

Studi Kasus dalam Bioprospeksi Kelautan dari Penemuan hingga Komersialisasi



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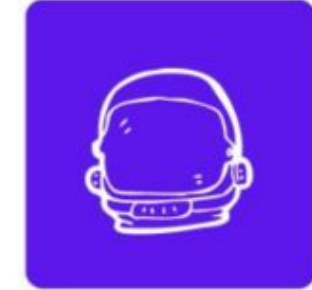
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MITRA PROYEK

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Pendahuluan

**Apa itu
bioprospeksi?**



Pencarian bahan-bahan bernilai dari organisme laut secara sistematis (obat, enzim, biomaterial).

**Mengapa
bioprospeksi
kekayaan laut?**

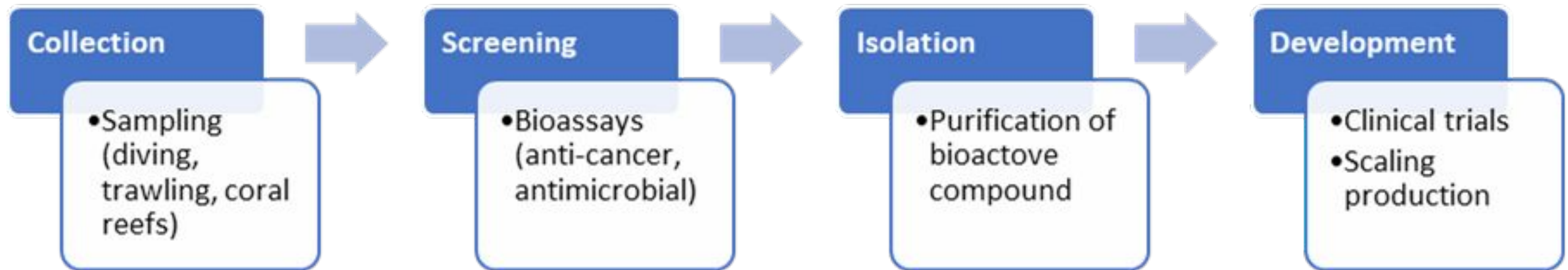


- ❑ Adaptasi unik → *novel chemistry*
- ❑ Tingkat kesuksesan tinggi: 7 dari 13 obat yang didapat dari organisme laut yang diakui oleh FDA berasal dari invertebrata

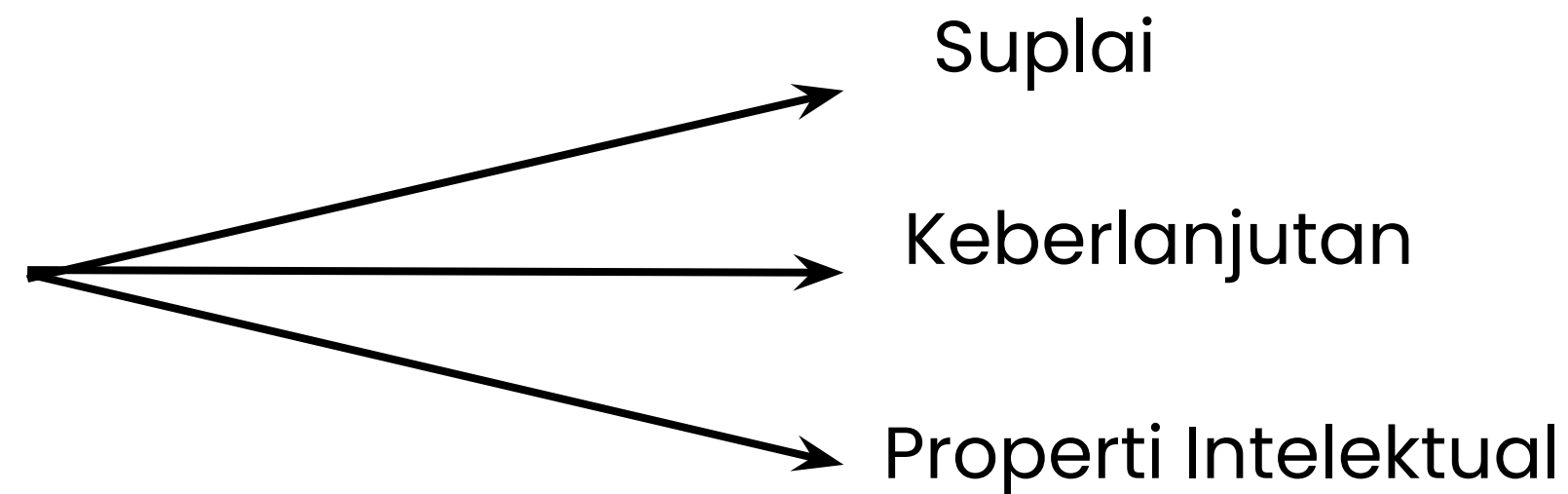


Pipeline Bioprospeksi

□ Langkah- langkah



□ Tantangan



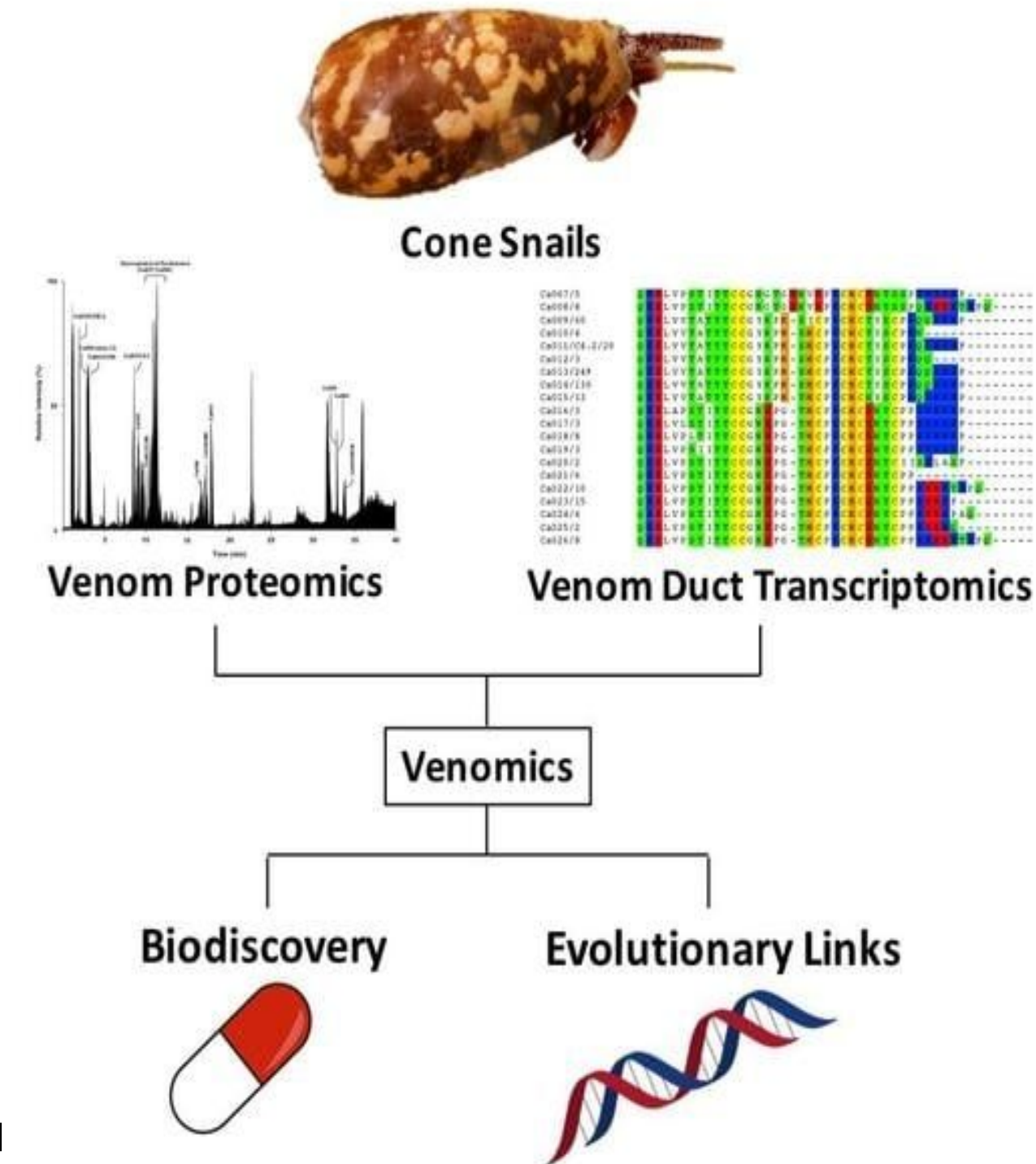
Penemuan

Studi Kasus 1: Ziconotide (Prialt®) – Bisa Siput Corong

- **Sumber:** *Conus magus* (Siput corong pasifik).
- **Observasi:** Melumpuhkan mangsa → neurotoksin potensial
- **Senyawa kunci:** ω -Conotoxin MVIIA (memblokir kanal kalsium).

Pengembangan dan Dampak

- **Aplikasi:** Pengurang rasa sakit kronis (1,000x lebih kuat dari morfin).
- **Tantangan:** Produksi (proses panen terlalu kompleks).
- **Pelajaran:** Senyawa peptida dari bisa sangat berharga di dunia neurosains



(Himaya & Lewis, 2018)

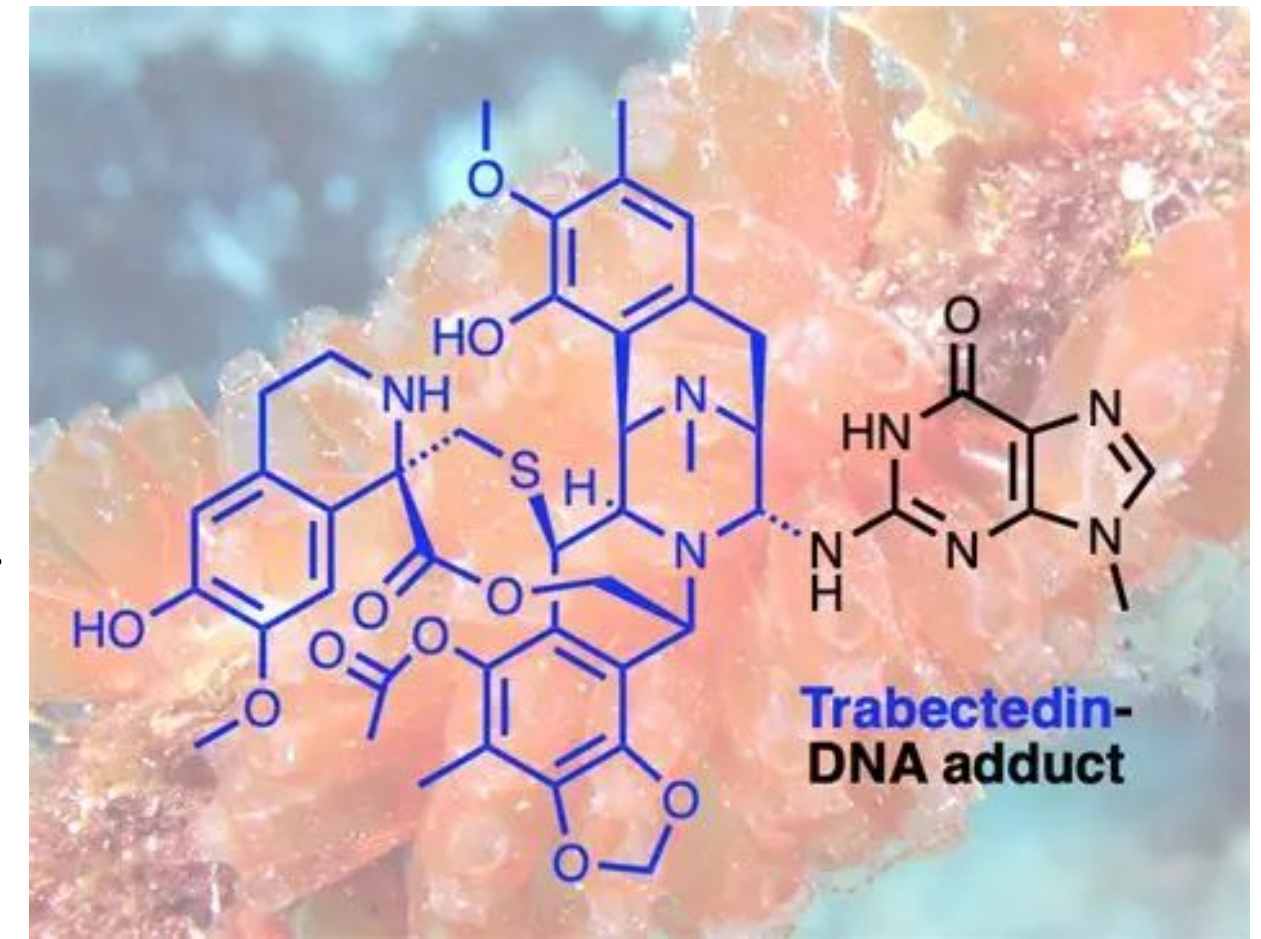
Penemuan

Studi Kasus 2: Trabectedin (Yondelis®) – Sea Squirt

- **Sumber:** *Ecteinascidia turbinata* (Tunikata Karibia).
- **Observasi:** Aktivitas anti-kanker berdasarkan skrining laboratorium
- **Senyawa Kunci:** Trabectedin (mengalkilasi DNA, membunuh sel tumor).

Komersialisasi

- **Pengakuan:** Diakui oleh FDA untuk sarkoma jaringan lunak (2007).
- **Solusi Pemenuhan Suplai:** Akuakultur + semi-sintesis (hindari panen berlebih).
- **Pelajaran:** Bakteri simbiotik kemungkinan menghasilkan senyawa tersebut.



(van Kesteren *et al.*, 2003)



Penemuan

Studi Kasus 3: Halichondrin B → Eribulin (Halaven®) – Spons Laut

- **Sumber:** *Halichondria okadai* (Spons laut Jepang).
- **Observasi:** Inhibitor mikrotubula yang potensial.
- **Tantangan:** Dibutuhkan 1 ton spons laut untuk menghasilkan 1 gram senyawa yang dibutuhkan

Terobosan dalam Mensintesis Senyawa

- **Solusi:** Sintesis total → senyawa analog yang disederhanakan (eribulin).
- **Dampak:** Obat kanker payudara (2010), penemuan kimia yang diakui Nobel



(Menis, *et al.*, 2011)



Penemuan

Studi Kasus 4: Pseudopterosins –Anti-inflamasi

- **Sumber:** *Pseudopterogorgia elisabethae* (Koral Karibia).
- **Penggunaan:** Anti-inflamasi alami (memblokir prostaglandin).
- **Aplikasi:** Kosmetik dari merk Estée Lauder (reduces skin irritation).

Keberlanjutan

- **Masalah:** Proses panen koral tidak berkelanjutan
- **Solusi:** Fermentasi menggunakan bakteri simbiotik



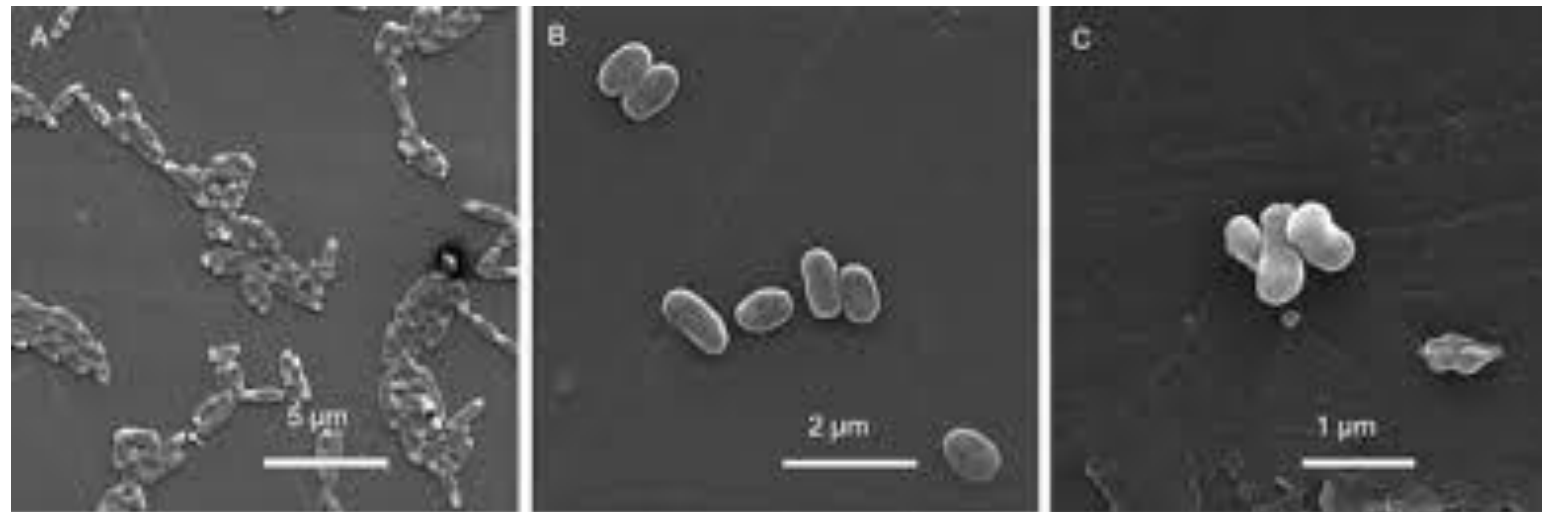
(Ringel et al., 2020)



Kemunculan Bidang Baru

- **Kawah Hidrotermal Laut Dalam:**

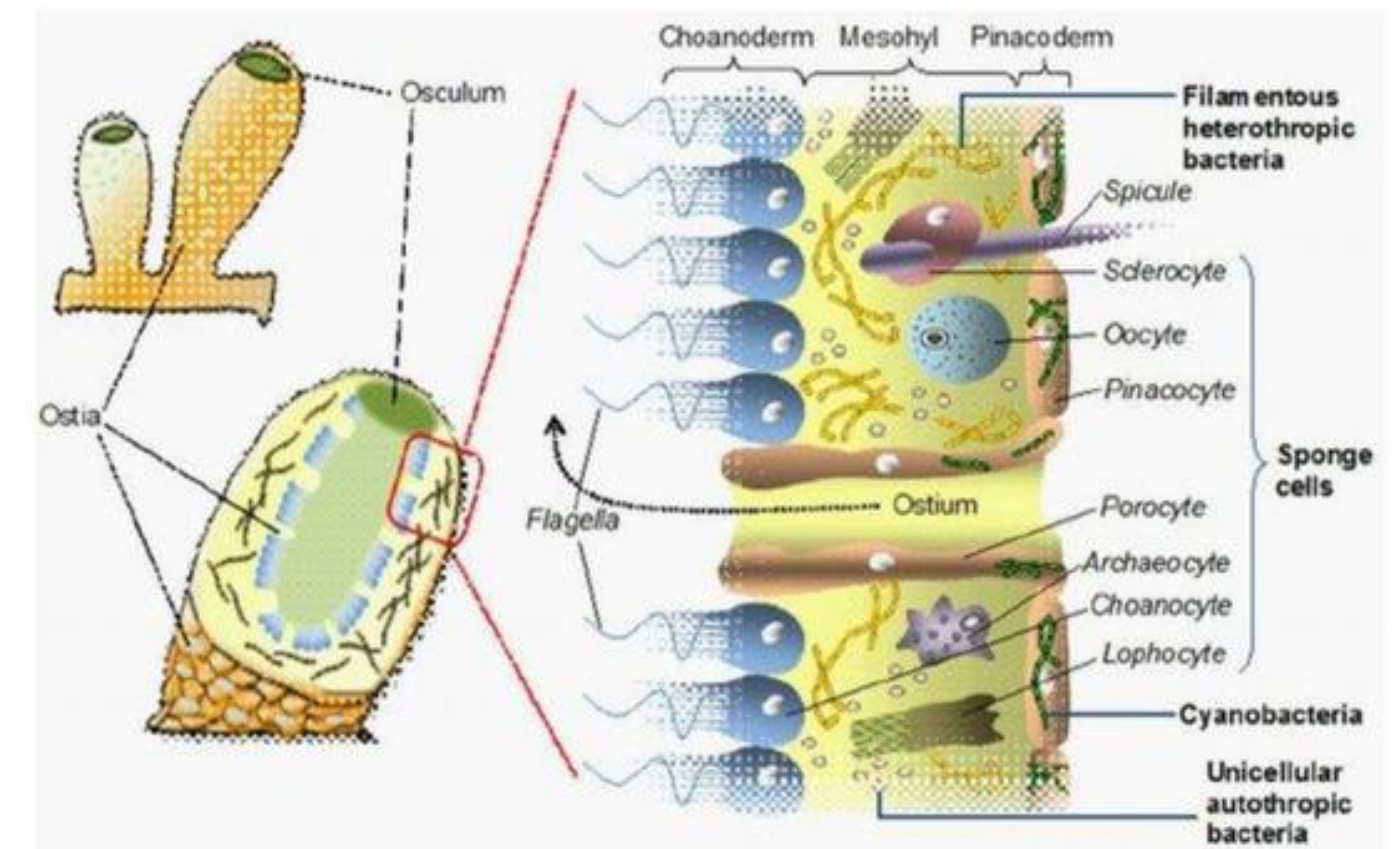
Bakteri *Exiguobacterium* □ enzim *heat-stable*



(Cavanaugh et al., 2021)

- **Penambangan Mikrobioma:**

Simbion spons laut menghasilkan >50% senyawa “inang”



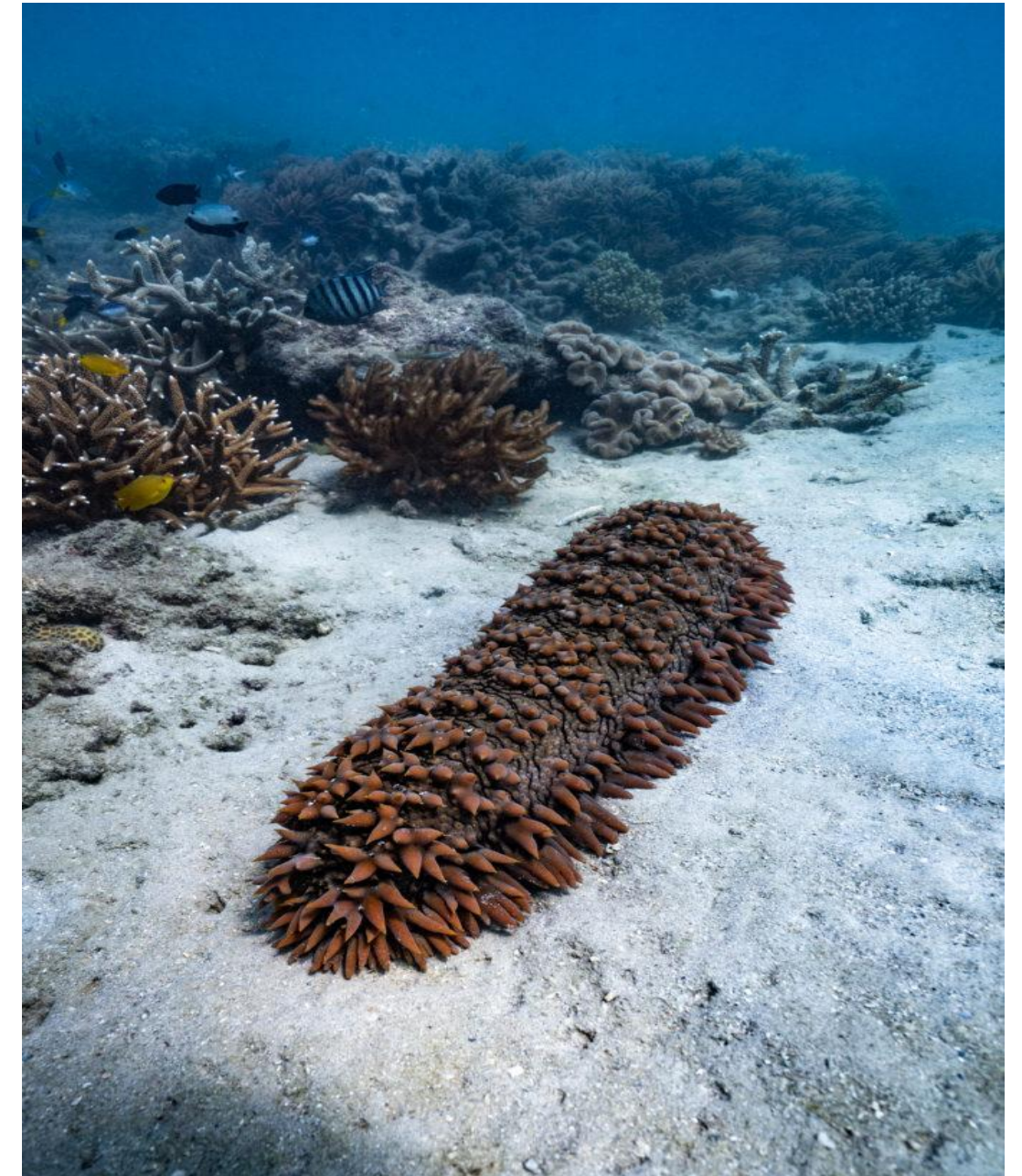
Bakteri simbiotik di dalam jaringan spons laut

(Nnaji et al., 2022)



Tantangan dan Etika

- **Akses dan Pembagian Manfaat:**
Protokol Nagoya (kerangka hukum).
- **Dampak Ekologis:**
Panen berlebihan (e.g., teripang).
- **Pembajakan Hayati:**
Siapa “pemilik” materi genetik suatu organisme laut?



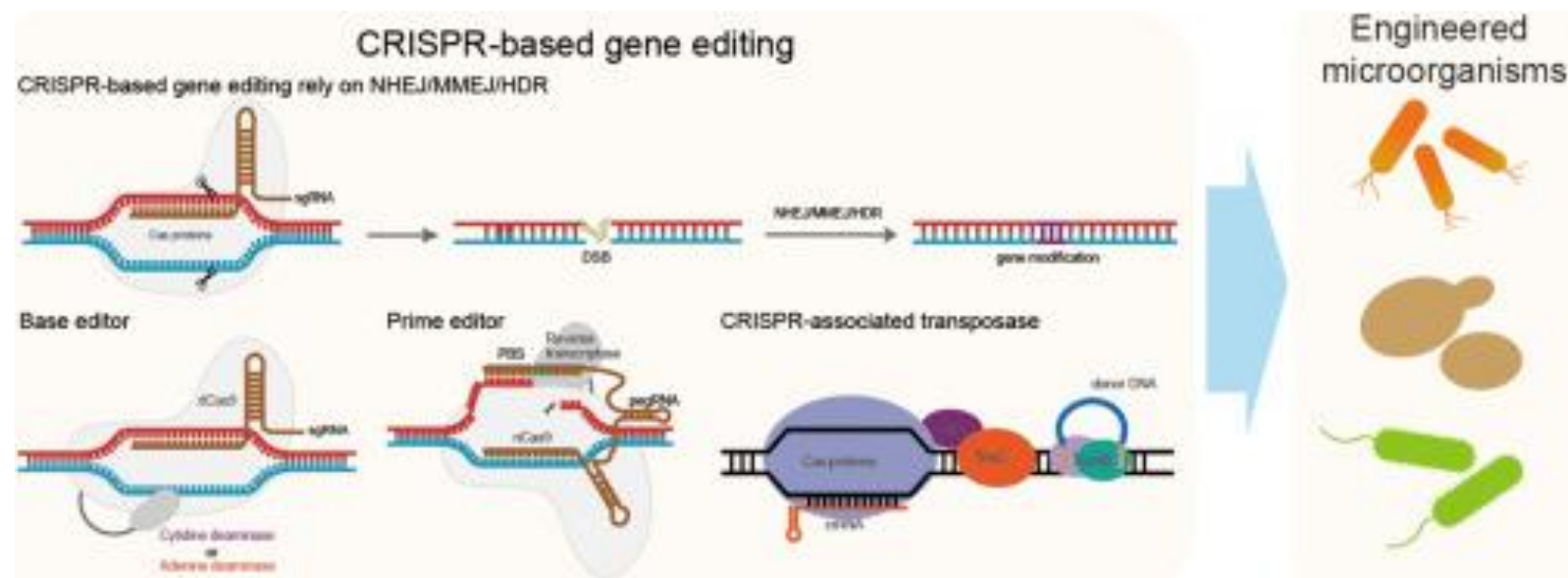
[Source:<https://oceanrafting.com.au/06-06-23-sea-cucumber/>]



Orientasi di Masa Depan

- **CRISPR & Biologi Sintetis:**

Merekayasa mikroba untuk menghasilkan MNP



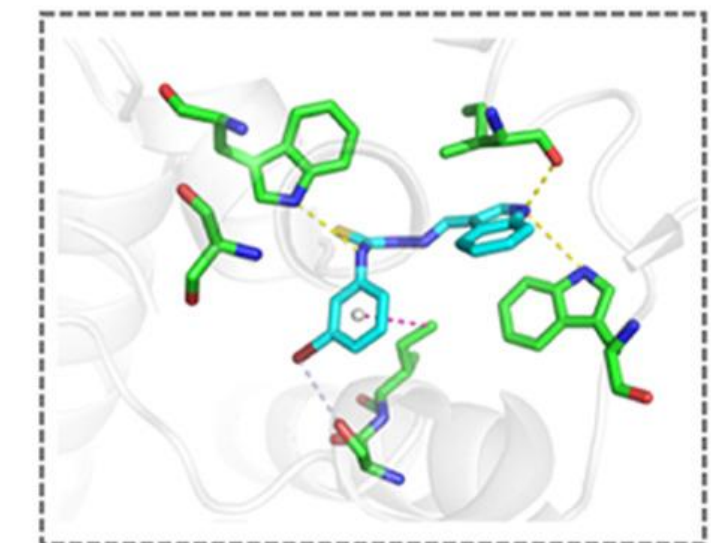
(Wei & Li, 2023)

- **Penemuan Berbasis AI:**

Machine learning untuk memprediksi bioaktivitas



AI



Biological activity

(Duan *et al.*, 2024)

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