Marine Genetic Resources: Benefit Sharing and Obstacles

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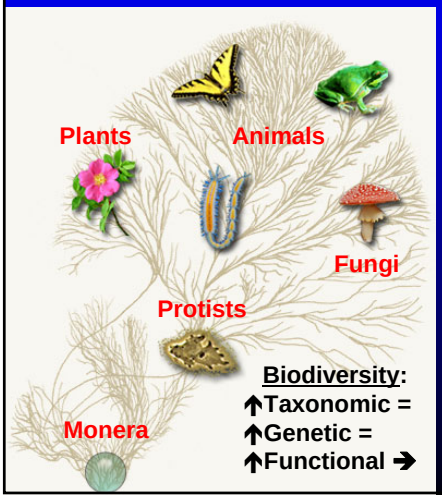
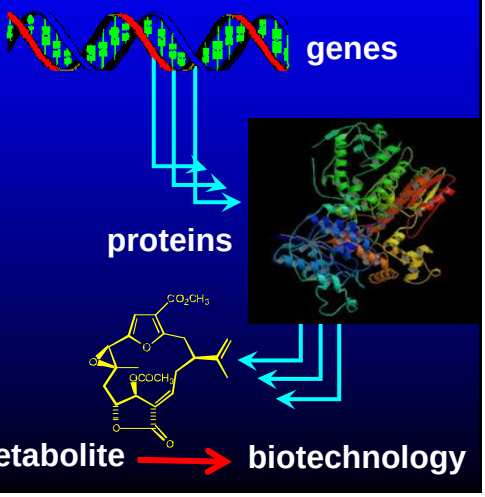
Background

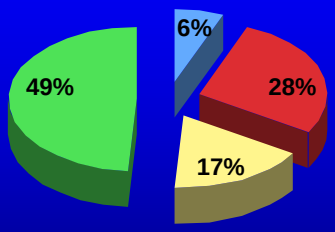
Marine Genetic Resources: "genetic material of actual or potential value". [Convention on Biological Diversity]





Marine Drugs

New Drug Sources over Last 25 Years*



Natural Product

Synthetic Product

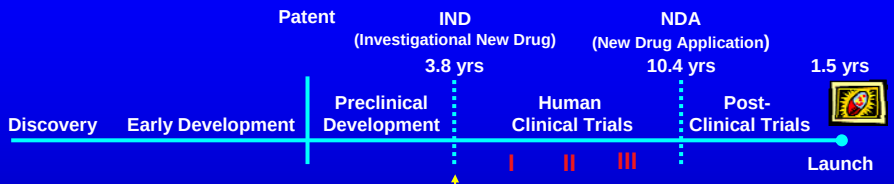
Modified Natural Product

Synthetic Product based on NP Pharmacophore

*after Newman & Cragg 2007: JNP 70:461

Product	Application	Original Source
Pharmaceuticals Acyclovir® (Ara-A) Cytosar-U® (Ara-C)	Antiviral drug Anticancer drug	**Sponge:** ***Cryptotheca crypta***
Pharmaceuticals Prialt® (conotoxin)	Analgesic	**Cone snail:** ***Conus magnus***

Discovery Timeline



extracts
bioassays
active extracts
lead compounds
lead candidates

1 kg

Numbers
100,000 ⇨ 1 clinical trials
costly: 0.5-1B $$$/drug

I = what dosage is safe/how treatment should be given

II = evaluate effectiveness/look for side effects

III = compare new treatment to current/standard treatment

Academics → Pharmaceutical Industry

(funding: NIH, WHO, NOAA, etc.)

Partnerships

Direct Benefit Sharing: IP Compensation

Research → Public Sector → Private Sector → Utility

Diffuse Benefit Sharing: Societal Opportunities

Our Partnership Model:

Baker et al 1995; J Nat Prod 58:1325
Rosenthal 1999; Pharm Biol 37:6

- capacity enhancement [scientists & infrastructure]
- research collaborations and shared results/IP
- technology transfer and education opportunities
- access to information relevant to biodiversity
- priority research and economic contributions

Case Studies

Indo-Pacific: 17 sovereign nations*
Caribbean: 9 sovereign nations*

*represent a gradient of coral reef health and biodiversity

Case Study 1

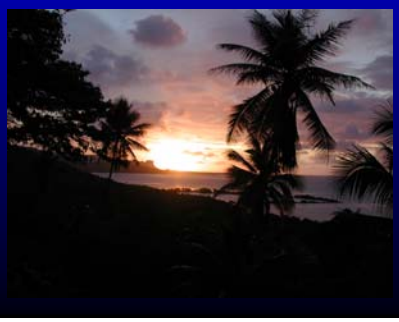
Cayman Islands

Reef use: tourism (SCUBA)
Reef Status: healthy [🡻]
Specific concerns: lionfish
Knowledge of MGR: minimal
Partnerships: Fisheries, LCRC

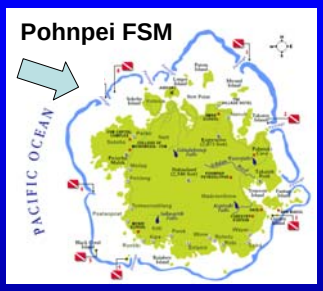
Case Study 2

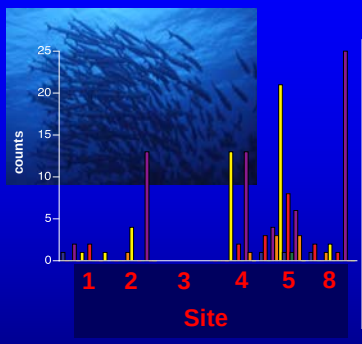
Pohnpei FSM

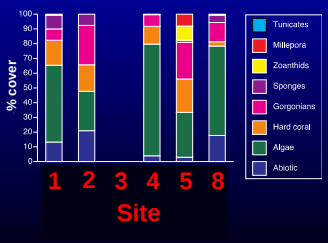
Reef use: fisheries
Reef Status: healthy [🡻]
Specific concerns: eutrophication
Knowledge of MGR: none
Partnerships: Fisheries, College of Micronesia, NGO

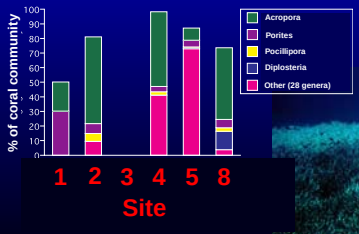


Non-$$$ Benefits









Scholarships

Graduate Degree in Marine Biotechnology Program

- **Qualified students recruited from host country**
- **Typically provide field support during initial collection**
- **Receive a scholarship to get a graduate degree at the host institution [MS or PhD], or to post-doc in host lab**
- **Take relevant classes towards degree, and write a thesis related to the biotechnology subject matter**
- **Often conduct research on samples from their home country; potentially conduct research on-site during trips home for the holidays**
- **Help develop partner laboratories in the host country to handle preliminary sample processing &/or screens**
- **Usually a guaranteed position in the host country either continuing the biotechnology efforts, or initiating sustainable programs in country**

Conclusions

- Marine genetic resources have tremendous potential for a variety of biotechnology applications:
  - public health
  - food security
  - environmental remediation
- There are direct [= shared IP/others] and diffuse [= use] benefits of marine genetic resources for society
- Commercialization of these resources requires significant R&D [= $$$], and even then marketable products are rare [focus on near-term benefits]
- In all countries there needs to be increased education of the fundamental research partnerships that can move samples from the laboratories into products that help people live better, healthier and more productive lives