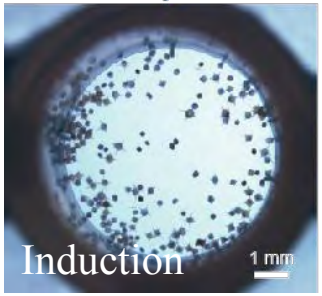

16 時間以上アッセイし、プレートを上向きにし付着していないプラヌラを除く

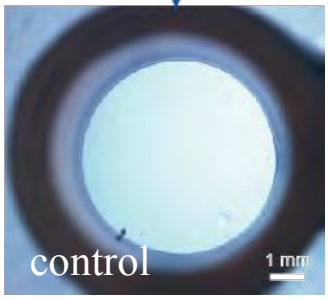

倒立顕微鏡下で計数する

15~24h incubation

Planula larvae
1,000 ~ 60,000 inds / L







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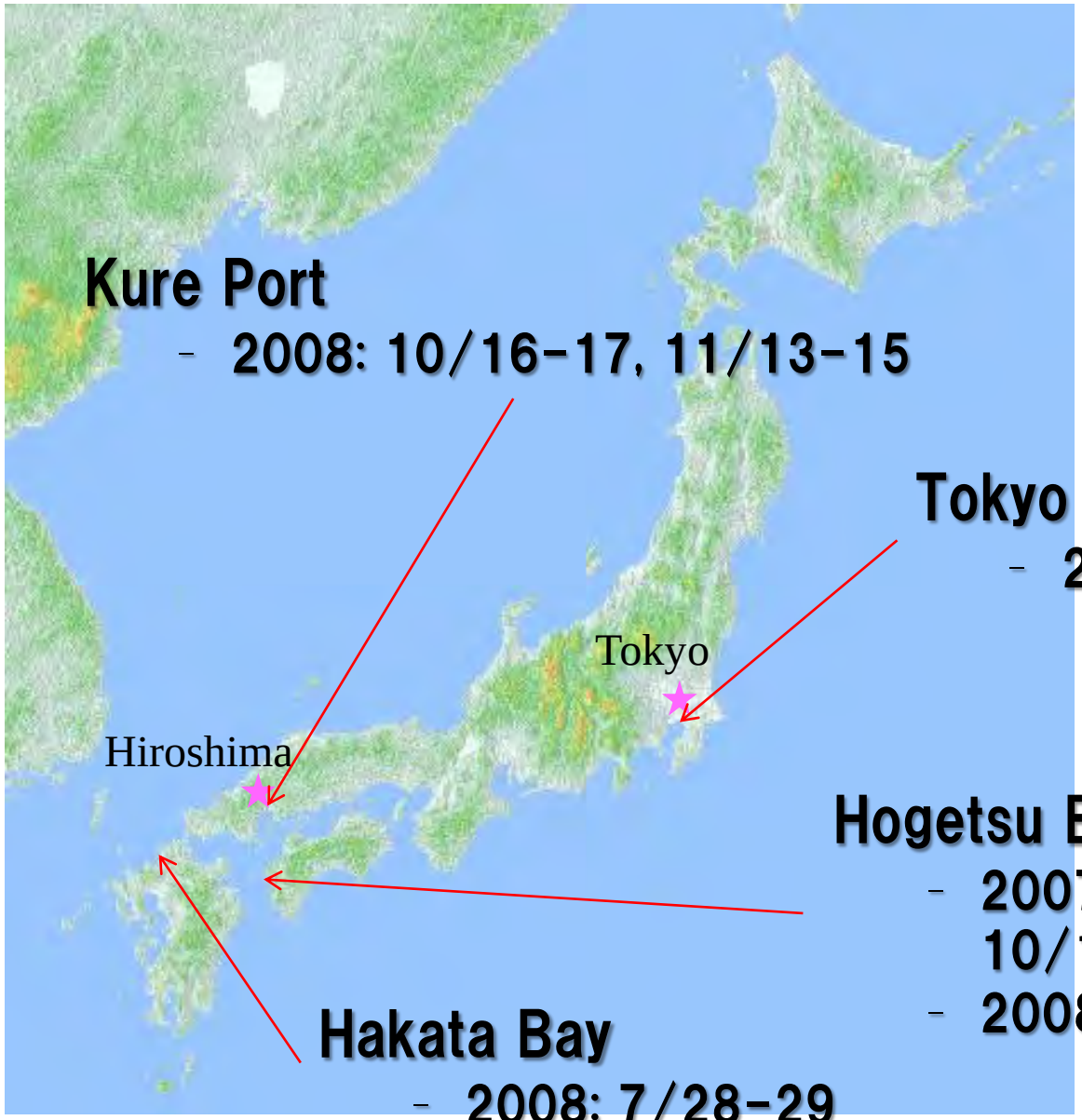
Locations of planula collection



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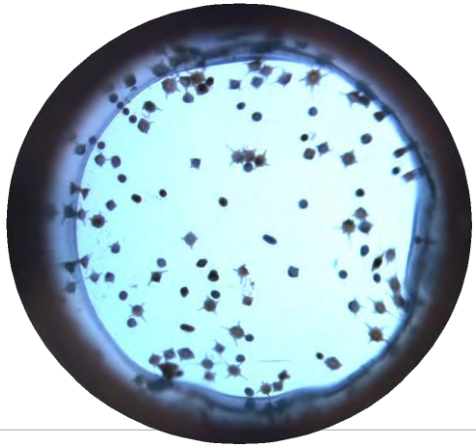
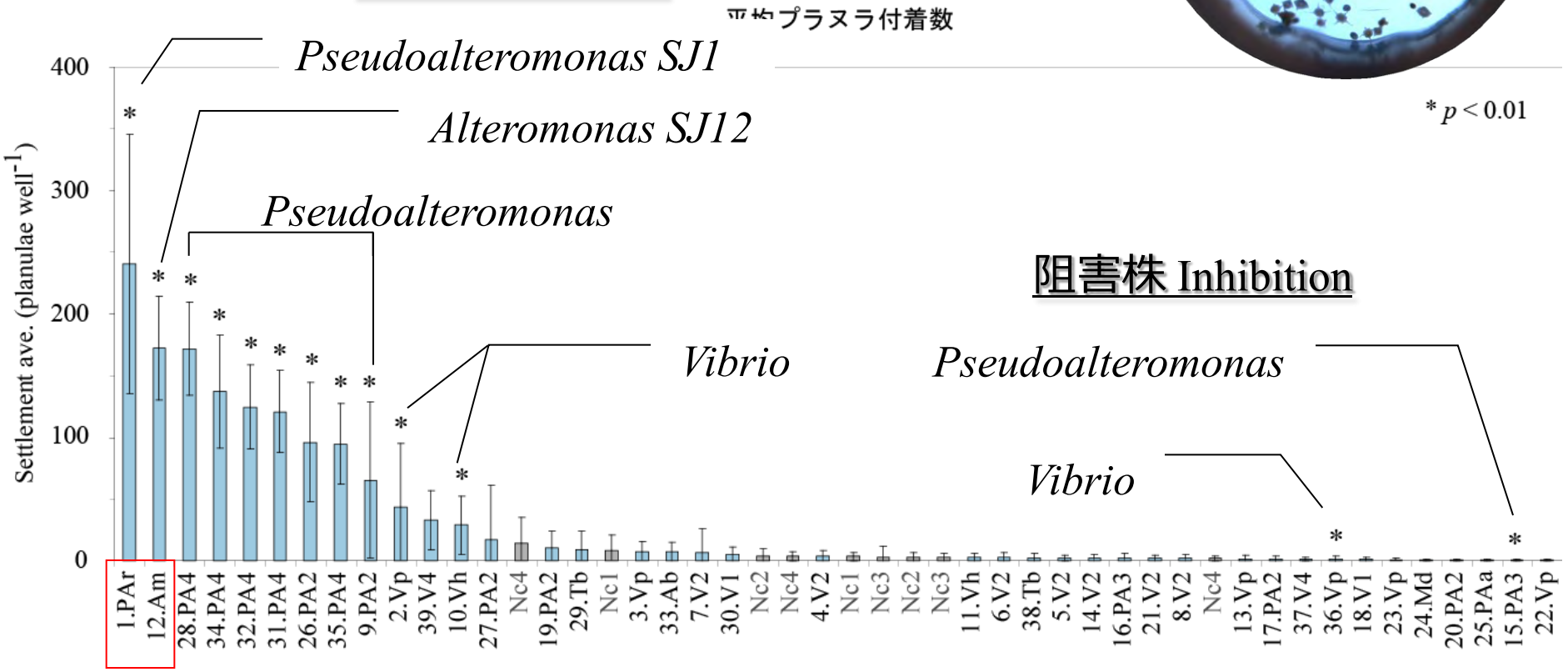
Isolation of settlement-inducing bacteria



誘因株 Induction

阻害株 Inhibition



Induction:12, Inhibition:8

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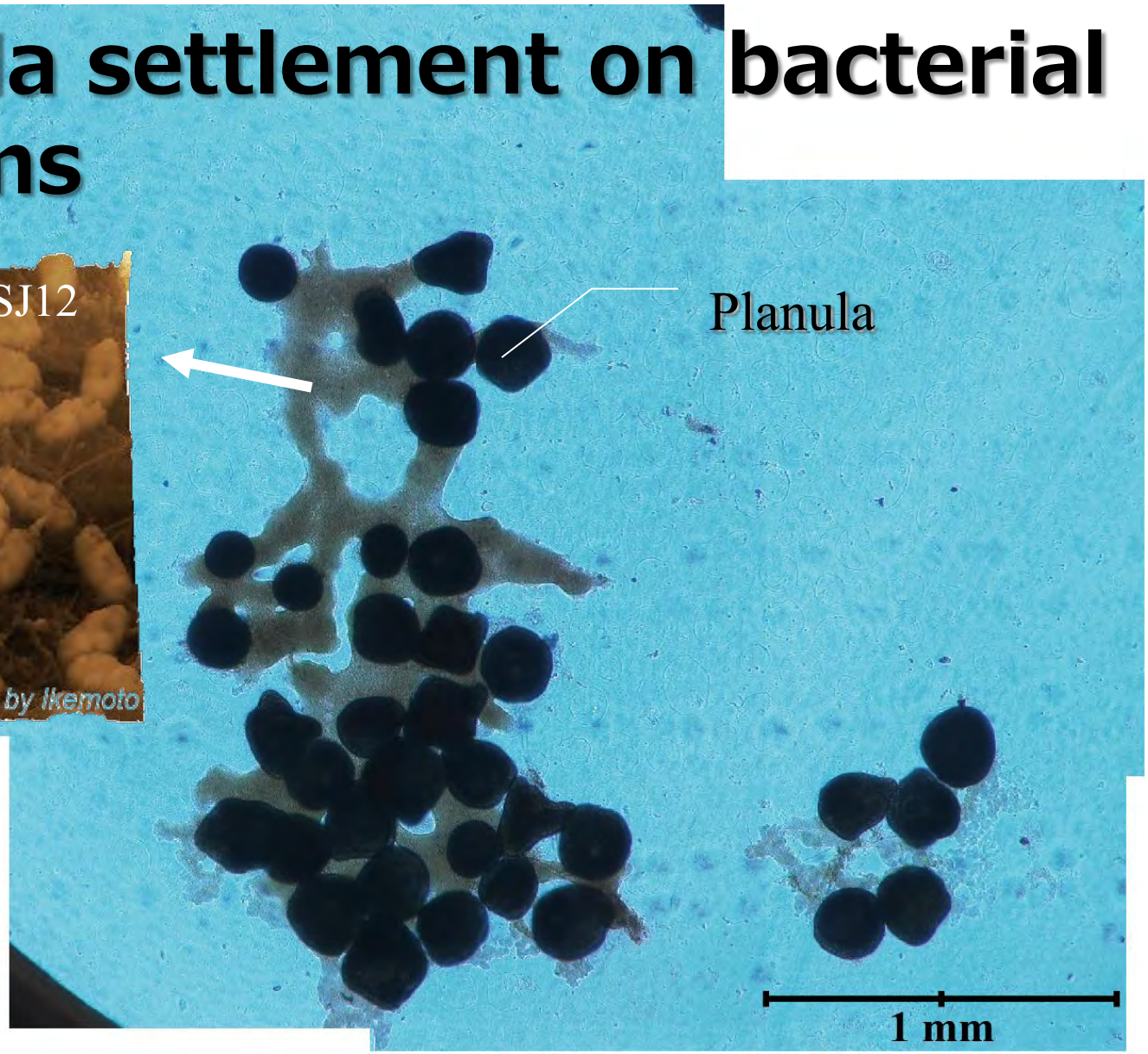
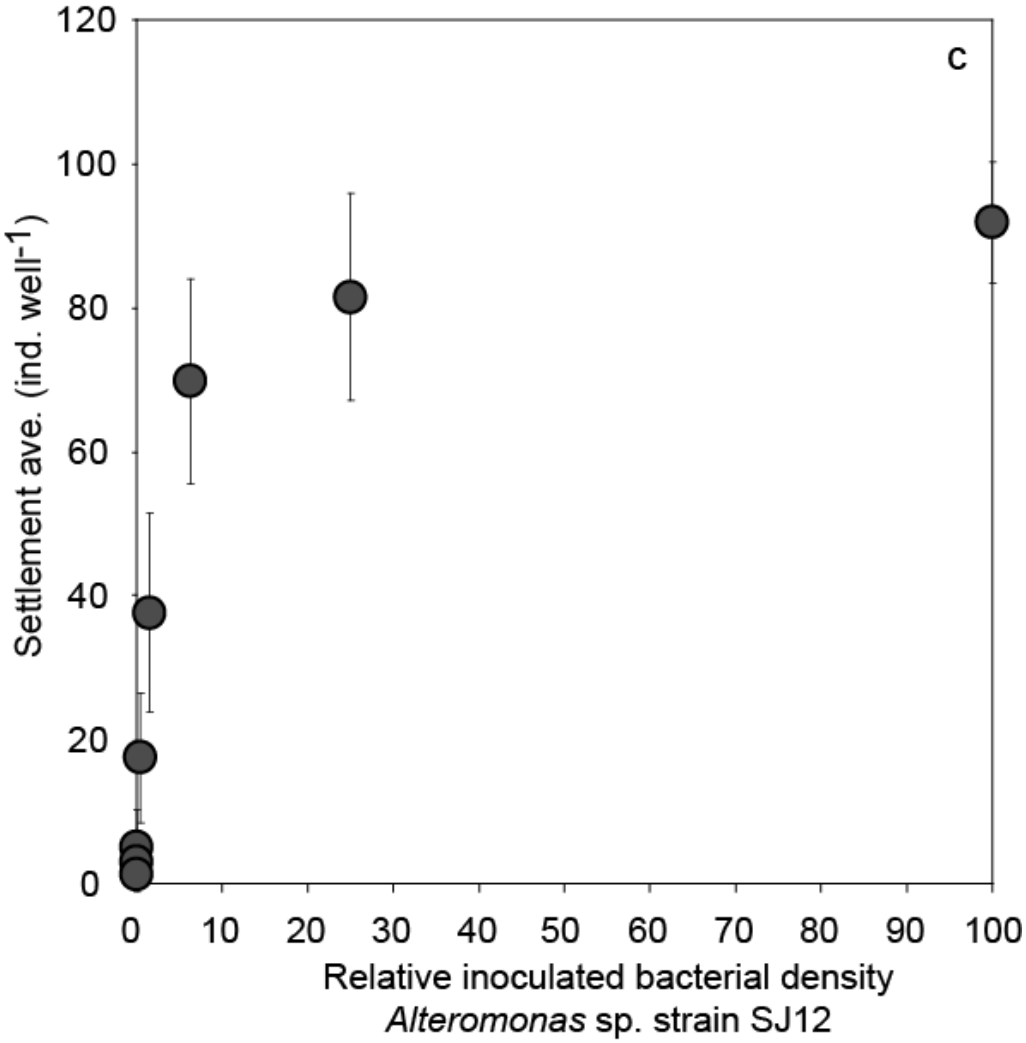
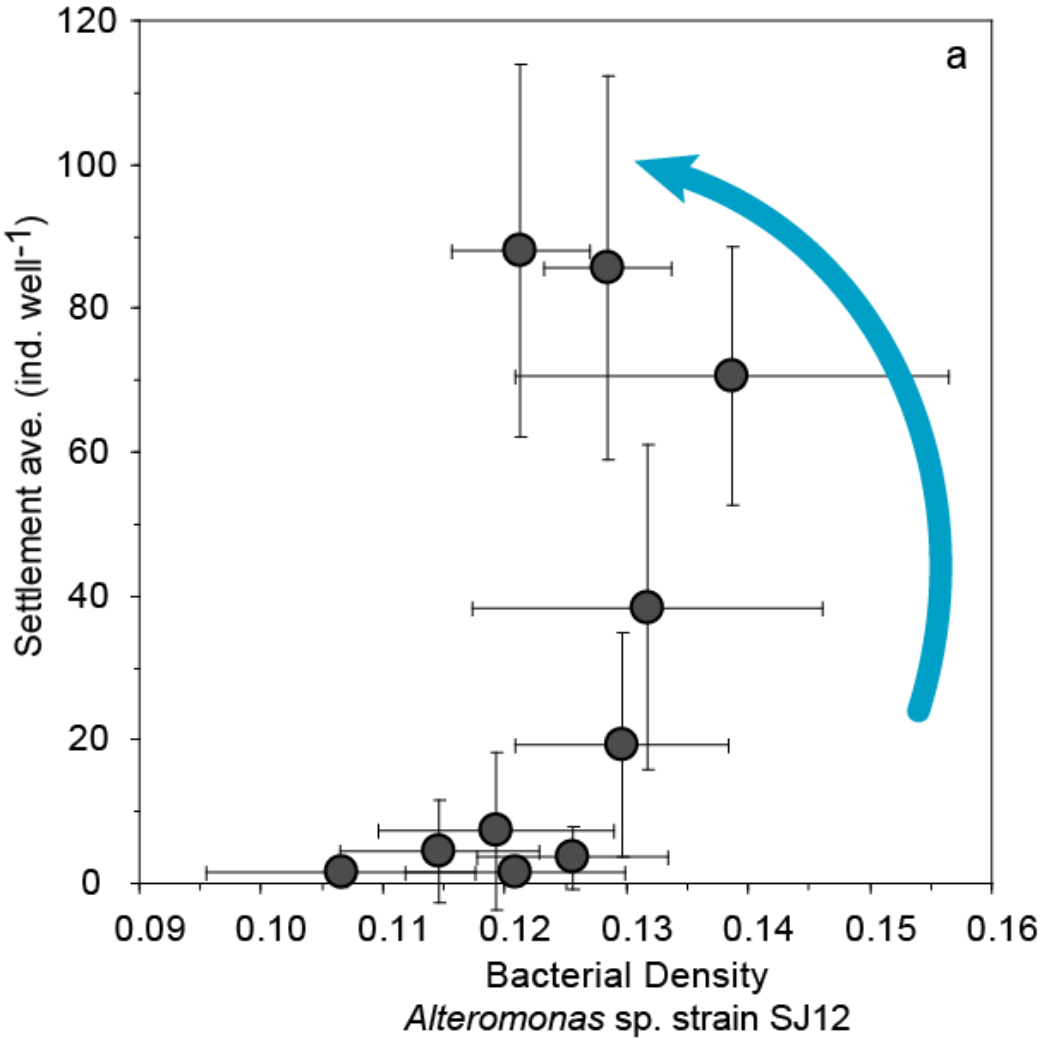
Planula settlement on bacterial biofilms



Planula settlement vs bacterial no.



Planula settlement vs biofilm density



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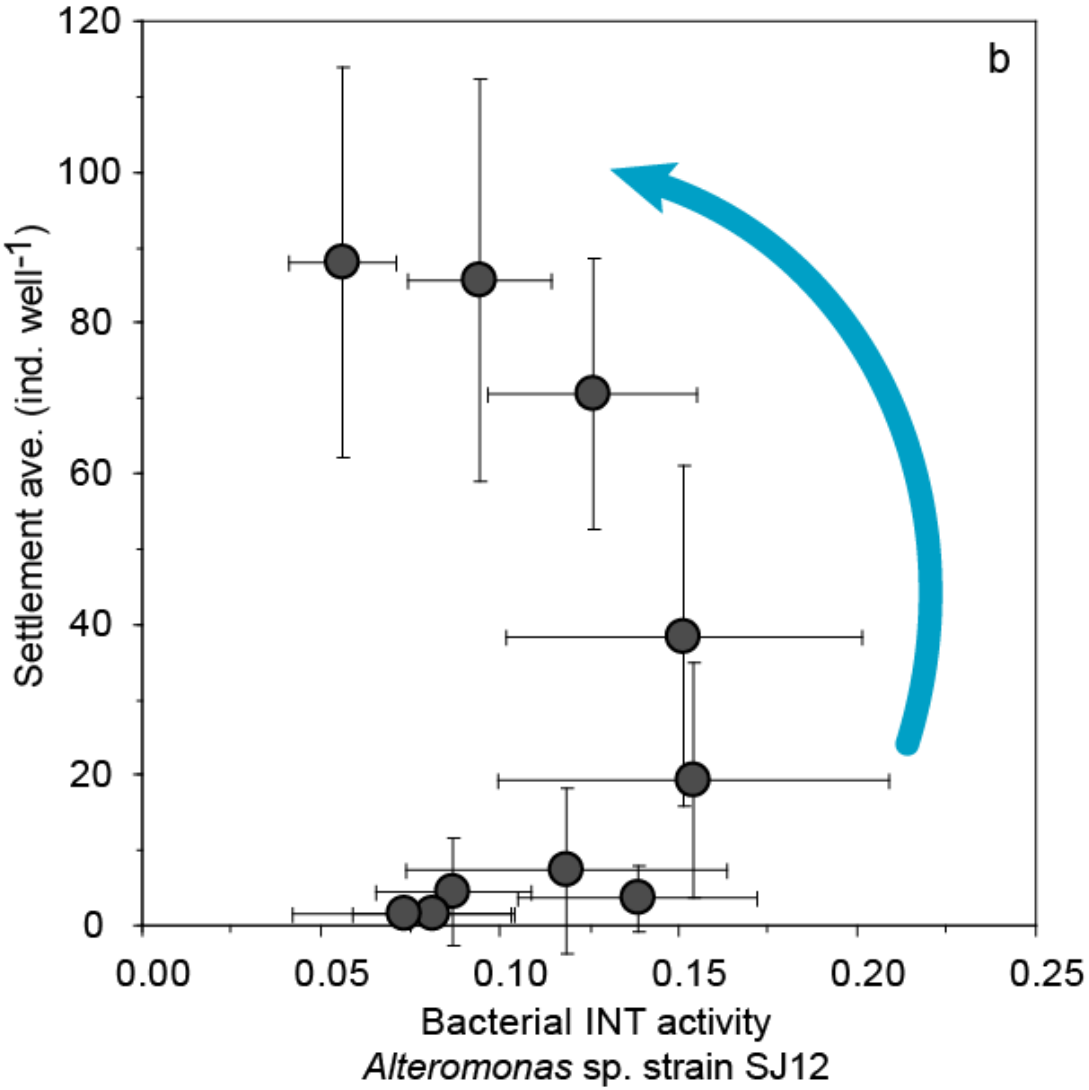
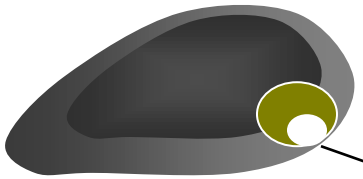
Planula settlement vs biofilm activity



Hypothesis of bacterial induction of planula settlment

プラヌラ Planula

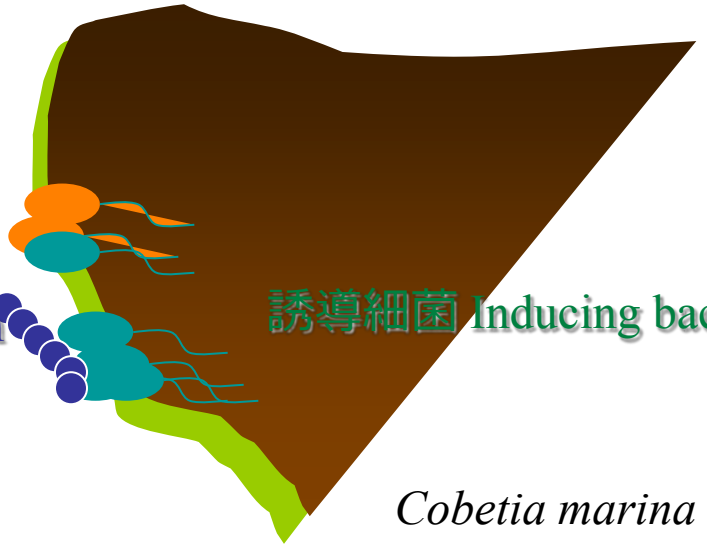


レクチン lectin

Obelia loveni
オベリアクラゲ

糖鎖認識

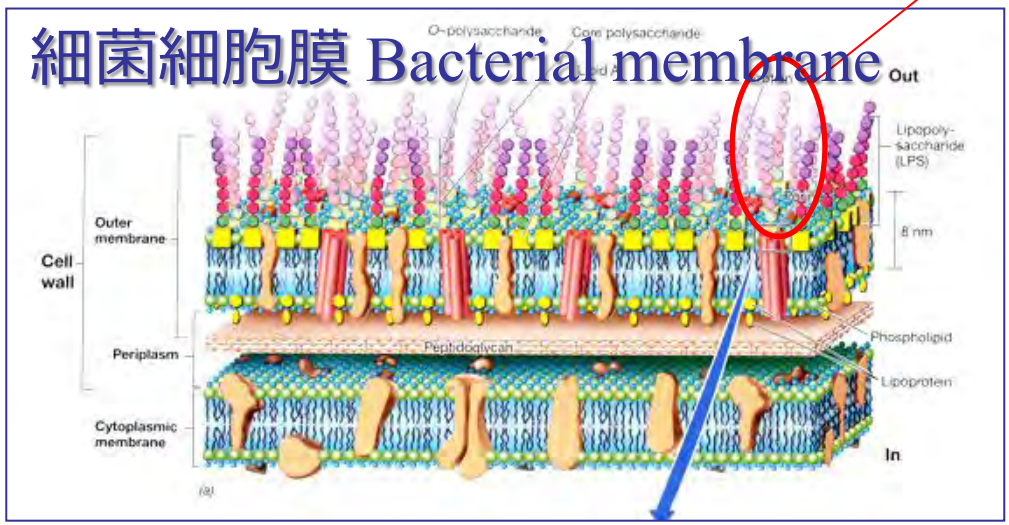
糖鎖
Sugar chain



誘導細菌 Inducing bacteria

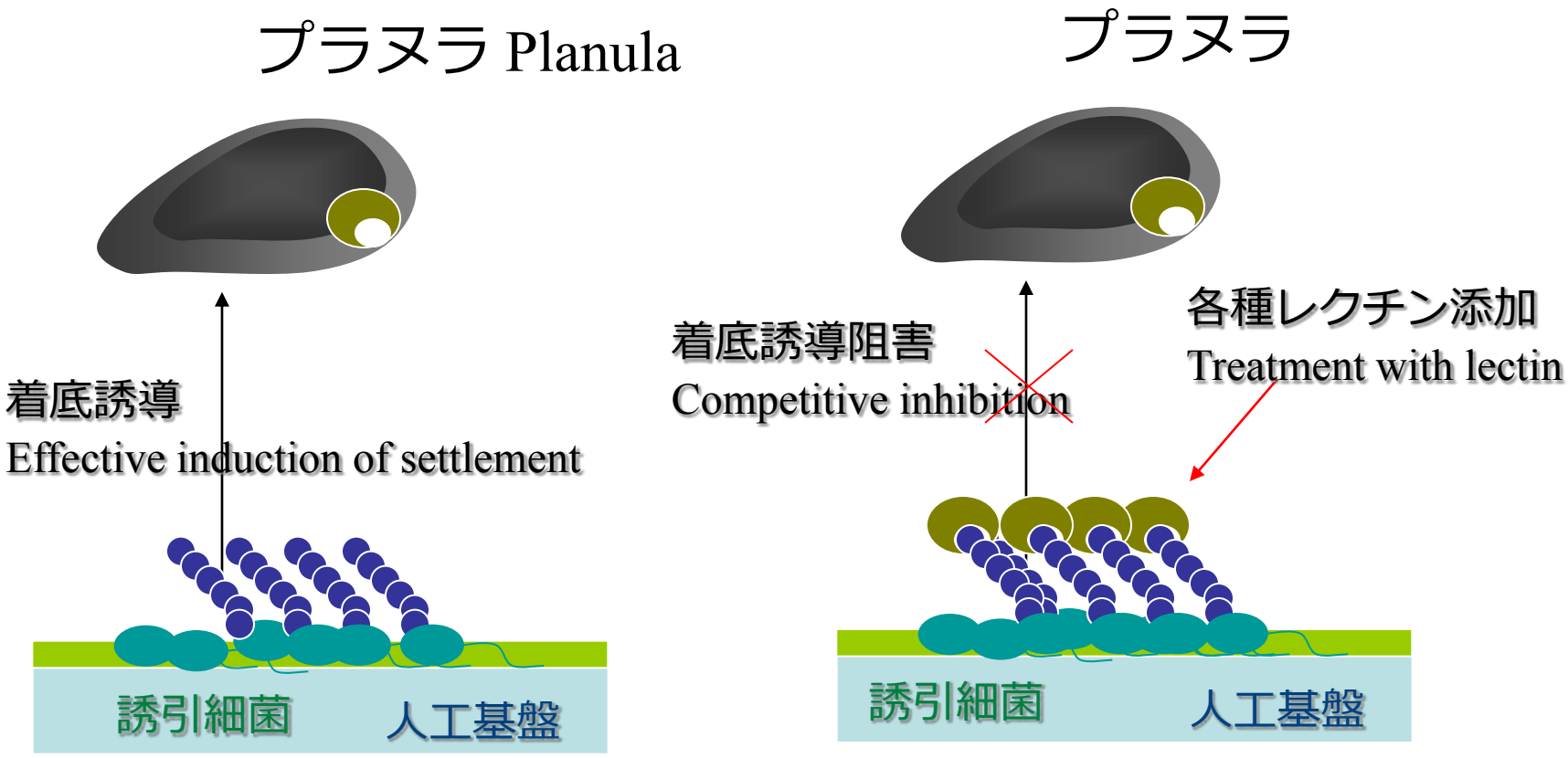
Cobetia marina

バイオフィルム
Biofol,



Kirchman and Mitchell (1981)
Dobretsov (2005)

Lectin assay



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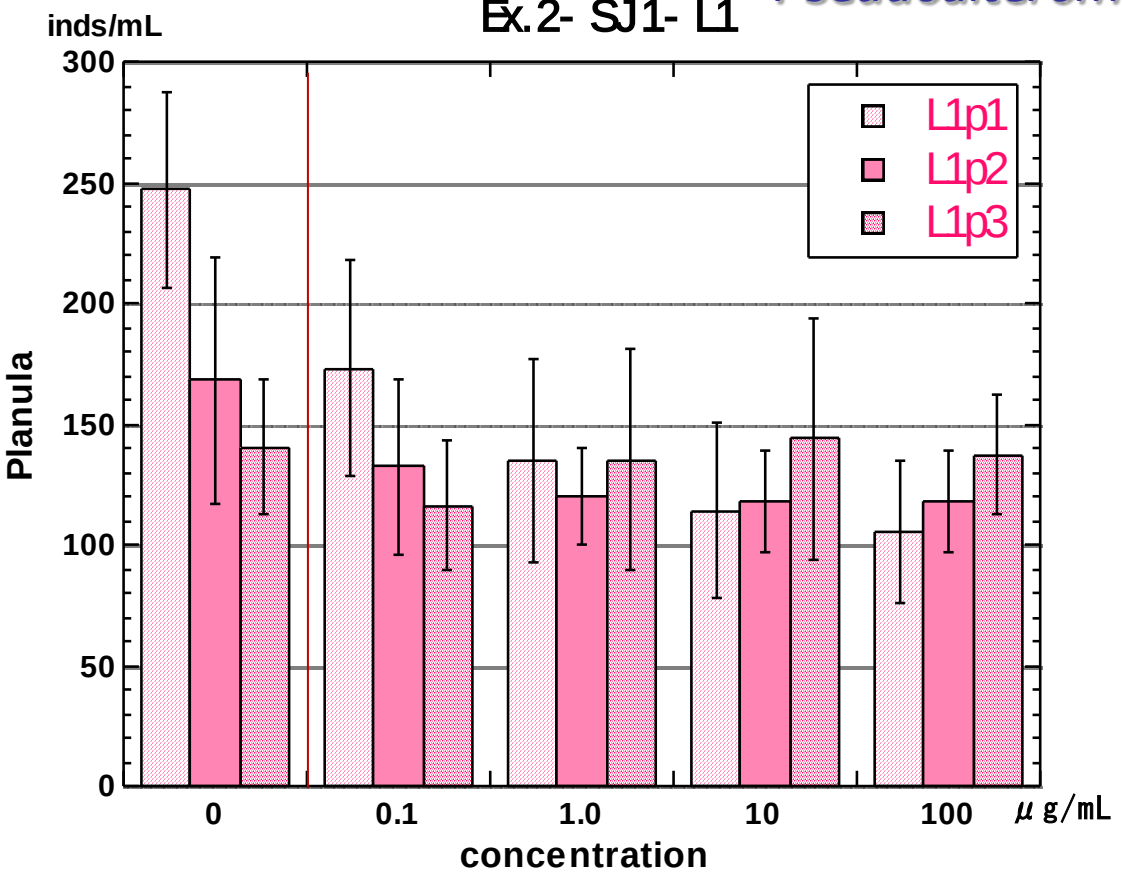
Effect of lentil lectin on bacterial induction of planula settlement

Pseudoalteromonas sp. SJ1

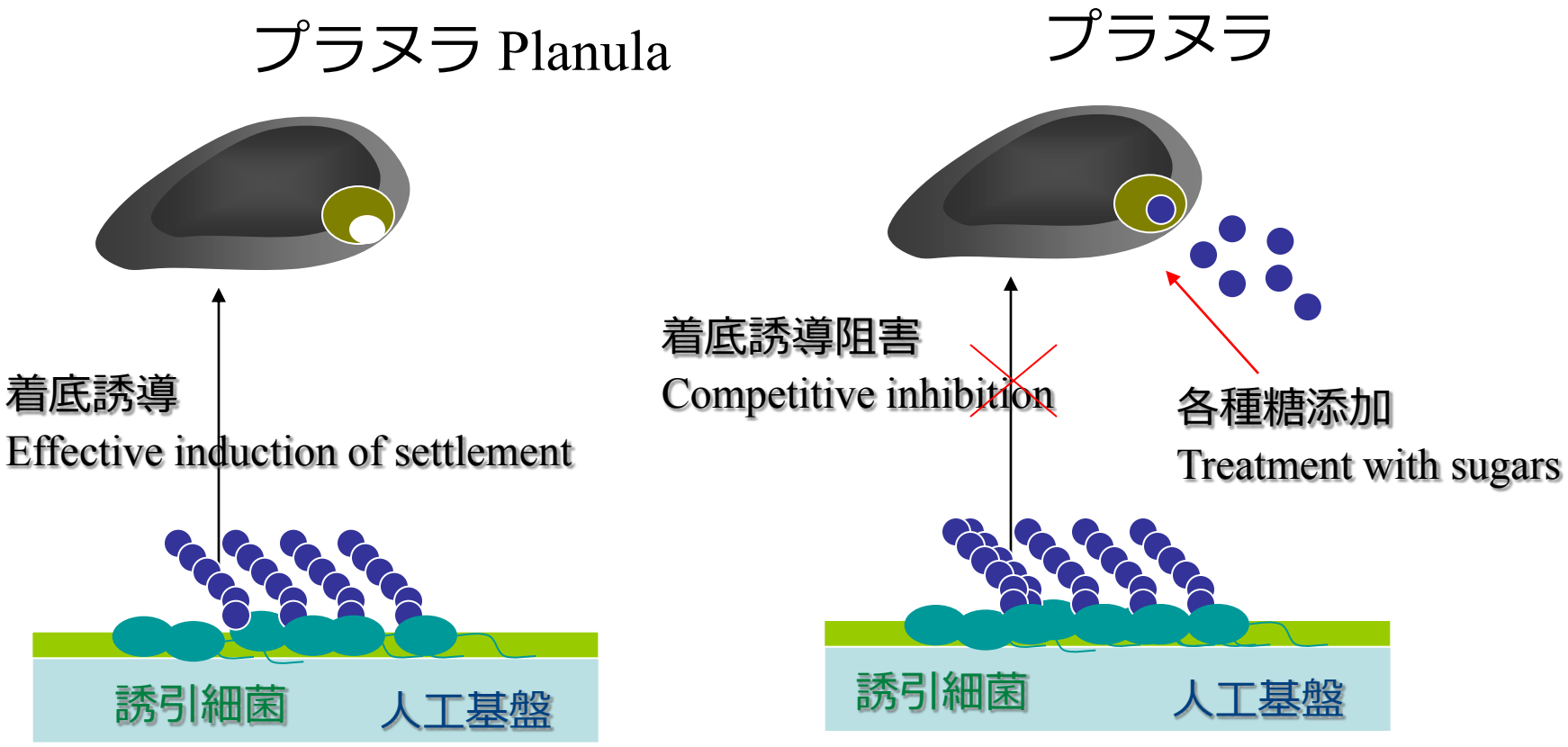


Lentil lectin

Suppression of bacterial inducing effect on planula settlement by lectins

No	Lectin	Source	Sugar specificity	Positive／no. of test
L1	Lentil (LCA)	*Lens culinaris*	Man, Fuc	3/5
L2	Peanut (PNA)	*Arachis hypogaea*	Gal/GalNAc	3/5
L3	Concanavalin A (Con A)	*Canavalia ensiformis*	Man	1/5
L4	Wheat germ (WGA)	*Triticum vulgaris*	GlcNAc, Sia	1/3
L5	Soybean	*Glycine max*	Gal/GalNAc	3/5
L6	Winged pea	*Lotus tetragonolobus*	Fuc	1/3

Lectin-sugar assay



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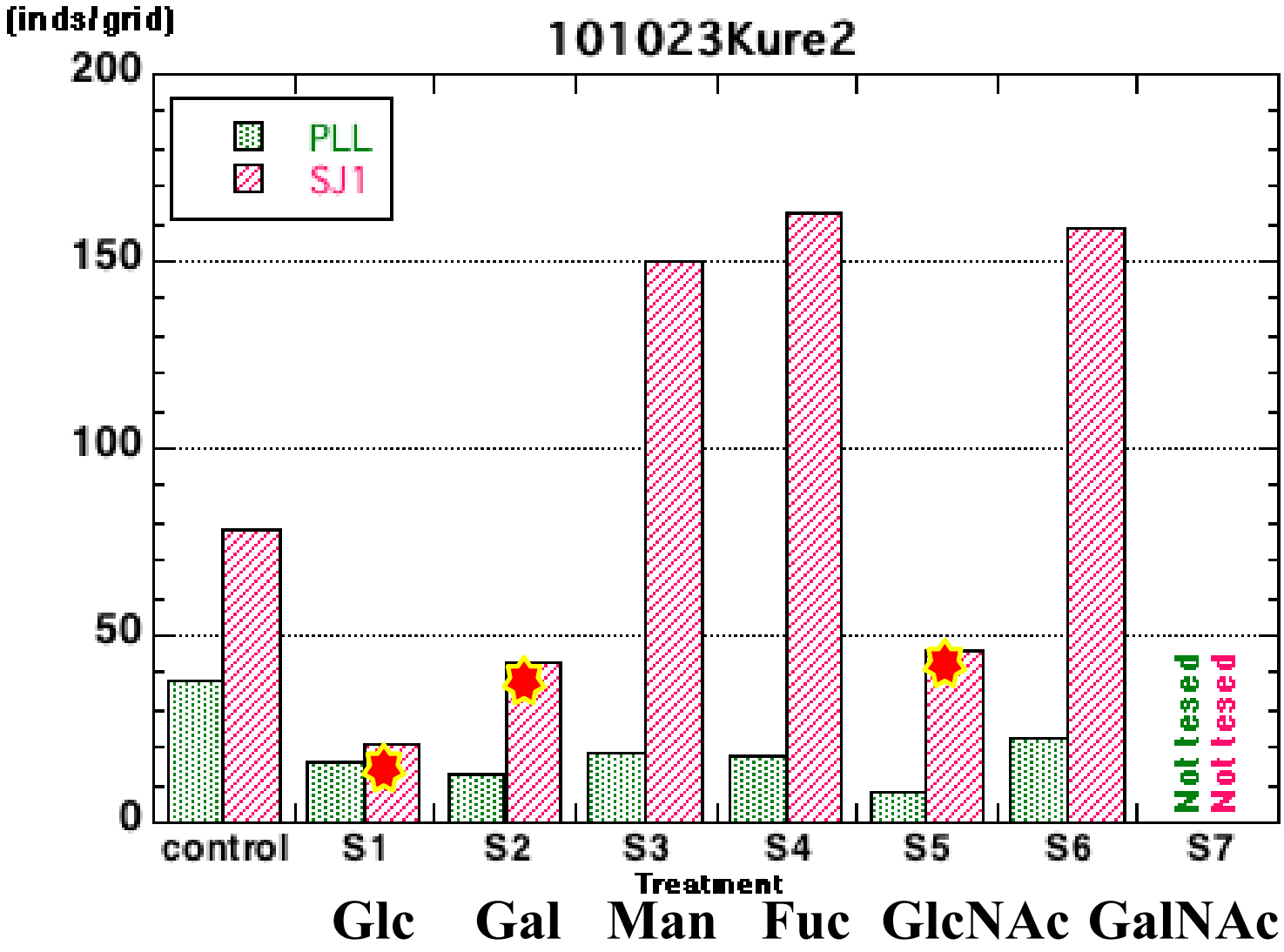
Lectin-sugar assay



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Simulated *in situ* collection of planula larvae

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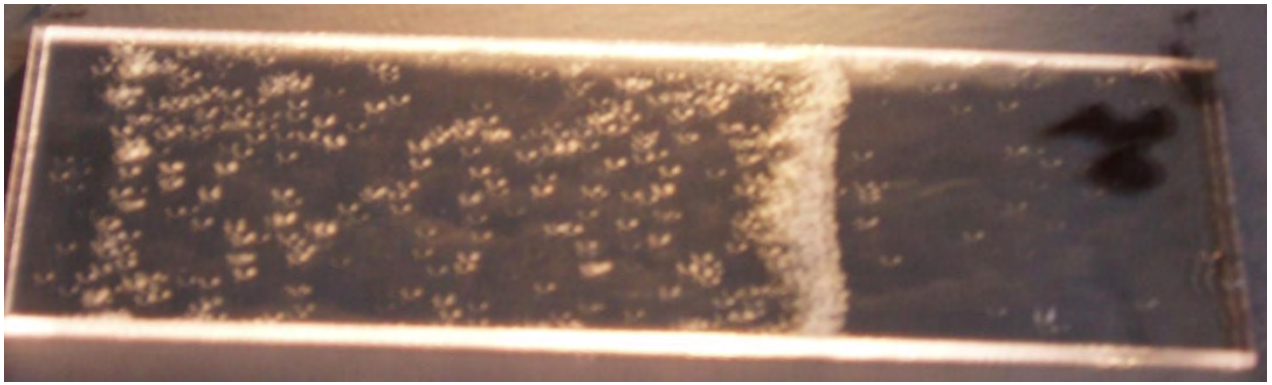
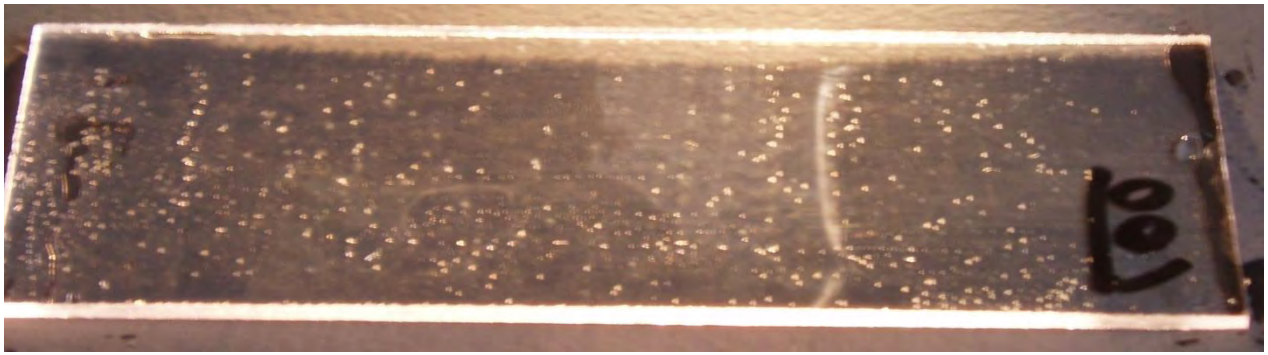
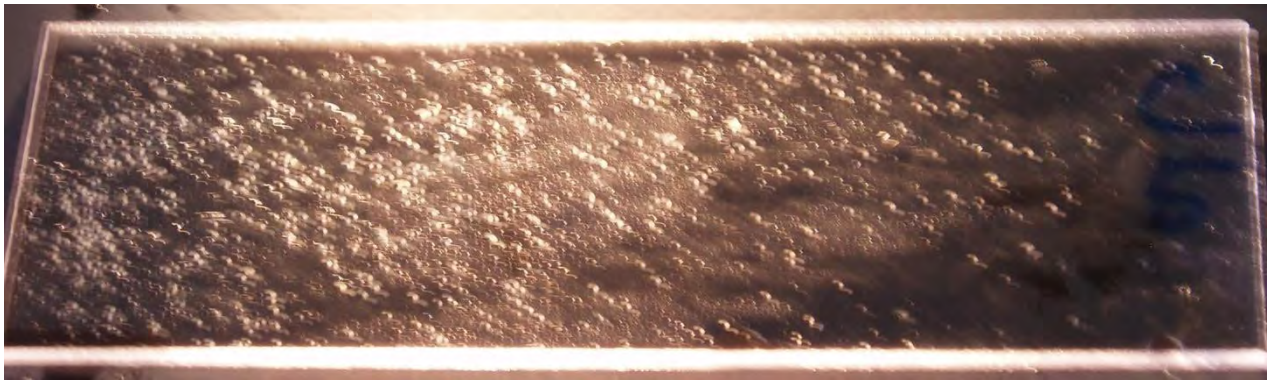
Simulated *in situ* collection of planula larvae



Inducing bacteria
SJ1



Inhibiting bacteria
SJ22



control

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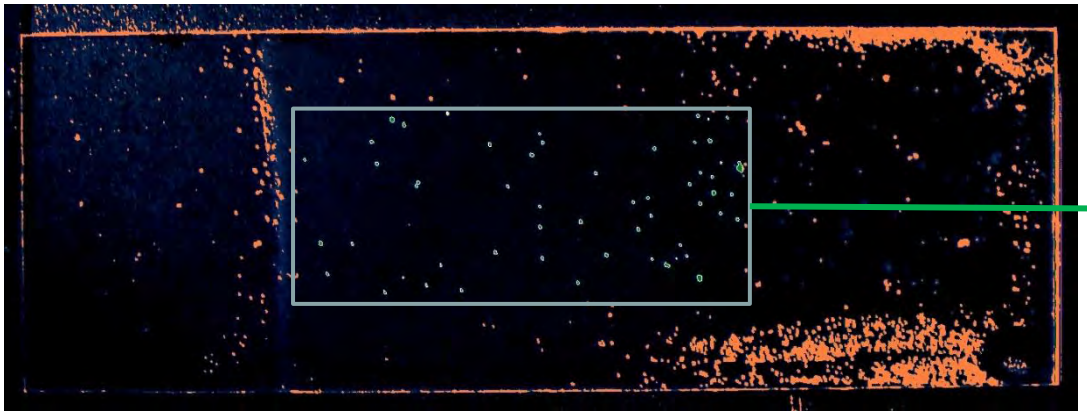
Image analysis



Total area

Number of planula

Planula size

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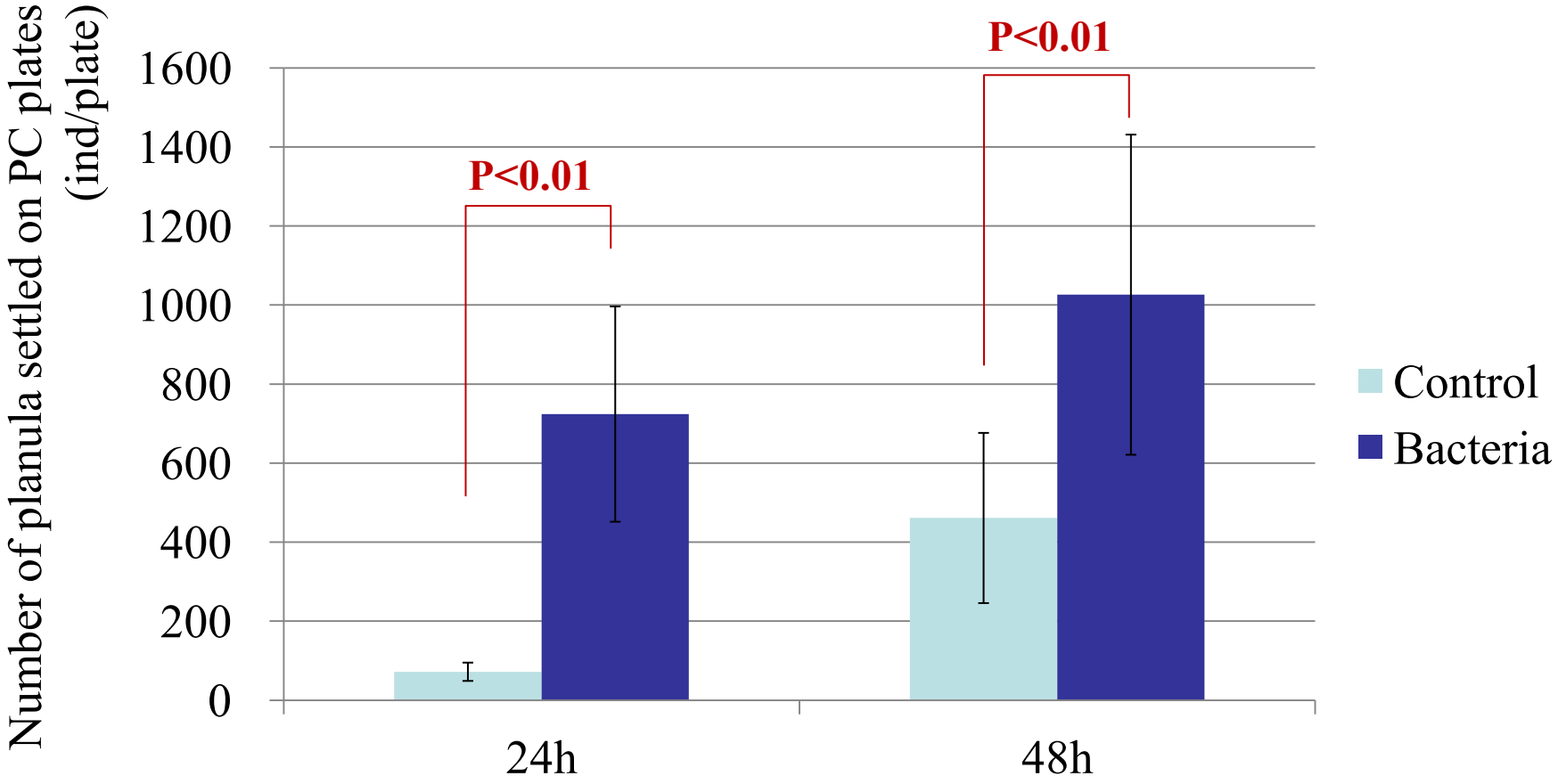
Simulated *in situ* collection of planula larvae



Summary

1. Marine bacteria inducing/inhibiting settlement of planula larvae of *Aureria aulita* (*Psudoalteromonas* sp., *Alteromonas* sp., *Vibrio* sp.) were successfully isolated.

2. Interaction between planula lectin and bacterial oligosacchalide possibly involves in the inducing effect.

3. Bacteria-coated plates can effectively collect planula larvae.

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Thank you

STOPJELLY project

Studies on prediction and control of jellyfish outbreaks

Funding: Agriculture, Forestry and Fisheries Research Council