OMAN

(532)

UNITWIN/UNESCO Chairs Programme

Progress report

Period of activity : September 2004 – May 2007

UNESCO Chair in seafood biotechnology

Report established by: Prof. Bassam Soussi, UNESCO Chairholder, Sultan Qaboos University

I. Activities

1. Academic activities

Education

Introduced two post graduate courses for M.Sc. students of Food Science and Nutrition Department, and Marine Science and Fisheries Department:

- FSHN6011 Functional Foods Fall 2004 / Spring 2006
- MASF6007 Marine Biotechnology Fall 2005 / Fall 2006

Training

- Training on scientific research procedures, laboratory safety and the use of advanced equipment. Participants were 10 research assistants in Oman.
- Training of two research assistants at the Center for Biotechnology Research (PGBRC), Queshm Island, Iran (19-30 November 2006). Organized in collaboration with UNESCO, ISESCO and Biotech MIRCEN network (Iran, Costa Rica, Egypt).
- Supervision of 4 M.Sc. students, 2 Post Docs. , and 2 Ph.D. students.

Research

Prof. Bassam Soussi is the Principal Investigator of three research projects: two in Sweden and one in Oman. The research proposal “Value-Added Marine Raw Materials and Health” proposed by the Chair has been awarded a grant from His Majesty Sultan Qaboos Trust Fund for Strategic Research on 2005. Participants from the College of Agricultural and Marine Sciences, College of Medicine, Ministry of Agricultures and Fisheries in Oman, and Gothenburg University in Sweden. On research collaboration with HEJ Research Institute of Chemistry (HEJRIC), Karachi, Pakistan, a new staff from HEJRIC, Post. Doc. Ahmed Abbas Khan, joined Prof. Soussi's research team in Marine Biotechnology. The UNESCO Chair has been awarded a Swedish prize for "Best Research Idea" on 13 December 2006 by the Sweden government through Gothenburg University, Sahlgrenska Science Park, Region West Gotaland and GU Holding Company. The idea was a practical innovation in the field of marine sciences and fisheries.

Establishment of a Center of Excellence in Marine Biotechnology

The establishment of the Center of Excellence in Marine Biotechnology was approved on 28 May 2005. The center will focus on capacity building and will make optimal use of the marine resources. A sustainable development in Oman will thereby be created that will encourage future growth and prosperity.

Objectives and strategies

- Promote the development of science and technology initiatives in marine biotechnology
- Bridge the gaps between basic and applied research, and facilities interdisciplinary efforts
- Establish a regional and international network of collaborating universities and government and other relevant institutions
- Increase competitiveness, create business opportunities and attract capital
- Create sustainable development
- Contribute to the development of the fisheries and aquaculture industry
- Spread information to industry and the general public

Vision

"To establish an internationally recognized Center of Excellence in Marine Biotechnology that will tap marine resources, ultimately resulting in the development of innovative therapeutic drugs and providing benefit to the entire Gulf region."

Mission

- Create a strong infrastructure and develop an integrated research program in marine biotechnology.
- Facilitate interdisciplinary and multi-institutional efforts to bridge gaps in research and encourage partnerships between academia, government and industry to commercialize scientific findings.
- Apply advanced molecular biology techniques and information technology to a carefully selected suite of marine habitats and organisms
- Discover genes and processes that can be used to develop innovative products and approaches to benefit biomedicine and industry
- Use and manage the marine resources in a sustainable manner

Executive summary of the project: "Value-Added Marine Raw Materials and Health"

This project is an integrated research program in value-added marine raw materials for health. The program consists of eight projects (Workpackages) in phases and sequences. The aims at large are studying bioactive compounds in marine raw materials from molecule to man with focus on health. Traditional and new tools for measurements are used. *In vivo* studies are based on mouse/rat models combined with state-of-the-art whole body high resolution MRS/MRI investigations.

Key issues addressed are:

1.Quality.
2.Safety.
3.Human nutrition.
4.Evaluation of novel candidate substances and their mechanisms of action. This multidisciplinary research program is performed at Sultan Qaboos University involving the colleges of agriculture and marine sciences and medicine and the ministry of agriculture and

fisheries. A strong and established international collaboration will facilitate technology transfer and sharing of scientific results and expertise. The project links medical sciences, food science and nutrition with seafood/marine biotechnology.

2. Conferences/Congresses/Meetings

Organized Conferences, Congresses, Workshops, and Meetings

- **Regional UNESCO Chairs Meeting** 4-5 December 2004 Muscat, Sultanate of Oman.
- **A kick-off meeting and workshop of the HM Project " Value-Added Marine Raw Materials and Health"**, September 11th 2005 Sultan Qaboos University.
- **Workshop and Consultative Meeting on Marine Biotechnology** 27-28 February 2006, Sultan Qaboos University, Muscat, Oman. Evaluated the marine biotechnology potential in Oman and presented the strategies for the development of the center. Participants from academic, industry and government organizations.
- **Workshop on "Value-Added Marine Raw Materials and Health"** September 2006. Participants were from post graduate students and researchers/staff

Chaired Conferences, Congresses, Workshops, and Meetings

- **International Conference on Post-Harvest Technology** (31 January - 2 February 2005). Organized by the College of Agricultural and Marine Sciences, SQU.
- **International Conference on Marine Biosafety and Environment** (21-23 February 2005). Organized by the Ministry of Regional Municipalities, Environment and Water Resources.
- **4th Annual Conference of the Indian Ocean Research Group**; Marine Biodiversity and Fisheries in the Indian Ocean Region: Opportunities and Threats (18-20 February 2007) Presented a paper and chaired one session Organized by the Ministry of Agriculture and Fisheries Publication: Marine Biotechnology for Oman.

Attended and Participated Conferences, Congresses, Workshops and Meetings

- Meetings with the Secretary General and the members of Oman National Commission for Education, Culture and Sciences.
- Meetings with the President of the World Academy of Biomedical Technology (WABT) and others discussing the proposal for developing a Center of Marine Biotechnology in Oman and the possible partnerships.
- A joint scientific meeting of the Lebanese Society of Radiology & Pan Arab Neuroradiology Society (13-19 September 2004), Lebanon
- UNESCO Chairs meeting in the Framework of the EURO-ARAB Research Network 10-12 December 2005
- Meetings with the Deans of SQU Colleges.
- Meetings with the officials from the Ministry of Agricultures and Fisheries, Ministry of Higher Education, and Ministry of Commerce and Industry. Discussed the vision of the chair and the means to realize it.
- Provided presentations for MAF-SQU Liaison Committee and CAMS-SCI Liaison Committee.
- Presentation of a paper entitled "Marine Biotechnology; New Business Opportunities" by Prof. B. Soussi; in the second Conference of GCC Businessmen and their Indian Counterpart; Organized by the Ministry of Commerce and Industry, Muscat 25-26 March 2006. The Conference resulted in the *Muscat Declaration* 2006 recommending collaboration in Biotechnology R&D between GCC and India.
- Workshop on National Micronutrients, 19 April 2006.

Missions / Travels Abroad

- Follow up meetings are planned to optimize strategies and networking with existing UNESCO structures.
- Technical visit to UNESCO Chair Ajman University, UAE, 12-13 September 2006.
- Technical visit to Marine Station of the Royal Swedish Academy of Science, Sweden, 13 November 2006.

3. Partnerships

- Follow up meetings are planned to optimize strategies and networking with existing UNESCO structures.
- Technical visit to UNESCO Chair Ajman University, UAE, 12-13 September 2006.
- Technical visit to Marine Station of the Royal Swedish Academy of Science, Sweden, 13 November 2006.

Visitors from Local and Abroad

- Dr. Benno Boer from UNESCO Office in Doha Regional UNESCO Chairs Meeting, Muscat, 4-5 December 2004
- Dr. Zein Al-Abdeen Rizk from UAE, he attended the Regional UNESCO Chairs Meeting, Muscat, 4-5 December 2004.
- H.E. Dr. Hilal Ali Al-Hinai, Secretary General of the Research Council, Oman. He chaired a morning session of the Workshop and Consultative Meeting on Marine Biotechnology, 27-28 February 2006.
- Dr. Hamed S. Al-Oufi, AVP for Science Colleges, SQU. He chaired a session of the Workshop and Consultative Meeting on Marine Biotechnology, 27-28 February 2006.
- Attendants of the Workshop and Consultative Meeting on Marine Biotechnology, 27-28 February 2006:
  - ✓ Ms. Lucy Hoareau, UNESCO Head Quarter, Paris.
  - ✓ Prof. Nasrin Moazami, Biotechnology MIRCEN, Iran.
  - ✓ Dr. Benno Boer, Regional UNESCO Office, Qatar.
  - ✓ Dr. Said Saleem Al-Kitani, Oman National Commission for Education,
  - ✓ Culture and Sciences.
  - ✓ Prof. Dr. M. Iqbal Choudhary, H.E.J. Research Institute of Chemistry,
  - ✓ Pakistan.
  - ✓ Prof. Nuzhat Ahmed, Center for Molecular Genetics, Pakistan.
  - ✓ Dr. Amr Amin, Biology Dept., UAE University, UAE.
  - ✓ Mr. Eslam Al-Hograty, Ajman University, UAE.
  - ✓ Dr. Louis Laleye, College of Food & Agriculture, UAE University, UAE.
  - ✓ Mr. Sverre Solberg, GaiaCare AS, Norway.
  - ✓ Mrs. Reem Obeidat, UNESCO Chair, Communication Technology & Journalism for Women, Dubai Women's College.
- UNESCO Ambassador and WABT President Dr. Omar Zeidan Organized in collaboration with the National Commission for Education, Culture and Science, March 2007
- Prof. Michael Crawford, London Metropolitan University, U.K. Arranged in collaboration with the Department of Food Science and Nutrition
  Short Abstract: Prof. Crawford presented two lectures: one in the College of Medicine related to the role of fatty acids in the well being of the new born and one in CAMS entitled "The effect of intensive agriculture on the rise in heart disease, stroke and cancer in developed and developing countries".

Information and documentation activities

- Lectures and presentations at the College of Agricultural and Marine Sciences, and the College of Medicine at SQU.
- Presentations at the SQU University Council and Advisory Board of the College
- Several articles in local Arabic and English newspapers and University media about marine biotechnology and other related activities and news were published.

- *Arabic Articles and News:*

- OMAN, 11 October 2004, "SQU-MAF committee discusses the establishment of Center of Excellence in Marine Biotechnology".
- ANWAR, 18 October 2004, "Food Technology".
- OMAN, AL-WATAN and AJIAAL, 11 October 2004, "Latest Food Technology at SQU".
- AL-WATAN, 11 October 2004, Title "For the first Time Food Technology taught at SQU".
- ANWAR, 25 October 2004, Title "Establishment of the Center of Excellence in Marine Biotechnology".
- UAE Newspaper, 11 December 2005, "Prof. Soussi participated in the Arabic and European Network for research meeting".
- OMAN, 27 February 2006, UNESCO Workshop & Consultative Meeting on Marine Biotechnology at SQU.
- Al-SHABIBA, 28 February 2006, UNESCO Workshop & Consultative Meeting on Marine Biotechnology at SQU.
- OMAN, 28 February 2006, Aiming for Experience Exchange and Cooperation during the UNESCO Workshop & Consultative Meeting on Marine Biotechnology at SQU.
- Al-WATAN, 6 March 2006, Activating the Activities of Office of the UNESCO Chair in Marine Biotechnology at SQU.
- TAWASOL*, June 2006, An article entitled "Marine Biotechnology; New investment Opportunities" published by Prof. Bassam Soussi in TAWASOL which is a booklet presented by Oman National Commission for Education Culture and Sciences)
- OMAN and AL WATAN, 18 December 2006, " Team New Discovery".
- ANWAR, 25 December 2006, "Team New Discovery".

- *English Articles and News:*

- Horizon, 20 October 2004, Title "UNESCO Chair introduces innovative master course".
- HORIZON, 30 April 2005, Title "The Future is in the Sea".
- OMAN DAILY OBSERVER, 1 May 2005, Title "The Future is in the Sea".
- TIMES OF OMAN, 3 May 2005, "4 New Projects under HM's Fund Announced".
- OMAN DAILY OBSERVER, 26 February 2006, "Marine biotech workshop at SQU".
- OMAN DAILY OBSERVER, 27 February 2006, "Seminar on marine Biotech today".
- GULF NEWS, 27 February 2006, "Oman aims to lead region in marine research".
- OMAN DAILY OBSERVER, 28 February 2006, "Marine Biotechnology Cluster on Anvil", and "Promising economic potential" said by Research Council Chief.
- OMAN DAILY OBSERVER, 27 March 2006 "Oman Seeks Collaboration with India on Marine Biotech Cluster".
- OMAN DAILY OBSERVER, 21 December 2006, "SQU Discovers New Benefits of Eating Seafood".
- OMAN DAILY OBSERVER, 25 February 2007, "SQU Team Strikes Major Discoveries".

- Report Documentation

Conclusions and Recommendation of the Workshop and Consultative Meeting on

Marine Biotechnology, 27-28 February 2006: Marine biotechnology has been identified as strategically important and many countries are investing heavily to stimulate its growth.

Accordingly the following are recommended:

1. Establish regional collaboration with universities by exchanging experts and students, including rotating regional visits between the participating entities. Set up an action plan to mention the responsibilities of each partner. Activate the network with regular communication i.e. newsletter.
2. Set up a mechanism facilitating researcher mobility between collaborating entities.
3. Empower the integrated program in marine biotechnology as a strategic profile area at SQU, incorporating several disciplines, with special emphasis on marine science and fisheries in addition to food and health sciences. In Oman substantial investment is needed for infrastructure/capacity building.
4. Increased government leadership
5. Industry partnerships must be established for mutual benefit by setting up mechanisms for transferring research findings to the industrial sectors.
6. Regional collaboration is a prerequisite for UNESCO support. Countries within the region are encouraged to collaborate if they want UNESCO assistance. The IOC/UNESCO will help to establish and support the regional collaboration. UNESCO plays a vital role by catalyzing joint, cooperative R&D efforts between laboratories and firms in industrial and developing countries.

- *Others*
- Letter of Agreement between Sultan Qaboos University (SQU) and the
- University of Gothenburg (GU), Sweden. Cooperation within the field of marine biotechnology, food science and biomedicine through the UNESCO Chair in marine biotechnology. The cooperation within marine biotechnology programme includes both Colleges of Medicine, and Agriculture and Marine Science at Sultan Qaboos University.
- Joint research proposals between SQU, GU and Chalmers University of Technology, Sweden. Increase student and staff mobility for short and medium term periods of training, education and research exchange at both universities.
- Fund raising activities generated the following:
  - UNESCO contract for workshops and training activities
  - Donation of advanced research equipment from a European company.
- The Chair is member of several executive boards and committees. He is also the Chairman of Biosafety Committee at SQU and the Chairman of ad hoc Committee on Genetic Resources.

4. Publications

The publications consist in 3 articles and 24 reports

Articles:

- *Singlet oxygen energy (SOE) illumination during cold ischemia improves the preservative effect of the UW solution on high energy phosphates in ischemic rat hearts*. American Journal of Transplantation 4, 390-390, 851 Suppl. 8. Authors: Lukes DJ, Skogsberg U, Nilsson A, Lundgren A, Lindgard A, Rakotonorainy O, Soussi B., Olausson M. 2004.
- *In vivo magnetic resonance imaging of magnetically labelled human embryonic stem cells after itramyocardial transplantation*. European Heart Journal 25, 147-147 Suppl.

S. Authors: Lorentzon M., Tallheden T., Nannmark U., Rakotonirainy O., Soussi B., Waagstein F., Lindahl A., Omerovic E. August - September 2004

- *Selective cerebral overexpression of growth hormone alters cardiac function, morphology, energy metabolism and catcholamines in transgenic mice.* Eurpean Heart Journal 25, 177 177 Suppl. S. Authors: Bohlooly M., Bollano E., Mobini R., Soussi B., Thornell J., and Omerovic E. August – September 2004

Reports

- *Phosphocreatine concentration assessment during early rejection in concordant hamster xeno hearts using HPLC or in vitro 31P MRS yields similar results*. XX Congress of the Transplantation Society. Authors: Lukes DJ, Asplund H, Skogsberg U, Lundgren Rakotonirainy O, Soussi B, and Olausson M. Vienna, September 2004.
- *Singlet Oxygen Energy illumination during cold ischemia improves the preservative effect of the UW solution on high energy phosphate levels in ischemic rat hearts*. 5th American Transplant Congress Authors: Lukes DJ, Skogsberg U, Nilsson A, Lundgren A, Lindgård A, Rakotonirainy O, Olausson M, and Soussi B. Boston, May 2004
- *Evaluation of antioxidative capacity of herring (Clupea harengus) light muscle press juice.* First International Congress on Antioxidant Methods. Authors: Gunnarsson G., Sannaveerappa T., Rådendal T., Lindgård A., Undeland I. and Soussi B. Orlando, June 2004.
- *The effects of fish muscle press juice on phorphol myristate acetate stimulated reactive oxidation species in human monocytes*. 34th WEFTA Annual Meeting, Authors: Gunnarsson G., Undeland I., Lindgård A., Sandberg AS. and Soussi B. Lübeck, Germany, September 2004
- *In vivo MR imaging of magnetically labelled human embryonic stem cells after intramyocardial transplantation*. ESC. Authors: Tallheden T., Nannmark U., Lorentzon M., Rakotonirainy O., Soussi B., Waagstein F., Lindahl A., and Omerovic E. Munchen, 2004
- *The effects of herring muscle press juice on the generation of reactive oxygen species from human monocytes*. Livsmedelforskardagarna. Authors: Gunnarsson G., Undeland I., Lindgård A., Sandberg AS. and Soussi B. Göteborg, Sweden, November, 2004
- *Natural antifouling substance(s) obtained from a marine species indigenous to Omani Coastal Waters International*, Marine Biotechnology Conference. Authors: Alshihi R., Ahmed S.I., Soussi B. and Alshuaily S. Canada, June, 2004
- *Evaluation of Antoxidative Capacity of Herring (Clupea Harengus) Light Muscle Press Juice*, The 1st International Congress on Antioxidant Test Methods, Author: Soussi B. Orlando, 16-18 June 2004
- *In vivo magnetic resonance imaging of magnetically labelled human embryonic stem cells after itramyocardial transplantation*. European Heart Journal 25, 147-147 Suppl. S. Authors: Lorentzon M., Tallheden T., Nannmark U., Rakotonirainy O., Soussi B., Waagstein F., Lindahl A., Omerovic E. August - September 2004
- *Recent Advances in clinical and experimental MR Spectroscopy*, Invited lecture, Joint scientific meeting of the Lebanese Society of Radiology & Pan Arab Neuroradiology Society, Author: Soussi B. Beirut, 16-18 September 2004.
- *Understanding the Brain Metabolism by MR Spectroscopy*. Joint scientific meeting of the Lebanese Society of Radiology & Pan Arab Neuroradiology Society Author: Soussi B. Beirut, 16-18 September 2004.

- *MRS as a tool in clinical neuroscience*. Joint scientific meeting of the Lebanese Society of Radiology & Pan Arab Neuroradiology Society Author: Soussi B. Beirut, 16-18 September 2004
- *Selective cerebral overexpression of growth hormone alters cardiac function, morphology, energy metabolism and catcholamines in transgenic mice.* Growth Horm IGF Res 15(2), 148-55. Authors: Bohlooly-Y M, Bollano E, Mobini R, Soussi B, Tornell J, Omerovic E. 2005
- *Singlet oxygen energy illumination during moderate cold ischemia prolongs the survival of concordant hamster xeno-heart transplants.* Transplant Proc 37(1), 518-20. Authors: Lukes DJ., Skogsberg U., Nilsson A., Lundgren A., Olausson M. and Soussi B. 2005.
- *Ischemic preconditioning can overcome the effect of moderate-severe cold ischemia on concordant mouse xeno heart transplants.* Transplantation proceeding 37 (8), 3332-3334 Authors: Lukes DJ, Lundgren A, Skogsberg U, Karlsson - Parra A, Soussi B, Olausson M. Oct 2005.
- *In vivo MR imaging of magnetically labeled human embryonic stem cells*. Life Sciences 79 (10), 999-1006. Authors: Tallheden T., Nannmark U., Lorentzon M., Rakotonirainy O., Soussi B., Waagstein F., Jeppsson A., Sjögren-Jansson E., Lindahl A. and Omerovic E. 2006
- *Inhibitory effect of known antioxidants and of press juice from herring (Clupea harengus) light muscle on the generation of free radicals in human monocytes.* J Agric Food Chem 54(21), 8212-8221. Authors: Gunnarsson G., Undeland I., Sannaveerappa T., Sandberg AS., Lindgård A., Mattsson-Hultén L. and Soussi B. 2006
- *Irradiation at 634 nm releases nitric oxide from human monocytes. Lasers in Medical Science*. Authors: Lindgård A., Hultén LM, and Soussi B. In press
- *Marine Biotechnology for the future: Building a Cluster*. Proceedings Workshop and Consultative Meeting on Marine Biotechnology. Author: Soussi B. Muscat, Oman, 27-28 February 2006. Language: English. *Short Abstract*: The aim of the workshop was to review the potential of marine biotechnology and map the directions for the center in terms of both science and developing regional partnerships. The meeting gathered postgraduate students and participants from academic, industry and government organizations. In addition to talks and discussion of key areas of regional interest, there was a consultative meeting to discuss ways in which the region can develop the research facilities, education and training and other resources necessary to harvest new and exciting benefits from the oceans. The workshop meeting is part of a strategy for capacity building in marine biotechnology. The consultative meeting with UNESCO experts is within the planned strategy for the establishment of a Center of Excellence in Marine Biotechnology as has been recently approved by the university.
- *Marine Biotechnology: New Business Opportunities.* The 2nd Conference of GCC Businessmen & Their Indian Counterparts. Author: Soussi B. Muscat, Oman, 25-26 March 2006. *Short Abstract:* The meeting was organized by the Ministry of Commerce and Industry in Oman and attended by ministers and industries in GCC India with large delegation of businessmen. This resulted in the Muscat Delegation in cooperation and partnership of GCC in India.
- *Abnormalities in phospholipid composition in the developing rat kidney following neonatal enalapril treatment.* 21st Scientific Meeting of the International Society of Hypertension Authors: Lasaitiene D, Chen Y, Lindgard A, Soussi B, and Friberg P. Fukuoka, Japan, Oct 2006

- *Thermal transitions and water sorption properties of king fish.* Asian-Oceania Drying Symposium. Authors: Al-Habsi N., Sablani SS., Rahman M. S., Al-Busaidi S., Al-Belushi R., and Soussi B. Hong Kong, 13-15 August 2007
- *Moisture isotherms and thermal transition of king fish muscle*. Institute of Food Technologists Conference. Authors: Guizani N., Sablani S., Rahman M., Al-Busaidi S. and Soussi B. 28 July – 1 August 2007
- *Moisture isotherm and thermal transition of king fish muscle* International CIGR Symposium: Processing and Innovations Authors: Sablani S., Rahman M. S., Guizani N., Al-Busaidi S. and Soussi B. Naples, Italy, 24-26 September 2007-09-08

II. Impact

Biotechnology continues to impact diverse scientific fields and many economical sectors. The potential economic and public health benefits from seafood/marine biotechnology are high. Increased investment in marine biotechnology will therefore accelerate the exploitation of the great opportunities of new sources, new products and processes. Consequently, this might develop viable strategies in a sustainable way. Several countries have realized this and are now increasing their activities in the field.

1. Nationally,

The activities of the UNESCO Chair in marine biotechnology at Sultan Qaboos University are especially significant for Oman considering:

- The great importance of renewable marine resources in the country.
- The long maritime tradition
- The strategic need to add value to local seafood products to break into profitable international markets.

2. Regionally

The UNESCO Chair aims to establish a network cluster within marine biotechnology encompassing the regional countries, with representatives from both the public and private sectors, including scientists and the UNESCO bodies. Capacity building in the field of marine biotechnology in the Gulf region with its vast and rich marine environment will strengthen higher education, encourage R&D and increase public awareness regarding health and environmental issues. The UNESCO Chair suggested of building the GCC **Center of Excellence in Marine Biotechnology** in Oman based on a partnership between the academia, the industry, and government.

3. Internationally

The Center will function as a Hub in Marine Biotechnology and will interact with relevant UNESCO and non-UNESCO Centers /networks worldwide:

- Facilitating partnerships
- Facilitating Technology transfer
- Facilitating Commercialization of new products over the broad spectrum of applications in marine biotechnology.

This initiative is expected to:

- develop new and improved marine products
- provide safe and abundant seafood
- enhance public health
- advance economic growth

- create business and employment opportunities
- promote sustainable environmental development

III. Forthcoming activities

- Fund raising
- Feasibility study for the regional Center/Cluster
- Networking
- Capacity building
- Building technical infrastructure
- Preparation of the Center of Excellence in Marine Biotechnology with partners from the public and private sectors.
- Meetings with Regional key players
- More post graduate courses in marine biotechnology and related topics
- Ph D programme in Marine Biotechnology

IV. Development prospects

- A multidisciplinary approach will be adopted to accelerate capacity building in marine biotechnology. Technology transfer between biomedicine/medical biotechnology, and food science /marine science and fisheries.
- Research disciplines that will benefit the development of marine biotechnology will be integrated, hence improving excellence within the area.

Target groups
- Undergraduate students
- Graduate students
- Postgraduate students
- Academics
- Public administrators
- Employees from industry or other private organizations
- Fisheries, Food, Pharmaceutical, Environmental

Geographical Coverage

- **National**

Oman

- **Regional**

- Africa
- Arab States: *Gulf, GCC*
- Asia/Pacific
- Eastern and Central Europe
- Western Europe and North America
- Latin America

- **Inter-regional**

India

- **International**