Who is investing in Marine Biotechnology?

Meredith Lloyd-Evans
BioBridge Ltd, Cambridge, UK
mlloydevans@biobridge.co.uk

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Meredith Lloyd-Evans – BioBridge Ltd

- Bioscience Innovation Consultancy – est. 1989 in Cambridge UK
- Working in marine biotechnology since 2004
- Author of UK report on status and prospects of MBt
- Leader of Blue Bio initiatives in UK Biosciences Knowledge Transfer Network
- Manager of CSA MarineBiotech – precursor of ERA-MB& author of review of international MBT
- Working on IP strategy, ABS case studies, best practice tool-kit and dissemination activities in PharmaSea www.pharma-sea.eu
- Preparing asset development strategy in MBT for UK research institute
- @BioBridgespeaks, http://uk.linkedin.com/in/meredithlloydevans/

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Topics

- Public strategies, investment in programmes
- Investment landscapes
  - Bioprospecting and novel bioactives
  - Functional food and cosmetic ingredients
  - Novel enzymes for industrial and process use
  - Algal technologies for biofuels
  - Valorising fisheries and aquaculture by-products
  - Biorefineries
  - Molecular aquaculture
  - Environmental blue biotech

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Public investment in marine biotechnology - 1

- **Australia** – individual states eg NSW Aquatic Biotechnology Sector Strategy May 2014, BlueBiotech Shoalhaven
- **Brazil** – via BIOMAR, MCTI - 23 projects since 2005; and Brazilian Development Bank eg $120M for Solazyme-Bunge biomass-to-ethanol plant
- **Canada** – Salmon Genome Project
- **Germany** – via ScanBalt strategy
- **India** – via National Biotechnology Strategy; joint programmes eg UK BBSRC-DBT biofuels, DBT-TEKES marine bio-prospecting and bio-energy
- **Ireland** – via Marine Institute
- **Japan** – Marine Bio 21 Project
- **Mozambique-** via National Biotechnology Program

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Public investment - 2

- **New Zealand** – via Biotechnology Roadmap
- **Oman** – via funds from Ministry of Ag and Fisheries
- **Saudi Arabia** – SAGIA expects investment of $300M by 2016 and $1.5B by 2025 in Blue Biotech, 50%-funding R&D via KACST
- **South Africa** – via DST-supported SANCOR (SA Network for Coastal and Oceanic Research)
- **South Korea** – Blue-Bio 2016
- **USA** – elements of USDA Biorefinery program, CO2 reduction program and DoE alternative energy support
- **International** – OECD initiative; CIESM; marine genomes
- **EU** – via ERDF, FPs/H2020, ERA-MBT

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Public investment - 3

- EU
  - ERA-MBT: 19 partners, **€2M EU, ?€25M+ national funding**
  - ERDF projects eg EnAlgae c. €6M
  - FP7 projects eg FUEL4ME, DEMA, FP7 ALGAE Cluster, PharmaSea, MaCuMBA, MG4U, MicroB3, MIRACLES, BIOFAT …. FP7 **>€130MEU contribution**
  - Infrastructure projects – EMBRC, ASSEMBLE, MIRRI …

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Private investment

- Marine Pole FR estimates that further investment of €650M has followed from initial cluster support, of which about €140M relates to marine bioresources business
- Sector-specific funds don't exist – but may be eligible as part of biotechnology, 'green', environmental, new energy or bioscience-focused funds:
  - Why can't we set one up??
- Most exploitations follow usual SME route of personal funds → angels/seedcapital/grants → VC → Series A/B/C → IPO/trade sale

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Streams for Marine Biotechnology

- Bioprospecting and novel bioactives
- Functional food and cosmetic ingredients
- Novel enzymes for industrial and process use
- Algal technologies for biofuels
- Valorising fisheries and aquaculture by-products
- Biorefineries

- Molecular aquaculture
- Environmental blue biotech

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Bioprospecting and novel bioactives

- SMEs mainly invested in by founders, with seed capital and some institutional investment
  - Aquapharm; BioAlvo; Nereus – cash-burn victims
    - ❖ Aquapharm – 2005 c. €2M, 2007 Series B c. €5M, 2010 Series C c. €6M
  - Sealife Pharma – 2008 pre-seed funding Accent Niederösterreich, aws; 2011 seed funding €2M from tecnet equity, PP-Capital
- Some major company activity eg Zeltia invests >€500M in PharmaMar R&D
- Academics and consortium projects mainly publicly-funded
  - EU-funded eg PharmaSea
  - Seek licensing deals with pharma companies
  - Benthic Labs, student start-up 2014 from UCCork for hagfish slime, gains $30,000 seedfunding from SOSVentures
- SMEs on whole also hope for licensing-out or trade sale
- EU funding - Innovative marine biodiscovery pipelines for novel industrial products – max €305M

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Functional food and cosmetic ingredients

- Various size companies, some large eg L'Oreal, Sederma, some small eg Fermentalg
  - Fermentalg founded 2009
  - Oils and proteins from algae
  - Seed funding 2009 €2.9M, 4 co-investors
  - Series B 2011 €5.3M, 3 co-investors
  - Series C 2013 €12M, 6 co-investors
  - IPO 2014 Paris EuroNext, €40M inc €12M from existing investors
  - From early stage, involvement of Picoty energy + various funds
- Algae.Tec Australia – A$100M for algal proteins and oils facility at Shoalhaven NSW
- Jan 2013 Algae Health Ireland founded with €1M from AIB Seed Fund, Western Investment Fund – astaxanthins and other bioactives
- South Australia-China marine biotech forum 2012 & 2013 – A$22M investment by QingDao company

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Novel enzymes for industrial and process use

- Many enzymes already derived from marine or extremophile sources
- Very few companies focusing solely on marine-origin enzymes – exceptions Barentzymes, ArcticZyme
- Aqua Bio Technology has protease-protein mixes from salmon eggs for dermocosmetic use
- SME intermediates may include extremophile-enzymes in their ‘mix’ eg Ingenza
- Some public funding eg Innovate UK-Innovasjons Norge, RCN (NorZyme)
- New enzymes may well be needed for biorefinery processes

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Algal technologies for biofuels

- Since 2006, “billions of dollars” –
  - Algenol Biofuels - $190M
  - Sapphire Energy - $350M in; $30M invested in New Mexico facility
  - BioProcess Algae - $135M in; $50M invested in New Mexico facility
  - Cellana - $20M for Kona facility (biorefinery)
  - Phycal – 2008 founded with $3M; 2013-2014 funded by Innovative Concepts for Beneficial CO_2 Use program, for $65M biorefinery in Hawaii
- Value of algae as components 2 x value as biofuel *(H Vieira)*

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Valorising fisheries and aquaculture by-products

- EU legislation changes will force new approaches to by-catch and discards
- Ensiling, fertilizer, soil conditioner, artificial reef deposits no longer the only processes for aquaculture/fish processing wastes
- Tech Transfer and KT from increasing biorefinery developments will aid processing of ‘wastes’

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Biorefineries

- A lead-on from algae for biofuels & by-product valorisation
- Strategy for split-outflows
- For algae, founded on CO_2-recycling and water-improvement.
- US Biorefinery Assistance Program (Sapphire Energy 454M)
- EU funding FP7 – MIRACLES, BIOFAT, All-gas, InteSusAl, The MicroAlgae Biorefinery - €36M of total €53M

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Molecular Aquaculture & *in situ* MBT

- Genomics and non-GM manipulation for enhanced disease resistance, productivity, nutritional quality
- Atlantic salmon NO-CA-CL, rainbow trout FR-US and cod NO genomes; oyster, tilapia, catfish, shrimp, kelp, scallop, grouper, sole, yellow croaker, many in CN (OUC Qingdao)
- Biologicals/vaccines for disease in aquaculture
- Marine environmental management using biotechnology – sensors, remediation
- Clearly a role in Ocean [Molecular Biotechnological] Observatories for biodiversity & pollution monitoring
- Private investment in vaccines, genome projects, pollution remediation (eg oilspills)
- Unclear where private investment is in other areas.

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