

IMAS

Innovative Marine Antifouling
Solutions for High Value Applications

A Collaborative Research Program





Institute of Materials Research and Engineering (IMRE)

Nanotechnology
Surface Science
Settlement Assays
Polymer Chemistry & Physics



Institute of Chemical and Engineering Sciences (ICES)

Polymer Synthesis
Catalysis
Reaction Engineering



Singapore Institute of Manufacturing Technology (SIMTech)

Mechanical Testing & Analysis
Manufacturing Technology

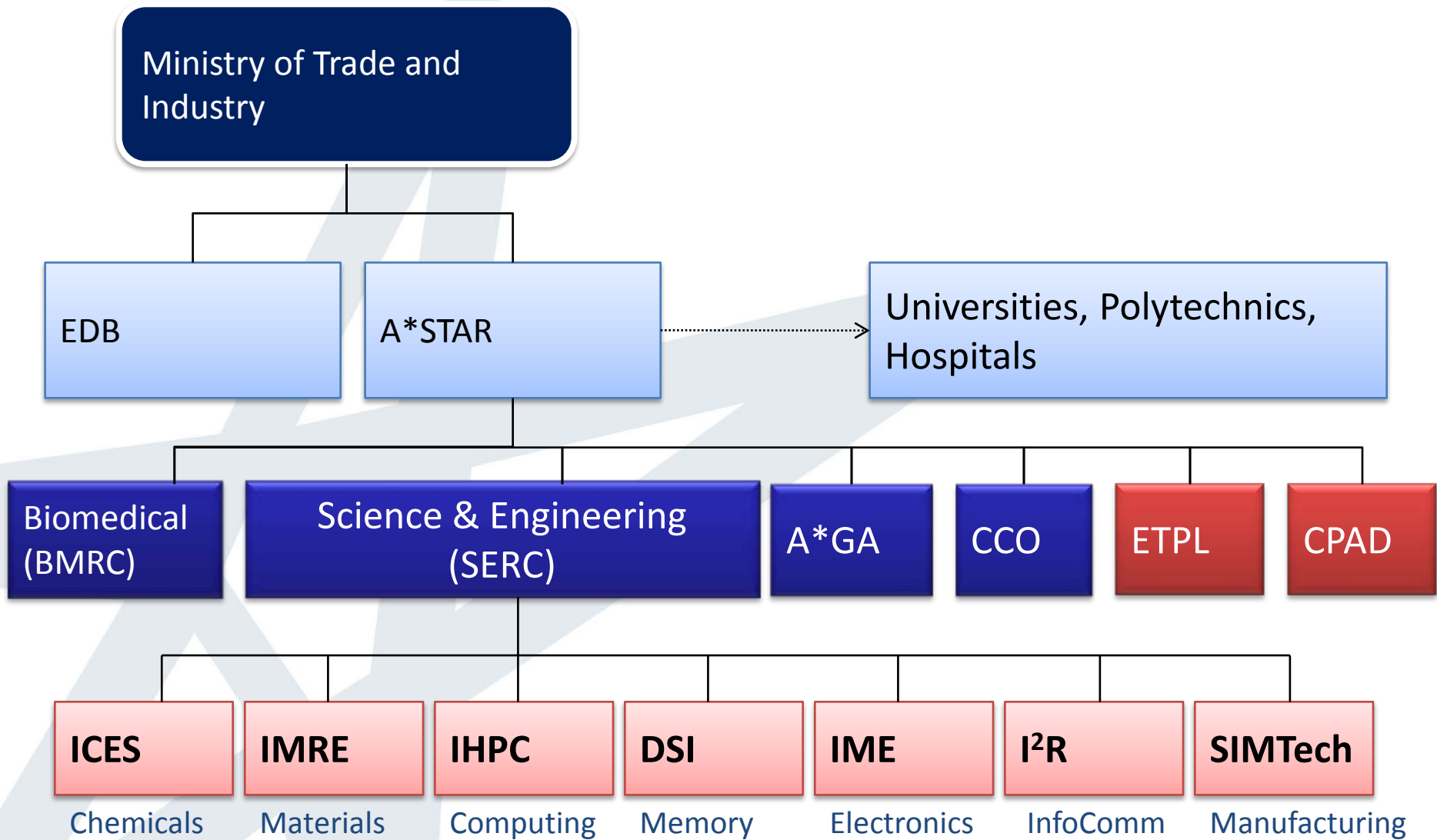


Tropical Marine Science Institute (TMSI)

Antifouling Screening
Settlement Assays of Marine Organisms
Field Tests in Seawater



Organization and Structure of A*STAR



IMAS

Innovative Marine Antifouling Solutions for High Value Applications

Participating Researchers:

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SIMTech: Dr. Marcin Debowski (PI)

TMSI: Dr. Serena Teo (PI)

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of the Agency for Science, Technology and Research (A*STAR)**

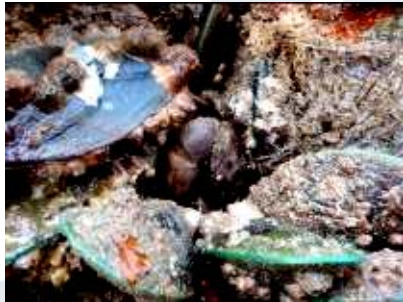
**A collaboration among polymer chemists, material scientists
and marine biologists**



Science and Engineering
Research Council

Marine Biofouling

...is the undesirable accumulation of microorganisms, plants, and animals on the surface of artificial structures immersed in seawater.



Mussels



Barnacles



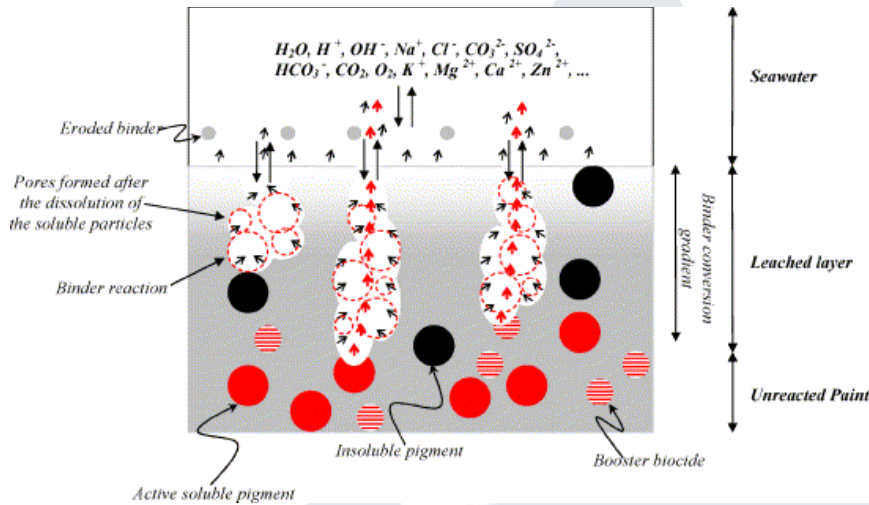
Tubeworms

Marine biofouling incurs economical costs for all maritime industries, resulting in increased fuel costs and mechanical damage.

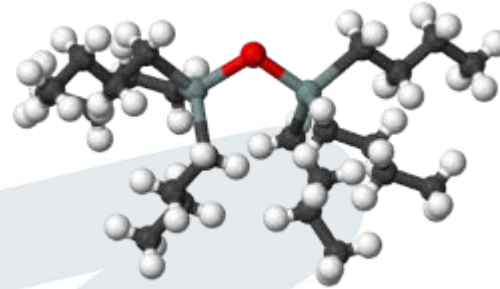
It is also a vector in the proliferation of invasive species in marine ecosystems.

Given the rapid growth of shipping, the marine offshore and hydroenergy industries, there is a pressing need for efficient and environmentally friendly antifouling solutions.

Existing antifouling Solutions



Traditional approach:
Self-polishing paints that release tin biocides into the seawater



TriButyltin (TBT):
Highly toxic
Alter shellfish shells
Retards reproduction
Interferes with metabolism

Yeber, D.M., Kiil, S., Dam-Johansen, K. *Progress in Organic Coatings* 2004 50, 75-104
© 2004 Elsevier Ltd.

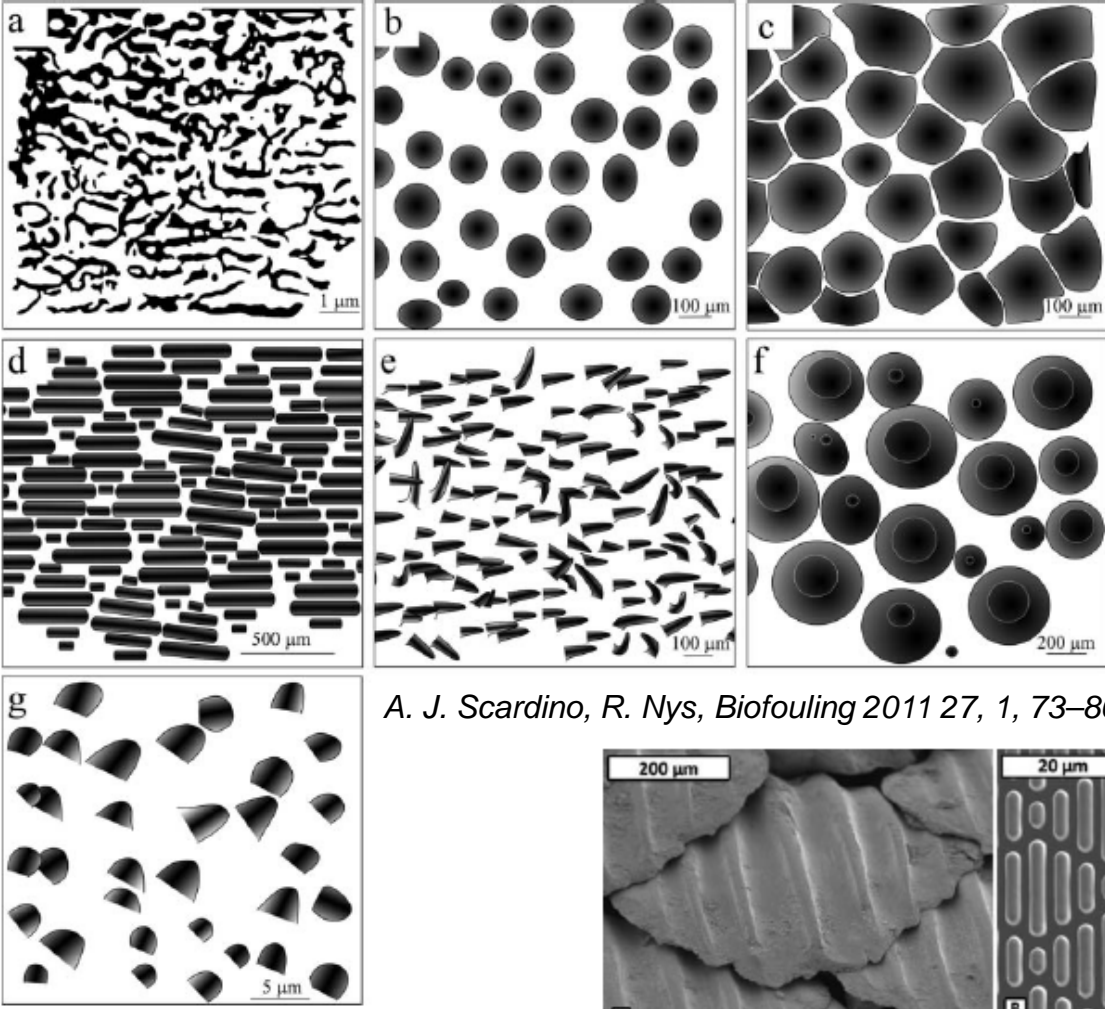
Coatings with tin-based biocides are banned for shipping through the IMO AFS Convention. Singapore has ratified the IMO AFS Convention.

Current technology is based on copper or zinc pigments with organic booster biocides, or low-energy surfaces for moving objects (fouling release).

As biocide technologies are likely to face increasing restrictions, thereby increasing the cost for development, environmentally benign technologies without the use of biocides are highly desirable.

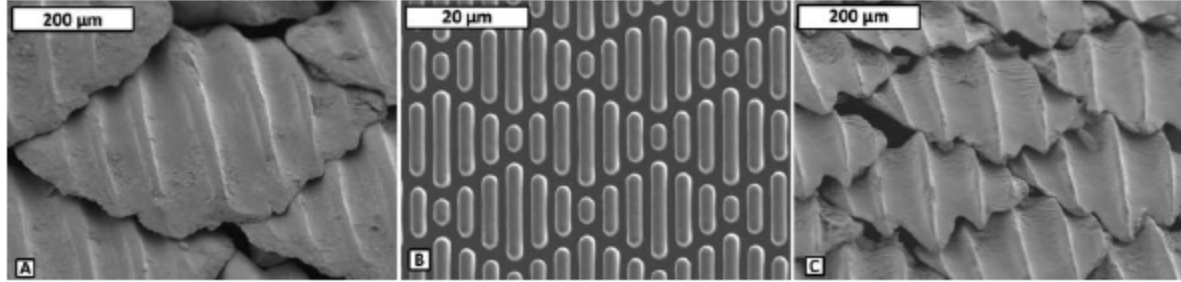
The IMAS program targets high-value, small underwater structures with a new, biocide-free approach to prevent biofouling.

Pre-existing biomimicking surface topologies



a Pilot whale (Baum et al. 2002)
b, c Sea stars (Guenther and de Nys 2007),
d Galapagos shark (Bechert et al. 2000)
e Yellowfin leatherjacket (Wang et al. 2009)
f, g Crab carapace (Bers and Wahl 2004).

A. J. Scardino, R. Nys, *Biofouling* 2011 27, 1, 73–86 © 2011 Taylor & Francis.



Sharklet Technologies™



Institute of
Materials Research
and Engineering



Institute of
Chemical and
Engineering Sciences



Singapore Institute
of Manufacturing
Technology



IMAS

Innovative Marine Antifouling Solutions for High Value Applications

Approach:

Quantify bio-response of marine organisms & their molecular-level interactions with surfaces

Strategy:

Biomimetic surfaces
Surface topological patterning
Surface chemistry
Surface mechanical performance

Marine organisms:

exploration/settlement of barnacles, tubeworms and other foulers

AFM protein investigations:

profilometry of deposited footprint protein
adhesion force of single protein molecule

Patterning

hot embossing
polymer casting

Polymer Synthesis:

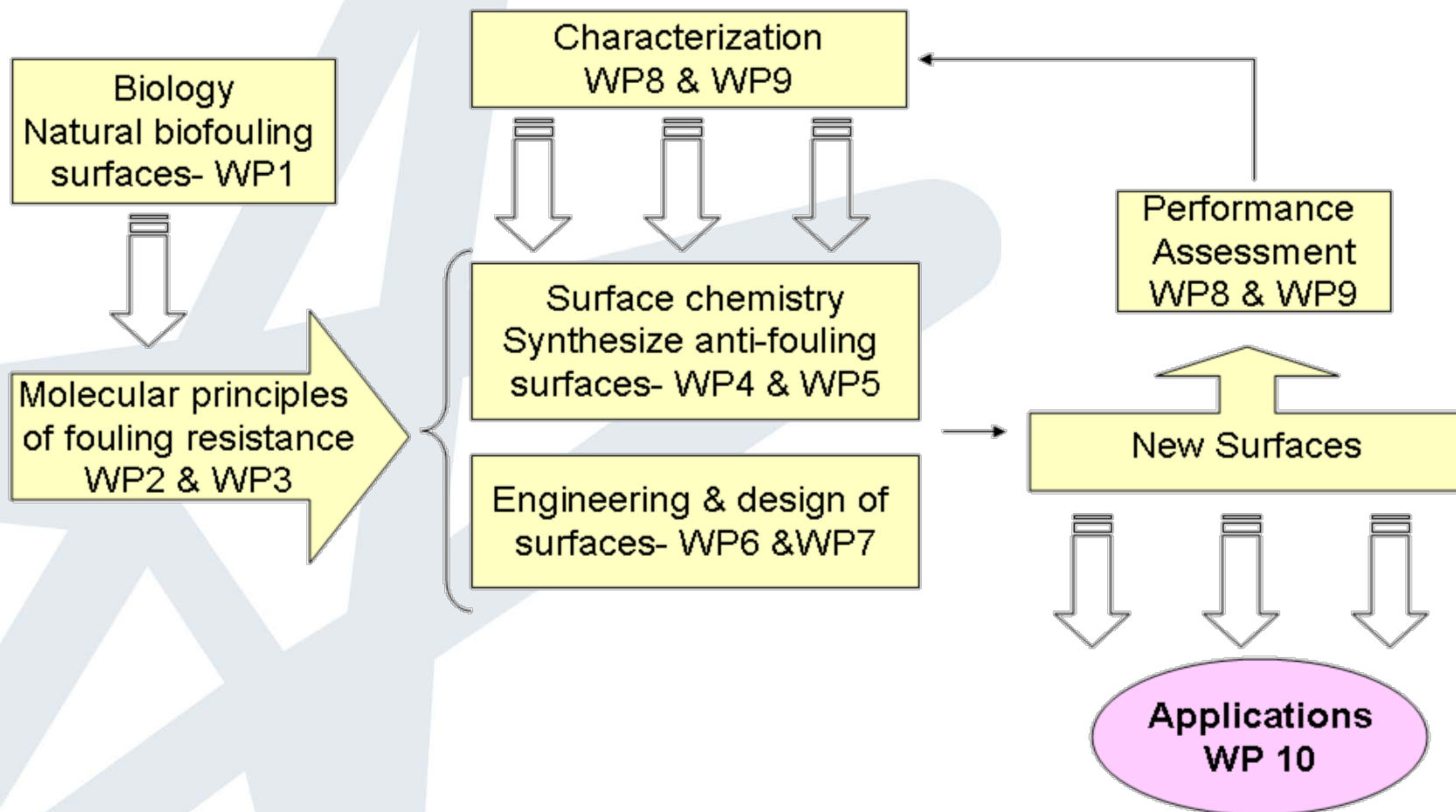
controlled polymerization
synthesis of polymeric
brushes



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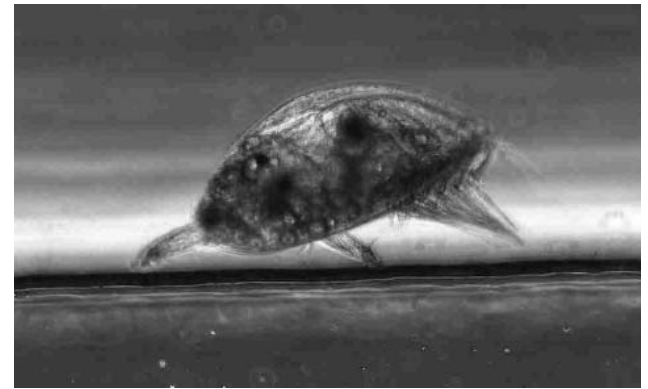
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Contact information

**We welcome industry collaborators to take part
in the IMAS programme**



For further information please contact us at:

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