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## RESEARCH PROPOSAL INTERNATIONAL RESEARCH COLLABORATION AND SCIENTIFIC PUBLICATION



## Marine Invertebrate Derived Fungi for Industrial Biotechnology of Antibiotics and Anticancers (Isolation, Bioassay, Taxonomy, Phytochemical and Metabolomic Studies)

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ANDALAS UNIVERSITY June, 2017

#### HALAMAN PENGESAHAN PENELITIAN KERJA SAMA LUAR NEGERI

<ul> <li>Marine Invertebrate Derived Fungi for Industrial Biotechnology of Antibiotics and Anticancers (Isolation, Bioassay, Taxonomy, Phytochemical and Metabolomic Studies)</li> </ul>
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#### **IDENTITY AND GENERAL INFORMATION**

- 1. Research Title: Marine Invertebrate Derived Fungi for Industrial Biotechnology of Antibiotics and Anticancers (Isolation, Bioassay, Taxonomy, Phytochemical and Metabolomic Studies)
- 2. Researchers

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3. Research Object (type of materials): Marine invertebrates derived fungi that are collected from the sea waters of West Sumatra.

4. Time/Period Starts: month: March year: 2018 Ends: month: November year: 2020

#### 5. The Proposed Budget to Directorate General of Research and Development

- Year 1 : Rp 213,910,000
- Year 2 : Rp 238,710,200
- Year 3 : Rp 228,010,200

6. Research Location (lab/studio/field):

- Laboratory of Sumatran Biota, Andalas University.
- Laboratory of Parasitology, Faculty of Pharmacy, Gadjah Mada University
- Laboratory of Biotechnology Testing, Biotechnology Research Center, Indonesian Institute of Sciences, Cibinong-Bogor.

7. Research Partner (if any, mention its contribution):

**Dr. RuAngelie Edrada-Ebel**, Senior lecturer and researcher from Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow, UK.

Her most recent research interests involve the metabolomics of sponges and marine-derived microorganisms. De-replication studies by LC-HRFTMS establish the chemical profile of an endophytic and/or endozoic microbial extracts and its plant or animal source. Identifying the compounds of interest at an early stage will aid in the isolation of the bioactive components. Each individual organism is represented by its genome but phenotypes are expressed and one of these is the production of secondary metabolites. Therefore metabolomics is important for functional genomics and in the search for new pharmacologically active compounds. Using the tools of metabolomics through the employment of high resolution NMR as well as LC-HRFTMS will be a very efficient approach.

Dr. Edrada-Ebel is currently author of more than 80 publications and two patents on the topic marine natural products.

8. The targeted findings (explanation, method, theory, or anticipation contributed to the field of study). The discovery of new antibiotics and anticancer compounds that are produced by various marine invertebrates derived fungi from West Sumatera.

9. The basic contribution to the field of study (explains in not more than 50 word; focus on original and fundamental ideas supporting the development of science and technology). Fungi that are associated with marine invertebrates are growing importance as promising sources of biologically active natural products. Broadening the biological and metabolomics screens used in natural product studies to extend over the tested anti-microbial and cytotoxic activities will increase the chance to discover bioactive drug leads with medicinal potential.

10. The targeted journals (write the name of the international journal, accredited national journal, or non-accredited, and state the year of publication).

International journal: Journal of Applied Pharmaceutical Science and /or Marine Drug will be published in 2018, 2019 and 2020.

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#### ABSTRACT

Among the natural sources, the potential of microorganisms in drug discovery is recently exploited. Many of the drugs especially the antibiotics currently in the pharmaceutical market have been reported from microorganisms. The culturable microorganisms can be manipulated and processed due to their small size and huge reproduction capabilities. The scaling up and mass production are relatively easy in microorganisms where they can be grown in large-volume. Many microorganisms can be stored for an indefinite time, ensuring availability of the targeted source organism. The microorganisms can be manipulated both physicochemically and genetically to increase yields of desired natural products. Among these microbes, marine fungi and bacteria have been widely studied for past several years and are considered as a prolific source of unique bioactive skeletons. Therefore, the discovery of marine derived microorganisms as producer bioactive compound is one of the appropriate ways to obtain a new bioactive compound required in the field of health. Marine microorganisms are microbes that have been isolated from marine sources on marine media.

This research project is focused on the discovery, isolation and structure determination of novel biologically active natural products from a variety of West Sumantran marine invertebrates derived fungi. For this purpose, we initially screen extracts of various fungi in antibacterial and cytotoxic bioassays to identify extracts with potent activities and then further subject these extracts to bio assay guided fractions using a variety of chromatographic methods in order to isolate the active natural products. The structures of these compounds are determined by the application of a variety of spectroscopic methods including advanced NMR spectroscopy. Metabolomic techniques such as nuclear magnetic resonance (NMR) spectroscopy and liquid chromatography-high resolution mass spectrometry (LC-HRMS) were applied in the preliminary screening of metabolites produced by selected potential marine invertebrate derived fungi. In general, this research has been developed and scheduled in three years.

<u>First year (2018),</u> the research is focused on isolation the marine derived fungi from various marine invertebrates. In same time the bioactivity testing of antimicrobial and anticancer are also conducted. The antibiotic and cytotoxicity bioactivity of isolated fungi will be determined using Agar diffusion method against some pathogenic microbial and MTT assay, respectively. Then, identification of the potential isolate of fungi strain using genetically methods is necessary to be done. To fast track the selection process, metabolomic tools were used to aid strain selection by investigating differences in the chemical profiles of fungi extracts using liquid chromatography-high resolution mass spectrometry (LC-HRMS) and nuclear magnetic resonance (NMR) spectroscopy. This process will be conducted by **Dr. RuAngelie Edrada-Ebel** from Strathclyde Institute of Pharmacy and Biomedical Sciences (SIPBS), University of Strathclyde, Glasgow, UK

<u>Second year (2019)</u>, the activities are same with that in first year, but, some bioactive potentially isolated fungi strains will be cultivated in large mass, in order to investigated its bioactive secondary metabolite as lead structures (candidate of drugs). The structure elucidation of bioactive compounds will be conducted by **Dr. RuAngelie Edrada-Ebel**.

<u>Third year (2020)</u>, optimization process of selected potential fungi growth on various cultivation medium and treatment in order to increasing the amount of bioactive compounds production will be conducted. Output of the project after three years planned is discovery and production antibiotic and anticancer compounds with excellent quality that <u>have a good</u> competitiveness as a lead structure in pharmaceutical industry.

#### **CHAPTER 1 INTRODUCTION**

#### <u>Background</u>

Microorganisms have been known for their ability to produce diverse bioactive molecules and novel source for drug discovery research. Faulkner has defined "marine microorganisms" as microbes that have been isolated from marine sources on marine media [Faulkner, 1999]. Among these microbes, marine fungi and bacteria have been widely studied for past several years and are considered as a prolific source of unique bioactive skeletons. In marine habitat, these microbes occur as suspended on living as well as inanimate surface of epibionts or as symbionts and hence these marine organisms (invertebrates) are known as important reservoir of microorganisms. Most marine invertebrates such as sponges, coral, and jellyfish harbor microorganisms (fungi and bacteria) within their tissues (either intracellular or extracellular space) [Wilkinson, 1992]. Marine fungi have been isolated from different marine sources and in recent years more attention is paid in research related to marine fungi biodiversity and chemodiversity

Until now, studies of bio prospecting of bacteria and fungi associated with marine invertebrate in Indonesia is still very limited. On the other hand, Indonesia has a huge wealth of biodiversity to be used in research. The southern coastal marine waters of West Sumatra is one area that is rich in marine biodiversity, but bio prospecting research to uncover the potential of exploiting the wealth of marine biodiversity as a source of the essential drug for the pharmaceutical industry is still very limited. Therefore, it is very urgent and rational by Indonesia to develop the search for new effective drugs from bacterial and fungal associated with the marine invertebrates. A big opportunity of development in new pharmaceutical products based on bacteria and fungi is very potential, because some researchers in this investigation have an excellent experience and have good track record in research of marine natural products chemistry.

Previous investigations correlated to bioactive compounds of marine derived fungi and bacteria funded by Directorate General of Higher Education Ministry of National Education Indonesia in project "International Research Collaboration and Publication (2015-2017)" have been done. The potential of fungal and bacteria isolates form marine sponge *Haliclona fascigera* to produce antibacterial and cytotoxic compounds are very interesting and should be further investigated as an effort to discover new drug compounds. So that further research needs to be done. Main outcome of those investigations was published in international seminar and national journal. Some important results of the research have been achieved successfully

[Handayani, et al., 2015a; Handayani, et al., 2015b; Handayani, et al., 2016a, Handayani, et al., 2016b; Handayani, et al., 2017a; Handayani, et al., 2017b].

In general <u>roadmap of this research</u> has been developed and scheduled in three years (see for detail Chapter 3). <u>First year</u> the research is focused on isolation the marine derived fungi from marine invertebrates. In same time the bioactivity testing of antimicrobial and anticancer are also conducted. The marine invertebrates (sponge and soft coral) are chosen as host of isolated microorganisms. Previous investigation has shown that sponge and soft coral were a potential source of bioactive metabolites compounds [Handayani, *et al.*, 1997a, Handayani, *et al.*, 1997b, Edrada, *et al.*, 2000].

The Antimicrobial and cytotoxicity bioactivity of isolated marine derived fungi will be determined using Agar diffusion method against some pathogenic microbial and MTT assay, respectively. Then, identification of the potential isolate of fungi strain using genetically methods is necessary to be done. In this project, metabolomics will be applied to identify and biotechnologically optimize the production of pharmacologically active microbial secondary metabolites. The links between metabolome evolution during optimisation and processing factors will be identified through metabolomics. Dereplication of secondar metabolites from promising isolates will be executed by HRFTMS using the LTQ-Orbitrap and high resolution NMR. Through multivariate analysis, this will enable Fourier transformation of FID data of multiple samples to statistically validate the parameters in the production of pharmacologically interesting secondary metabolites. Metabolomics has become a powerful tool in systems biology which allows us to gain insights into the potential of natural marine isolates for synthesis of significant quantities of promising new agents, and allows us to manipulate the environment within fermentation systems in a rational manner to select a desired metabolome. This process will be conducted by Dr. RuAngelie Edrada-Ebel from Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow, UK.

<u>Second year</u>, the activities are same with that in first year, but, some bioactive potentially isolated bacteria and fungi strains will be cultivated in large mass, in order to investigated its bioactive secondary metabolite as lead structures (candidate of drugs). The structure elucidation of bioactive compounds will be conducted by **Dr. RuAngelie Edrada-Ebel**.

<u>Third year</u>, optimization process of isolated endophytic bacterial and fungal growth on various cultivation medium and treatment in order to increasing the amount of production of bioactive compounds will be conducted. Output of the project after three years planned is

discovery and production antimicrobial and anticancer compounds with excellent quality that has a good competitiveness as a lead structure in pharmaceutical industry.

### Expected scientific and economic prospects

- 1. Scientific Prospects: Indonesia is one of the center marine biodiversity in the world. For certain groups of marine macroorganism as well as microorganism, Indonesia is "the hot spot" of biodiversity unmatched by any other country in the world. The combined effort of Indonesian and UK group from Academia is sure to make a significant contribution to our knowledge on the occurrence and chemical diversity of bioactive natural products in tropical marine biota. Based on previous research by the principal investigator within United Kingdom, it can be expected that a wealth of new compounds with some of them exhibiting novel modes of action will be discovered. The data achieved during this project will be jointly published in International Journals and/or as chapters of books such as Journal of Natural Products. A type collection of each organism collected and analyzed through this project will be established and maintained in Indonesia. This collection can be expanded through future activities. So far no collection of the kind described here is available in Indonesia. This type collection of identified species will be an important point of reference for any further scientific activities within Indonesia. Furthermore it will provide a stimulus for research and training in the field of taxonomy that is urgently needed within Indonesia.
- 2. <u>Economic prospect</u>: The ultimate economic aim of this project is the discovery of pharmacologically active compounds from Indonesian marine microorganisms that have the potential to be marketed in a foreseeable future. Drug discovery holds the biggest economic potential but is very demanding in terms of time and money before a product can be launched to the market.

### Justifications of the approach proposed

The combined effort of several Indonesian and UK groups from Academia is sure to make a significant contribution to our knowledge on the occurrence and chemical diversity of bioactive natural products in tropical marine microorganism associated with sponges. This joint England Indonesian proposal will tap the largely unexploited biodiversity of Indonesian marine microorganism. The Indonesian groups will prepare the crude extracts of each of the collected microorganism by following a standard protocol. These extracts will then be funneled into bioactivity screens conducted by both the Indonesian and UK research groups involved (e.g. antibiotic properties against bacteria and fungi and anticancer) according to their fields of interests. Simultaneously each extract prepared will be screened for novel constituents by on-line analytical methods such as HPLC-MS or GC-MS by <u>the group at Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow, UK (**Dr. RuAngelie** Edrada-Ebel). The ultimate aim of the fractionation will be the isolation and identification of the active principle(s) present in the extract. Structure elucidation by spectroscopic methods (mainly by NMR and MS) will be primarily performed by the group at University of Strathclyde that has access to state of the art analytical facilities. Each fractionation will be guided by appropriate bioassays for a focused isolation of the active compounds.</u>

Based on previous research by the principal investigator with the Institution in University of Strathclyde, it can be expected that a wealth of new compounds with some of them exhibiting novel modes of action will be discovered. On the taxonomic level an inventory of Indonesian marine sponges which is so far not existing, will be compiled through the course of this project. This inventory will not only contain species known to science that occur also in Indonesia but (based on existing experience) also a good number of new species that are likely to be discovered through this project. So far no collection of this kind described here is available in Indonesia. This type collection of identified species will be an important point of reference for any further scientific activities within Indonesia in the direction outlined in this proposal. Furthermore it will provide a stimulus for research and training in the field of taxonomy that is urgently needed within Indonesia.

Special purpose for three years project will be focused on:

#### First Year (2018)

- Isolation of marine derived fungi from marine invertebrate and cultivation the isolated fungi for bioactivity testing. <u>Output</u> of the activity is number of pure fungi strains obtained.
- 2. Determining the minimum inhibition concentration of antimicrobial activity (MIC) and  $LC_{50}$  of cytotoxicity against some cultured of carcinoma cell. <u>Output</u> of this activity is to obtain marine derived fungi from marine invertebrate which are potentially

producing bioactive compound. This result will be published in international journal (Journal of Applied Pharmaceutical Sciences and Marine Drugs).

- Identification the species of marine derived fungi from marine invertebrate using biochemical and genomic approach. <u>Output</u> of the activity is to get naming taxonomically at each isolated microbial strain.
- 4. Examination of the content of secondary metabolites produced by each pure fungi strain that have bioactivity using a chemical reaction method.
- All result will be published in international journal (Journal of Applied Pharmaceutical Sciences and Marine Drug

#### Second Year (2019)

- Cultivation of secondary metabolite producing isolated marine derived fungi from marine invertebrate under standard laboratory conditions. <u>Output</u> of the activity is to get crude extract of secondary metabolite in large sufficient quantities for isolation the pure bioactive compounds.
- 2. The bioactive secondary metabolite will be isolated from the biologically active fractions through chromatographic methods by step gradient elution. <u>Output</u> of the activity is to get pure bioactive compounds.
- 3. Antimicrobial and anticancer assays of pure isolated compounds
- 4. All result will be published in international journal (Journal of Applied Pharmaceutical Sciences and Marine Drugs).

#### Third Year (2020)

- Optimization process of isolated marine derived fungi growth on various cultivation medium and treatment. <u>Output</u> of the activity is determination optimal process and condition of cultivation in order to increasing the amount of production of bioactive compounds.
- 2. This result will be published in international journal (Journal of Applied Pharmaceutical Sciences and Marine Drugs).

<u>Urgent of this investigation</u> is that results of research have not only big opportunities to be published in international seminar and journal but also can be developed to produce a pharmacologically compounds as products. The above formulation will be solved with this proposed research.

Final Target of Research Result (especially new investigation/technology/patent, etc.)

- 1. Several international publications due to new result of research obtained from marine derived fungi.
- 2. Obtaining a patent for the discovery of new drug compounds from marine derived fungi that are still limited studied previously.

No			Indicator				
	Category	Sub Category	Manda tory	Optional	2018	2019	2020
1.	Scientific Publication <sup>2)</sup>	International	$\checkmark$		accepted	accepted	accepted
		National-Accredited		$\checkmark$	accepted	accepted	accepted
2.	Invited speaker in scientific forum <sup>3)</sup>	International		1	has been conducted	draf	draf
	scientific forum	National		$\checkmark$	has been conducted	draf	draf
3.	Keynote speaker in	International		$\checkmark$	nothing	nothing	nothing
	scientific forum <sup>4)</sup>	National		1	nothing	nothing	nothing
4.	Visiting Lecturer <sup>5)</sup>	International		1	has been conducted	draf	draf
5.	Intellectual	Patent		1	registered	draf	draf
	Property Right <sup>®</sup>	Simple Patent		1	nothing	nothing	nothing
		Copy Right		1	nothing	nothing	nothing
		Trade Mark		1	nothing	nothing	nothing
		Trade Secret		1	nothing	nothing	nothing
		Industrial Product Design		$\checkmark$	nothing	nothing	nothing
		Geographical Indication		$\checkmark$	nothing	nothing	nothing
		Plant Variety Conservation		$\checkmark$	nothing	nothing	nothing
		ntegrated Circuit Topography Conservation		V	nothing	nothing	nothing
6.	Intermediate Technolog	y <sup>7</sup> )		$\checkmark$	nothing	nothing	nothing
7.	Model/Prototype/Design Engineering <sup>8)</sup>	/Art/ Social		√	nothing	nothing	nothing
8.	Book (ISBN) <sup>9)</sup>			1	product	draf	draf
9.	Technological Readiness	s Level (TRL) <sup>10)</sup>			2	2	2

**Tabel 1 Annual Target Achievement Plan** 

<sup>1)</sup> CY = Current year (year one)
<sup>2)</sup> Fill in with nothing, draf, submitted, reviewed, or accepted/published

#### **CHAPTER 2 STUDY OF LITERATURE**

#### State of the art.

Terrestrial fungi have for long been known as a rich source of biologically active secondary metabolites. Since the discovery of penicillin by Sir Alexander Fleming in 1928, which resulted in a breakthrough in the treatment of bacterial infections, fungi have become an important source of drugs for the treatment of a variety of diseases. Beside other well-known antimicrobial agents of fungal origin like fusidic acid and griseofulvin [Grove, *et al.*, 1952], new semisynthetic antifungal drugs like anidulafungin (Eraxis), caspafungin (Cancidas) and retapamulin (Altabax) are likewise derived from fungal metabolites [Butler, 2004; Abramovits, *et al.* 2007]. With the discovery of cyclosporine isolated from *Tolypocladium inflatum* in 1971 an important step in immunopharmacology was taken and improvements in the field of organ transplantation and treatment of autoimmune diseases are still in progress, like the introduction of substances such as the fungal-derived mycophenolic acid (Myfortic) to the market in 2004.

Fungal metabolites are, however, not only indispensable for medicine but are also important for plant protection, as demonstrated by the discovery of the strobilurines that were first isolated from *Strobilurus* sp. and served as lead compounds for synthetic fungicidals such as trifloxystrobin (Flint) [Balba, 2007]. However, 'the rediscovery of high numbers of previously described metabolites has to some extent precluded the study of traditional terrestrial sources of fungi'and recently, interest of natural product chemists and pharmacologists alike has turned to so far less investigated habitats and ecological niches such as the oceans [Bugni and Ireland, 2004].

#### <u>Previous Investigations of bioactive natural products from marine derived fungi asocciated in</u> <u>marine invertebrates</u>

The oceans cover nearly three-quarters of the earth's surface and can be considered a 'soup' of essentially all imaginable types of microbes [König, 2006]. Ecological niches, e.g. deep-sea hydrothermal vents, mangrove forests, algae and sponges provide distinct habitats for the isolation of specific micro-organisms. Marine microorganisms including bacteria, cyanobacteria, microalgae and fungi have become an important source of new pharmacologically active metabolites. Recent reviews demonstrate the importance of these organisms as potential sources of pharmaceutical leads. Especially, marine fungi have shown promising potential as sources of new and bioactive natural products as suggested by the chemical diversity of their secondary metabolites even though sample collection and

preparation as the first step might be more difficult for marine-derived fungi than for terrestrial material because of difficulties inherent to the collection in marine environment such as the need for scuba diving. Although the most famous group of bioactive compounds obtained from marine-derived fungi are still the cephalosporines with cephalosporine C, first isolated by G. Brotzu in 1945 from a marine strain of *Acremonium chrysogenum*, there are also more recent promising examples. These include halovir and several naturally occurring analogs, which are potent inhibitors of *Herpes simplex* viruses 1 and 2. Synthetic studies that were carried out for these substances allowed insight into structure–activity relationships [Ebel, 2006; Dalla Bona, 2006]. The new alkaloid sorbicillactone A isolated from the sponge-derived fungus *Penicillium chrysogenum* showed promising activity against leukemia cells without exhibiting notable cytotoxicity. Large-scale fermentation of the fungus yielded sufficient amounts of the compound for preclinical investigations [Ebel, 2006; Bringmann, 2007].

Overall, research on marine derived fungi has led to the discovery of more than 270 new natural products mainly from the early 1990s to mid 2002 (with more than two-thirds of these compounds isolated from (sponge- and plant-derived fungi), whereas more than 330 new metabolites were reported only in the 5 years period between 2002 and 2006 including numerous compounds with new carbon skeletons. This sharp rise in numbers indicates a growing interest in marine-derived fungi as sources of new bioactive metabolites [Blunt, 2007].

### <u>Road map of Research Activity and Research Experience of bioactive natural products from</u> <u>marine invertebrates</u>

This proposed international collaboration research is continuity and improvement of previous investigation related to bioactive natural products from marine sponge collected from West Sumatera. The project was financially supported by DGHE (Dikti) from Fundamental and Hibah Strategis Nasional Projects since 2004 up to 2009 [Handayani *et al.*, 2003-2005, Handayani, *et al.*, 2007a; Handayani, *et al.*, 2007b; Handayani, *et al.*, 2009a]. On this basis, <u>the marine derived fungi became a major topic in the research proposed today</u>. Research targeted at marine invertebrates such as sponge, soft corals and molusca, because based on the results of previous studies, this animals proved to produce bioactive compounds.



*Output* hingga saat ini : 13 jurnal internasional, 17 jurnal terakreditasi, Promotor S3 2, 2 S2 dan 100 S1, S3 4 org (2 mhs PMDSU) in progress.



The Utilization of marine natural products with antimicrobial and anti-cancer activity as secondary metabolites of microbial symbiosis with a sponge is more profitable than isolating these compounds directly from its host (sponge itself). Relatively slow growth of the sponge caused limited supply of biomass, constraints in obtaining secondary metabolites. The use of microbial life in the form associated with the sponge symbiont is better because it can be purified and cultured in the laboratory, so it does not need to collect them from the wild, can be propagated in a relatively faster and more easily manipulated. Research on the utilization of marine derived microbes producing medicinal compounds from marine waters of Indonesia, especially in West Sumatra waters are still very limited in number and have not been widely reported in scientific journals. Based on that, it is necessary to do further research on marine invertebrate derived fungi which is able to producing antimicrobial and cytotoxic compounds, so that at the end of this study, several scientific publications which reveal the existence of a potential isolated fungi in producing lead compound of medicine can be realized.

#### **CHAPTER 3 METHODS OF RESEARCH**



Figure 2 Steps of isolation marine invetebrate derived fungi up to developing process of production bioactive compounds.

This project will be carried out using the following methods/activities:

### First Year (2018)

a. Collection of samples

Marine invertebrates will be collected (wet weight: 0.1 - 0.2 kg) from some small Islands, in West Sumatera. The samples soon after collection are washed with sterile seawater and transferred to a sterile plastic bag and transported under frozen condition to the laboratory for the isolation of fungi. In the laboratory, each sample is cut aseptically into small pieces using a steril scalpel. The pieces (10 gram) were mix with 90 ml of sterile seawater. This suspension is serially diluted up to  $10^{-6}$ .

b. Isolation of marine invertebrate derived fungi

0,1 ml of the diluted suspension is taken from  $10^{-3}$  and  $10^{-4}$  dillution and pour plated using ±15 ml Sabouraud dextrose agar (+ Chloramphenicol) medium prepared in sterile

seawater and incubated at  $28 \pm 2^{\circ}$ C for 5 days. The colonies are counted and recorded. Based on the morphological characteristics (form, margin and color of the colony), each colony is separated and transfer into a new Sabouraud dextrose agar medium and incubated [Kjer, *et al.*, 2010].

c. Cultivation of fungi isolates for bioactivity assay

The isolated fungi are sub cultured on Sabouraud dextrose agar plates and incubated at  $28 \pm 2^{\circ}$ C for 2 days. A loopful of the fungal culture from the plate is inoculated into 100 ml of Sabouraud dextrose broth in sterile seawater and incubated  $28 \pm 2^{\circ}$ C for 5 days. At the end of incubation period, each of broth culture is filtrated by Whatmann paper No. 1 under vacuum. The culture filtrate is extracted three times with 1/3 volumes of ethyl acetate. This organic solvent is collected and evaporated using Rotary evaporator at 40 °C. The yield of dry extracts is screened for their antimicrobial and anti-cancer activities [Kjer, *et al.*, 2010].

#### d. Screening for antimicrobial activity

Antagonistic assay for fungi against microbial pathogens

Agar diffusion assay: Aliquots of the fungi extracts are applied to sterile filterpaper discs (6 mm diameter, Oxoid Ltd.) using a final disc loading concentration of 500  $\mu$ g for ethyl acetate extract. The impregnated discs are placed on Nutrient Agar medium plates previously seeded with the selected bacteria pathogens such as *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*, and *Pheseudomonas auroginosa* along with a disc containing solvent blanks. Antagonistic activity is detected after an incubation of 24 h at 37 °C

Antagonistic activity of isolated fungal strains are tested for their antifungal activity against selected fungal pathogens such as *Candida albic*ans and *Trycophyton* sp on Potato dextrose agar plates and incubated at  $28 \pm 2^{\circ}$ C for 2 days.

The presence of zone of clearance on agar plates is used as an indicator for the antibacterial and antifungal activities. The clear/inhibition zone is determined in millimeters. The strain which showed the maximum zone of inhibition will be chosen for phytochemical study. The presence of inhibitions zone on agar plates is used as indicator of bioactive potential of the strain.

#### e. Cytotoxicity Assay

Cytotoxicities are carried out against L5178Y mouse lymphoma cells, hela cervix carcinoma cells, and PC12 rat brain tumor cells is performed using the microtubule tetrazolium (MTT) assay. Stock solutions in ethanol 96 % (v/v) are prepared.

Exponentially growing cells are harvested, counted and diluted appropriately. 50 µl cell suspensions with approximately 3,750 cells are pipetted into 96 well plates. Subsequently, 50 µl of sample solution (concentration varying from 3- 10 µg/ml) is added to each well. The small amount of ethanol present in the wells do not affect the experiments. The test plates are incubated at 37 °C with 5% CO2 for 71 hrs. A solution of 3-(4,5-dimethydiazol-2-yl)-2,5-diphenyltetrasolium bromide (MTT) is prepared at 5 mg/ml in saline phosphase buffer (PBS;1.5 mM KH2PO2, 6.5 mM Na2HPO4, 137 mM NaCl, 2.7 mM KCl; pH 7.4). From this solution, 20 µl is pipetted into each well. The yellow MTT penetrates healthy living cells and in the presence of mitochondrial dehydrogenases, it transforms to a blue formazan complex. After the incubation periods of 3 hrs and 45 minus at 37 °C in an incubator humidified with 5% CO2, the medium is centrifuged (15 min, 20 °C, 210 x g). The cells are lysed with 200 µl of DMSO to liberate the formed formazan product. After thorough mixing, the absorbance is measured at 520 nm by using a scanning micro-well spectrophotometer. The color intensity is correlated with the number of healthy living cells. Cell survival is calculated using the formula:

Survival (%) =  $\frac{100 \times (abs \text{ of treated cells} - abs \text{ of culture medium})}{(abs of untreated cells - abs of culture medium)}$ 

All experiments are carried out in triplicates and repeat three times. As control, media with % EGMME/DMSO is used.

Cytotoxicity Assay is going to be carried out in Pharmacy Faculty of Gadjah Mada University under supervisor by Dr. rer.nat. Triana Hertiani, M.Si., S.Si., Apt.

#### f. Metabolomic analysis

Metabolomics is an efficient method to confirm the results of the biosynthetic genebased screening. The tools of metabolomics will be applied to assess the production of biologically active secondary metabolites from marine/terrestrial-derived microorganisms in a variety of culture media at various growth phases. The Natural Products Metabolomics Laboratory at <u>Strathclyde Institute of Pharmacy and Biomedical Sciences</u> has developed algorithms to efficiently detect the production of interesting secondary metabolites during the cultivation and production processes that would assist in maintaining or enhancing synthesis of the desired compounds. Metabolomics has become a powerful tool in systems biology which allows us to gain insights into the potential of microbial isolates for synthesis of significant quantities of promising new agents, and allows us to manipulate the environment within fermentation systems in a rational manner to select a desired metabolome

#### g. Molecular and Morphological Taxonomy of isolated Fungi

To determine the taxonomy of the fungi strain isolates with the most potential bioactivity, their ITS1-5.8S-ITS2 ribosomal DNA sequence information and morphological characteristics will be investigated.

Taxonomy process is going to be carried out in Laboratory of Biotechnology Testing, Biotechnology Research Center, Indonesian Institute of Sciences, Cibinong-Bogor and analysis by Dr. Dr. Trina Ekawati Tallei.

#### Second Year (2019)

a. Isolation of bioactive compounds

The pharmacologically active compounds will be isolated from the biologically active fractions through chromatographic methods by step gradient elution. Fractions that give the same behavior on TLC plates will be combined and screened for bioactivity. Further purification may be done by rechromatography or by crystallization. The pure compound will be structure elucidated and subjected to bioactivity study to determine their  $EC_{50}$  or  $LC_{50}$  values. Quantitative assays, in comparison with a positive control will be carried out especially for the most promising compound.

#### b. Spectroscopical structural elucidation

Simultaneously, the extracts prepared will be screened for novel and known constituents by on-line analytical methods such as HPLC coupled to a photo-diode

array detector, HPLC-MS or GC-MS by <u>the Natural Products Metabolomics Group</u> (NPMG) at Strathclyde Institute of Pharmacy and Biomedical Sciences (SIPBS), <u>University of Strathclyde, Glasgow, UK</u>. Data originating from these spectroscopic surveys can be directly compared to an in-house library of spectral data of marine natural products compiled in recent years by the group at NPMG or to commercially available data collections such as Marinlit<sup>®</sup> in order to avoid time consuming re-isolation of already known marine metabolites. Structure elucidation by spectroscopic methods (mainly by NMR and MS) will be primarily performed by <u>NPMG</u> team since they have access to state of the art analytical facilities. New compounds will be extended spectroscopical analysis employing mass spectroscopy (EI; FAB or ESI ionisation modes), <sup>1</sup>H and <sup>13</sup>C NMR spectroscopy using one and two dimensional methods (COSY, ROESY, NOESY, HMBC, HMQC) as well as chirooptical methods such as optical rotation or circular dishroism.

#### Third Year (2020)

Growth Optimization process of isolated fungi on various cultivation medium and treatment.

a. Production of the bioactive compound

In order to supply sufficient of bioactive compound for experiments on biochemical mechanism, bioactivities, and toxicological studies, production is performed with isolated fungi strain in various medium and treatment (optimation with pH, and days of incubation).

b. Improvement of the culture conditions

Variations in the composition of complex nutrient components and single defined carbon substrates will be studied to obtain the optimal production of bioactive compound. Replacement of glucose with other carbon sources (lactose, sucrose, maltose, fructose, galactose, trehalose, glycerol, pyruvate, acetate or tri-sodim citrate) will be determined.

#### **CHAPTER IV BUDGET**

In general, the budget is proposed to carry out activities in Indonesia. While activities in Giasgow, UK are not chargeable to fund of the Indonesia government and is the sole responsibility of Dr. RuAngelie Edrada-Ebel who had promised as much as £7,500 per year (see her letter of research agreement in Appendix 4). The activities to be carried out in Glasgow are metabolomics analysis, structure elucidation and spectroscopy analysis (NMR and MS data) and specific bioactivities assay.

No.	Type of Pudget		Budget (Rp.)	
	Type of Budget	Year I	Year II	Year III
1.	Honoraria	54,360,000	54,360,000	54,360,000
2.	Travel expenses	57,000,000	57,000,000	47,000,000
3.	Material expenses	65,550,000	90,350,200	89,650,200
4.	Miscellaneous expenses	37,000,000	37,000,000	37,000,000
	Total	213,910,000	238,710,200	228,010,200
	Grand Total		680,630,400	

#### Grand Total of budget per year based on item

#### **RESEARCH SCHEDULE**

No.	TYPE OF ACTIVITY	YEAR 1 (2018)									
		1	2	3	4	5	6	7	8	9	10-12
1.	Collection of invertebrates										
2.	Isolation of marine invertebrate derived fungi										
3.	Cultivation of isolated fungi										
4.	Antimicrobial and Anticancer Testing										
5.	Identification of fungal isolates producing antimicrobial/anticancer										
6.	Metabolomic analysis										
7.	Writing of Research Report										

No.	TYPE OF ACTIVITY	YEAR 2 (2019)									
		1	2	3	4	5	6	7	8	9	10-12
1.	Cultivation of production of secondary metabolites of fungal isolates lab scale										
2.	Isolation of antimicrobial/anticancer compounds										
3.	Analysis of the structure of antimicrobial compounds										
4.	Antimicrobial and Anticancer Testing										
5.	Identification of fungal isolates producing antimicrobial/anticancer										
6.	Metabolomic analysis										
7.	Writing of Research Report										

No.	TYPE OF ACTIVITY	YEAR 3 (2020)									
		1	2	3	4	5	6	7	8	9	10-12
1.	Optimization process of growth of isolated fungal										
2.	Isolation of antimicrobial/anticancer compounds										
3.	Data analysis										
4.	Writing of Research Report										

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## **APPENDIX 1 BUDGET JUSTIFICATION**

#### A. Honorarium

Research Tim	Work	Hour/	Rate / prs / hour	Bu	,-)	
	month	Week		Year I	Year II	Year III
Project Leader	10	20	OJ, @Rp.40000	32,000	32,000	32,000
Member 1 (Anggota 1)	5	10	OJ, @Rp.25000	10,000	10,000	10,000
Member 2 (Anggota 2)	5	5	OJ, @Rp.25000	5,000	5,000	5,000
Data Analyser	1	1	1 Packet	1,330	1,330	1,330
Assistance	9	10	OH, @Rp.67000	6,030	6,030	6,030
	To	54,360	54,360	54,360		

## **B.** Travel expense

No.	Travel Item	Justifikation of Travel	Budget (Rp.)	Budget (Rp.)	Budget (Rp.)
			Year I	Year II	Year III
1.	Local Transport	Sample collection	10,000,000	10,000,000	
		(2x @ Rp. 5,000,000)			
2.	Padang – Yogjakarta	Bioactivity Testing in Jakarta	6,000,000	6,000,000	6,000,000
	(roundtrip)	(2x @ Rp. 3,000,000)			
3.	Sample shipping to	for metabolomics/spectroscop	1,000,000	1,000,000	1,000,000
	UK	analysis			
		(2 x @ Rp. 500,000)			
4.	Airfare :Padang-Jakarta-	Purification of sample	30,000,000	30,000,000	30,000,000
	Glasgow (roundtrip)				
	(1 prsn x @ Rp. 30,000,000)				
5.	Cost of visa to UK		3,000,000	3,000,000	3,000,000
	(1 prsn)				
6.	Local tranportation in		6,000,000	6,000,000	6,000,000
	Glasgow, UK				
	Т	otal	57,000,000	57,000,000	47,000,000

## C. Material, Material processing / analysis expenses, and supply expense

No.	Name of material	Quantity	Unit cost	Year I	Year II	Year III
1.	Methanol (TG)	100L	25,000	2,500,000	2,500,000	2,500,000
2.	Aceton (TG)	50 L	25,000	1,250,000	1,250,000	1,250,000
3.	Ethyl Acetate (TG)	100 L	40,000	4,000,000	4,000,000	4,000,000
4.	Buthanol (TG)	20L	70,000	1,400,000	1,400,000	700,000
5.	Hexan (TG)	50 L	30,000	1,500,000	1,500,000	1,500,000
6.	Ether (TG)	10 L	35,000	350,000	350,000	350,000
7.	Silica Gel 60	1 kg	2,000,000	4,000,000	4,000,000	4,000,000
8.	Silica Gel (TLC)	1 boxes	3,000,000	6,000,000	6,000,000	6,000,000
9.	Chloroform	2,5 L	3,000,000	6,000,000	6,000,000	6,000,000
10.	Silica Gel C18 (TLC RP 18)	2 boxes	2,500,000	5,000,000	5,000,000	5,000,000
11.	Amberlite XAD16	1 kg	6,000,000	6,000,000	6,000,000	6,000,000
12.	Sephadex LH 20	1 kg	18,000,000		18,000,000	18,000,000
13.	Na <sub>2</sub> SO <sub>4</sub> anhidrate	5 kg	100,000	500,000	500,000	500,000

14.	Dichloromethane (TG)	50 L	50.000		2,500,000	2,500,000		
15.	Nutrient Agar	500 g	1,000,000	1,000,000	2,000,000	2,000,000		
16.	Nutrient Broth	500 g	1,000,000	1,000,000	2,000,000	2,000,000		
17.	Sabouroud Dektrosa Agar	500 g	1,000,000	1,000,000	2,000,000	2,000,000		
18.	Sabouroud Dektrosa Broth	500 g	1,000,000	1,000,000	2,000,000	2,000,000		
19.	Malt Extrac	500 g	1,000,000	1,000,000	2,000,000	2,000,000		
20.	Marine Agar	500 g	1,000,000	1,000,000	2,000,000	2,000,000		
21.	Culture of pathogenic bacteria (for	3 sp	200,000	600,000	600,000	600,000		
	antimicrobial analysis)	1			,			
22.	Culture of species pathogenic fungi	3 sp	250,000	750,000	750,000	750,000		
	(for antifungal analysis)	•						
23.	Glass container for microbial	1	200,000	400,000	400,000	400,000		
	cultivation (Volume 1 l)							
24.	Material for citotoxicity assay	1	10,000,000	10,000,000	10,000,000	10,000,000		
25.	Dimetil sulfoksida (DMSO)	500 ml	500,000	500,000	500,000	500,000		
26.	Antimicrobial Susceptibility Test	1 box	1,000,000	1,000,000	1,000,000	1,000,000		
	Discs (Oxoid) Antimicrobial	(1000 pc)						
	Susceptibility Test Discs (Oxoid)							
27.	NaCl fisiologis	1 L	250,000	250,000	250,000	250,000		
28.	Blue tips	1 pack	400,000	400,000	400,000	400,000		
29.	White tips	1 pack	400,000	400,000	400,000	400,000		
30.	Yellow tips	1 pack	400,000	400,000	400,000	400,000		
31.	Aluminium foil	3 rol	30,000	90,000	90,000	90,000		
32.	cutton	1 kg	50,000	50.000	50.000	50.000		
33.	Tissue	10 rol	4,000	40,000	40,000	40,000		
34.	Ethanol	10 L	30,000	300,000	300,000	300,000		
35.	Kain Kasa	5 m	10,000	50,000	50,000	50,000		
36.	Wathman paper	4 box	50,000	200,000	200,000	200,000		
37.	Printer ink	2 set	300,000	600,000	600,000	600,000		
38.	Printer paper	2 pack	30,000	60,000	60,000	60,000		
39.	Kloramfenikol	10 g	2,000	200.000	200.000	200.000		
40.	Plastic bag 5 L	1 kg	10,000	10,000	10,000	10,000		
41.	Aquades	25 L	10,000	250,000	250,000	250,000		
42.	High-throughput sample purification,							
	high-resolution spectroscopic analysis,	ysis, <b>f7</b> 500 per year						
	and bioassay testing against microbes			a, eve per ye				
12	and cell lines costing	10.6 1	1 500 000	15 000	15 000	15 000		
45.	Fungal Identification on	10 fungal	1,500,000	15,000	15,000	15,000		
	Biochemically and DINA Testing							
	Total	65,550,000	90,350,200	89,650,200				

## **D.** Miscellaneous expenses

No	Name of Activities	Year I	Year II	Tear III
1.	Books, Journals and information from interlibrary loan	2,000,000	2,000,000	2,000,000
	and internet			
2.	Photocopy of project report and administration	1,000,000	1,000,000	1,000,000
3.	Sending Marine Invertebrate Sample to Netherland for	1,000,000	1,000,000	1,000,000
	taxonomy identification			

4.	International Conference/ Seminar in abroad (with	10,000,000	10,000,000	10,000,000
	consumption and accommodation) for 1 persons			
5.	Cost for Publication	5,000,000	5,000,000	5,000,000
6.	Equipment rental	5,000,000	5,000,000	5,000,000
7.	Equipment maintenance costs	5,000,000	5,000,000	5,000,000
8.	Laboratorium fee	2,000,000	2,000,000	2,000,000
	Total	37,000,000	37,000,000	37,000,000

### **APPENDIX 2 EQUIPMENTS FOR RESEARCH**

List of main equipment used for supporting this research. All of equipment shown in table are in good condition.

There are three main location to conduct research activities, namely:

- 1. Laboratory of Sumatran Biota, University of Andalas.
- 2. Laboratory of Parasitology, University of Gadjah Mada, Yogjakarta.
- 3. The Natural Products Metabolomics Group, Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde

No.	Name of Equipment	Specification
1.	Rotary Evaporator	IKA <sup>®</sup> RV8
2.	Balance	Axis®
3.	Spektroscopy UV-VIS Pharmaspec 1700	Shimadzu <sup>®</sup>
4.	Spektrometry IR	Perkin Elmer FT-IR Spectrum
		one
5.	HPLC	Shimadzu <sup>®</sup>
6.	Laminar Air Flow Cabinet	Innotech <sup>®</sup>
7.	Inkubator	Galenkamp <sup>®</sup>
8.	Autoklaf	Important <sup>®</sup>
9.	Centrifuge	Charpy
10.	Vortex	Whirlimixer <sup>TM</sup>
11.	UV-Lamp $\lambda_{254nm}$	Merck
12.	Ultrasonicator	Bransonic <sup>®</sup>

# APPENDIX 3 ORGANIZATION STRUCTURE OF THE RESEARCH TEAM AND DIVISION OF TASKS

No	Name / NIDN	Institution	Field of Study	Time Allocation (hour/ week)	Job Description	
1.	Prof. Dr. Dian Handayani NIDN: 0017056811	Pharmacy Faculty Univ. of Andalas	Biology Pharmacy	20	<ol> <li>Preparing research proposals</li> <li>Planning for implementation of the work</li> <li>Managing the implementation of work</li> <li>Taking responsibility for conduct of research in the laboratory</li> <li>Preparing research report</li> <li>Writing articles for publication in scientific journals</li> </ol>	
2.	Dr. RuAngelie Edrada-Ebel	Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde	Biology Pharmacy	Internationa 1 Partner	<ol> <li>Participate and develop a research proposal</li> <li>Participate implementation of the work plan</li> <li>high-throughput sample purification, high- resolution spectroscopic analysis, and bioassay testing against microbes and cell lines. (Metabolomic profiling)</li> <li>Structure elucidation of bioactive compounds produced by marine derived fungi</li> </ol>	
3.	Dr.rer.nat. Triana Hertiani, M.Si., S.Si., Apt	Pharmacy Faculty Univ. of UGM	Pharmacy	10	<ol> <li>Participate and develop a research proposal</li> <li>Participate</li> </ol>	

					<ul><li>implementation of the work plan</li><li>3. Participate preparing the bioassay testing against microbes and cell lines.</li></ul>
4.	Dr. Trina Ekawati Tallei	FMIPA, Unstrat, Manado	Biology	5	<ol> <li>Participate and develop a research proposal</li> <li>Participate implementation of the work plan</li> <li>Participate preparing the research report</li> </ol>
5.	Putri Yolanda	Assistance	Pharmacy	10	<ol> <li>Support all activities in the laboratory</li> <li>Preparation of the tools and materials required</li> <li>Maintenance of equipment</li> </ol>
6.	Harmizal	Data Analyser	Pharmacy	1	Assist in the data processing in the laboratory

# APPENDIX 4 THE APPROVAL LETTER OF INTERNATIONAL COOPERATION PARTNERS





#### MEMORANDUM OF UNDERSTANDING

MEMORANDUM OF UNDERSTANDING by and between the Faculty of Pharmacy Andalas University (FFUA), located at Kampus Limau Manis, Padang, West Sumatra, Indonesia and the University Of Strathelyde (SU)incorporated by Royal Charter a charitable body registered in Scotland with registration number SC015263 and having its Principal Office at 16 Richmond Street, Glasgow, G1 1XQ United Kingdom which aims at promoting academic cooperation between the FFUA and SU. WHEREAS

Faculty of Pharmacy Andalas University, herein represented by its Dean of Faculty of Pharmacy, and SU, represented by the Dean of the Faculty of Science, based on the shared understanding that cooperation between both institutions will further research and other academic and cultural activities, on the shared understanding that this Memorandum of Understanding does not contain an exhaustive list of the aims and objectives and is not intended to be legally binding. However, FFUA and SU will endeavour to work together in good faith (but without legal obligation) to implement the aims and objectives set out below and do hereby resolve to execute this Memorandum of Understanding, which shall be governed by the following terms and conditions:

#### SECTION 1 - PURPOSE

FCFRP-USP and SU agree to promote academic cooperation between both institutions, in the area of Natural Products Chemistry (the "Purpose"), by means of:

- 1. exchange of teaching staff and researchers;
- 2. joint development of research projects;
- 3. joint organization of scientific and cultural events;
- 4. interchange of information and of academic publications;
- 5. exchange of students;
- 6. exchange of members of their technical and administrative staffs; and
- 7. shared courses and subjects.

This list is provided for illustrative purposes only and the parties acknowledge that the actual nature of the collaboration between them may or may not include each of the items in the list.

#### SECTION 2 - IMPLEMENTATION

For the purpose of implementing each specific cooperation activity, both institutions shall prepare a work program describing the forms, the means and the respective agreed responsibilities, which shall thereupon be the object of a separate specific formal written agreement, which shall not be effective until executed by an authorised signatory of each of the signatory parties to this Memorandum of Understanding.

#### SECTION 3 - FUNDING

Each institution shall even its best efforts to procure funding from internal or external sources, so as to ensure the feasibility of the cooperation programs.

#### SECTION 4 - REQUIREMENTS

The scholars, researchers and students taking part in the cooperation programs hereunder shall comply with the immigration requirements of the country of the host university, and shall contract an international medical and hospital insurance covering the stay abroad.

#### SECTION 5 - ACADEMIC FEES

The exchange students involved in exchange programs shall pay such academic fees, if any, at their home institution.

#### SECTION 6 - EFFECTIVE TERM

This Memorandum of Understanding shall become effective on the last date of its execution and shall remain effective for a period of five years at the end of which it shall automatically terminate. Upon the completion of this term, the terms of this Memorandum of Understanding may be renewed, upon the written assent of both institutions, and such renewal shall take the form of a new Memorandum of Understanding or as part of a specific agreement.

#### SECTION 7 - AMENDMENTS

Any changes to the terms and conditions of this Memorandum of Understanding shall become effective by means of a written amendment mutually accepted by an authorised signatory of each of the signatory parties to this Memorandum of Understanding.

#### SECTION 8 - COORDINATION

As coordinators for this Memorandum of Understanding, the following are appointed: on behalf of FFUA, Prof. Dr. Dian Handayani, Apt., Department of Pharmaceutical Biology; and on behalf of SU, Dr. RuAngelie Edrada-Ebel, Natural Products Metabolomics Group, Strathelyde Institute of Pharmacy and Biomedical Sciences, University of Strathelyde.

#### SECTION 9 - TERMINATION

This Memorandum of Understanding may be terminated at any time, by either party, by means of a 180-day prior written termination notice.

And having thus agreed and covenanted, the parties execute this Memorandum of Understanding in two (2) identical counterparts in each version, in English and in Bahasa Indonesia, to one and same effect. In the event of any conflict between the two versions of this Memorandum of Understanding, the English language version shall take precedence.

#### SECTION 10 - GENERAL

Each party undertakes that it will treat the other's information marked "confidential" or which from its very nature is obviously confidential with the same degree of care as it employs with regard to its own confidential information of a like nature and shall not use or disclose to any third party any of that information except as is strictly necessary for the Purpose.

This Memorandum of Understanding is personal to the parties and may not be assigned or otherwise transferred by either party without the prior written approval of the other party.

Unless and until formal agreements in respect of the specific cooperation activity between the parties are approved and executed between the parties then sections 1 to 8 of this Memorandum of Understanding are not intended to and shall not create any legal obligations between the parties. All negotiations and correspondence regarding the specific cooperating activity between the parties shall be subject to contract.

The parties will consult with each other and attempt to resolve disputes or misunderstandings that arise in the administration of this Memorandum of Understanding informally. In the event that internal attempts at resolution are not successful, the parties agree that:

2/3

- any proceedings relating to any claim or matter arising under or in connection with this Memorandum of Understanding or the legal relationships established by this Memorandum of Understanding instituted against SU by FFUA shall be brought in the Scottish courts and shall be governed by and construed in accordance with Scots law; and
- ii. any proceedings relating to any claim or matter arising under or in connection with this Agreement or the legal relationships established by this Agreement instituted against FFUA by SU shall be brought in the courts of Padang state or Indonesia and shall be governed by and construed in accordance with the laws of Indonesia.

Signed by A Prof. Dr. Helmi Arilin, MS., Apt Dean of faculty of Pharmacy Andalas University

Signed by

Professor David Littlejohn, Executive Dean, Faculty of Science, University of Strathclyde

Don't Lity M

7 MAY SOIS

Date:

Witnessed by:

i.

Prof. Dr. Werry Darta Taifur, SE., MA Rector of Andalas University

Date:

#### LETTER OF SUPPORT



STRATHCLYDE INSTITUTE OF PHARMACY & BIOMEDICAL SCIENCES

Dr. rer. Nat. Dian Handayani, Apt Fakultas Farmasi Universitas Andalas Kampus Limau Manis Padang 25163

27 May 2017

#### RE: RESEARCH COLLABORATION ON MARINE NATURAL PRODUCTS

Dear Professor Handayani,

In reference to our previous correspondence regarding a possible research collaboration between the Strathclyde Institute of Pharmacy and Biomedical Sciences (SIPBS), University of Strathclyde and the Fakultas Farmasi Universitas Andalas, I, the undersigned (Dr. RuAngelie Edrada-Ebel), do agree to this collaboration between our research teams. I head the Natural Products Metabolomics Group (NPMG) and a collaboration between our research groups will involve exchange of knowledge. The work of NPMG will involve carrying our high-throughput sample purification, high-resolution spectroscopic analysis, and bioassay testing against microbes and cell lines costing approximately at £7,500 per year. Should you require further assistance please do not hesitate to contact me.

With kind regards,

Ru Angelie Edrahathel

Dr. RuAngelie Edrada-Ebel Senior Lecturer in Pharmaceutical Analysis Head The Natural Products Metabolomics Group Strathclyde Institute of Pharmacy and Biomedical Sciences University of Strathclyde The John Arbuthnott Building 161 Cathedral Street Glasgow G4 0RE United Kingdom Tel: +44(0)141 548 5968 Fax:+44(0)141 552 2562 ruangelie.edrada-ebel@strath.ac.uk

The place of useful learning The University of Strathclyde is a charitable body, registered in Scotland, number SC015263



YEAR WINNER



#### MATERIAL TRANSFER AGGREEMENT



LETTER 1 - MTA346

30<sup>th</sup> September 2015

Prof. Dr. Dian Handayani Apt. Fac. of Pharmacy Andalas University kampus Limau Manis Padang 25162 West Sumatera **INDONESIA** 

Dear Professor Handayani,

#### Material Transfer Agreement with University of Strathclyde **Our reference MTA346**

I'm pleased to enclose a fully-executed copy of the Material Transfer Agreement. Thank you for your help

Yours sincerely,

Ridal Comen

Michael Cannon **Contracts Manager** 

Research & Knowledge Exchange Services 50 George Street Glasgow G1 1QE Scotland

t: +44 (0)141 548 3707 Director: f: +44 (0)141 552 4409 www.strath.ac.uk/rkes

Dr David McBeth

the place of useful learning

INVESTORS

The University of Strathclyde is a charitable body. registered in Scotland, number SCo15263

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ANDALAS UNIVERSITY MTA 1 - MTA346

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# MATERIAL TRANSFER AGREEMENT

#### (FOR DISTRIBUTION)

Faculty of Pharmacy Andalas University Kampus Limau Manis, Padang, West Sumatera, Indonesia (hereinafter referred to as PROVIDER), Strathclyde Institute of Pharmacy and Biomedical Sciences University of Strathclyde (hereinafter referred to as the RECIPIENT), and the researcher belonging to the RECIPIENT's organization (hereinafter referred to as the RECIPIENT RESEARCHER) agree to the following terms and conditions with respect to the provision of the following MATERIAL by the PROVIDER to the RECIPIENT:

A series of research materials originating from West Sumatran resources

This agreement is applicable to only the original MATERIAL for the analyses of chemical contents. Hereinafter, the above MATERIAL is referred to as the BIOLOGICAL RESOURCE.

1. The PROVIDER is engaged in collecting, storing, and distributing biological resources for the purpose of furthering research and development, and the utilization thereof, in the field of life sciences and international research community. The PROVIDER retains ownership rights to the BIOLOGICAL RESOURCE.

2. a) The RECIPIENT and the RECIPIENT RESEARCHER will use the BIOLOGICAL RESOURCE for the following specific research project:

1
Title of Research Project: Isolation of Bioactive Natural Products From Endophytic Microbe of West Sumatran, Indonesian Marine Habitats

• .

b) The RECIPIENT and the RECIPIENT RESEARCHER must obtain a written permission from the PROVIDER, 30 days prior to the use of the BIOLOGICAL RESOURCE for any purpose other than the research project specified above.

1. The RECIPIENT RESEARCHER, or joint researchers or students who work for the research project specified in Section 2.a) above directly under the RECIPIENT RESEARCHER's supervision will use the BIOLOGICAL RESOURCE only within the RECIPIENT's organization, and only within the RECIPIENT RESEARCHER's laboratory.

2. Neither the RECIPIENT nor the RECIPIENT RESEARCHER shall distribute or resell the BIOLOGICAL RESOURCE to any third party, or otherwise use the BIOLOGICAL RESOURCE in a manner contrary to the PROVIDER'S interest. Distribution includes assignment or lease, and offering to assign (displaying for the purpose of assignment). The RECIPIENT RESEARCHER will be responsible for any activities of joint researchers or students who are under the direct supervision of the RECIPIENT RESEARCHER.

3. The RECIPIENT or the RECIPIENT RESEARCHER will expressly acknowledge the PROVIDER as the source of the BIOLOGICAL RESOURCE when reporting on the results of research using the BIOLOGICAL RESOURCE (by printed publication, internet, oral presentation, etc.). Furthermore, the RECIPIENT or the RECIPIENT RESEARCHER will provide a copy of such report to the PROVIDER. The PROVIDER may publicly disclose this

report to promote the contribution of the PROVIDER, and this will not amount to any infringement of any copyright held by the RECIPIENT or the RECIPIENT RESEARCHER.

4. The RECIPIENT or the RECIPIENT RESEARCHER shall treat as confidential and maintain secrecy regarding any information related to the BIOLOGICAL RESOURCE, which the PROVIDER has disclosed to the RECIPIENT or the RECIPIENT RESEARCHER and marked as "confidential." When the RECIPIENT or the RECIPIENT RESEARCHER seeks to publish results of research that include "confidential" information, a written permission from the PROVIDER must be obtained 40 days prior thereto.

5. The RECIPIENT shall not bear the costs and expenses related to the provision of the BIOLOGICAL RESOURCE by the PROVIDER.

6. The RECIPIENT and the RECIPIENT RESEARCHER acknowledge that the BIOLOGICAL RESOURCE is or may be the subject of a patent application. This agreement does not grant the RECIPIENT or RECIPIENT RESEARCHER any license under a patent or any other intellectual property right concerning the BIOLOGICAL RESOURCE.

7. When the RECIPIENT or the RECIPIENT RESEARCHER seeks to obtain an intellectual property right, such as a patent, with respect to any research product obtained through the use of the present BIOLOGICAL RESOURCE, they will first report to the PROVIDER and comply with a separate agreement in relation thereto.

8. The PROVIDER warrants that to the best if its knowledge and belief, the BIOLOGICAL RESOURCE does not infringe any third party intellectual property right. The RECIPIENT or

the RECIPIENT RESEARCHER assumes all liability for direct claims against the RECIPIENT, the RECIPIENT RESEARCHER and the PROVIDER by a third party for infringement of any patent, copyright, trademark or other intellectual property right, which may arise from the use, storage or disposition of the BIOLOGICAL RESOURCE by the RECIPIENT or the RECIPIENT RESEARCHER, except where the dispute arises from the gross negligence or willful misconduct of the PROVIDER. The liability of the RECIPIENT or the RECIPIENT PROVIDER under this Agreement shall not extend to any indirect or consequential damages or losses.

9. The RECIPIENT or the RECIPIENT RESEARCHER acknowledges that the BIOLOGICAL RESOURCE may have defective, hazardous or faulty properties and may not necessarily be fit for a particular purpose and that the RECIPIENT or the RECIPIENT RESEARCHER assumes all liabilities for any consequences resulting from the use of the BIOLOGICAL RESOURCE.

10. In connection with the BIOLOGICAL RESOURCE, the research environment and experimental protocols must be in conformity with relevant laws, regulations and guidelines, and the BIOLOGICAL RESOURCE must be dealt with in compliance with all laws and regulations. The RECIPIENT or the RECIPIENT RESEARCHER shall, when necessary, take any steps or procedures to comply with legal requirements for the handling of the BIOLOGICAL RESOURCE.

11. Both parties shall discuss to reach an amicable resolution of any accidents that occur during shipment of the BIOLOGICAL RESOURCE. 12. When the RECIPIENT or the RECIPIENT RESEARCHER is in breach of this agreement, this agreement becomes null and void. Furthermore, the PROVIDER may terminate the subsequent use by the RECIPIENT or the RECIPIENT RESEARCHER of the BIOLOGICAL RESOURCE or other biological resources of the PROVIDER.

13. This agreement will terminate at the earliest of the following periods:

• ,

- (a) when the BIOLOGICAL RESOURCE becomes generally and legally available from a third party;
- (b) on completion of the RECIPIENT's current research use of the BIOLOGICAL RESOURCE;
- (c) on the thirtieth (30th) day of a written notice from either party to the other, or
- (d) three (3) years from the date of the PROVIDER's execution of this AGREEMENT.

When termination occurs, the RECIPIENT or the RECIPIENT RESEARCHER will discontinue the use of the BIOLOGICAL RESOURCE and will return or destroy any remaining BIOLOGICAL RESOURCE.

14. Both parties shall discuss in good faith to reach an amicable resolution of matters that arise in connection with the performance hereof as well as matters that are not expressly set forth in this agreement.

15. Any proceedings relating to any claim or matter arising under or in connection with this Agreement or the legal relationships established by this Agreement instituted against the

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RECIPIENT or RECIPIENT RESEARCHER by the PROVIDER shall be brought in the Scottish courts and shall be governed by and construed in accordance with Scots law.

Any proceedings relating to any claim or matter arising under or in connection with this Agreement or the legal relationships established by this Agreement instituted against the PROVIDER by the RECIPIENT or RECIPIENT RESEARCHER shall be brought in the courts of Indonesia and shall be governed by and construed in accordance with the laws of Indonesia.

The RECIPIENT and the PROVIDER do hereby sign two original copies of this AGREEMENT and each party holds one signed copy.

PROVIDER Organization: Faculty of Pharmacy Andalas University Complete address: Kampus Limau Manis Padang 25163 Telephone number : 0062-751-71682 Name of authorized representative: Helmi Arifin

Title: Prof. Dr.( Signature: Date: 2 July 2015

PROVIDER RESEARCHER: Name: Dian Handayani Title: Prof. Dr Signature:

Date: 2 July 2015

RECIPIENT Organization: University of Strathclyde Complete address: Research and Knowledge Exchange Services, 50 George Street, Glasgow G1 1QE, Scotland Telephone number : 0141 548 2456

Name of authorized representative: MICHAEC GANNAL Title: Signature: Maral Cumon 201 FEDTER AER 2015 Date:

7

• . \* \*

**RECIPIENT RESEARCHER :** Name: Dr. RuAngelie Edrada-Ebel Title: Dr. Signature:

Mangelee Edrada-Ehel Date: 29 Sept 2015

## APPENDIX 5 CURRICULUM VITAE CHIEF RESEARCHER AND TEAM MEMBER

### **Curriculum Vitae of Chief Researcher**

# A. Identity

1	Full Name	Prof. Dr. Dian Handayani, Apt
2	Sex	Female
3	Present Job	Dosen Fakultas Farmasi Universitas Andalas
4	NIP	196805171991032002
5	NIDN	0017056811
6	Place and Date of Birth	Bandung, 17 Mei 1968
7	E-mail Address	dianh_17@yahoo.com
8	Telephone No/Fax/HP	08126785517
9	Office Address	Kampus Limau manis, Padang 25163
10	Number Telephone / Fax	0751-777057
11	Number of Supervision graduate Student	S-1 = 70 orang; S-2 = 1 orang; S-3 = 2 orang
12	Nomor Telepon/Faks	
		1 Kimia Organik I
		2 Biokimia
13	Lecturing	3 Kimia Bahan Alam I
		4 Kimia Bahan Alam Kelautan
		5 Kimia Bahan Alam Lanjutan (S2)

### **B. Education**

	S-1	S-2	<b>S-3</b>
Name of University	Universitas Andalas	-	University of Würzburg, Germany
Field of Study	Farmasi	-	Biologi Farmasi
Year: Start-Finish	1985 - 1990	-	1994-1998
Title of Skripsi / Thesis / Dissertation	Isolasi Alkaloid Utama dari Daun <i>Phoebe rigida</i>	-	Isolation and elucidation structure of bioactive compounds from West Sumateras marine sponges
Supervisor	Prof.Dr. Dayar Arbain	-	Prof.Dr. Peter Proksch

# C. Research Experience in the Last 5 Years

			Funding	
No.	Year Title of Research		Source*	Amount (Million IDR)
1	2009	Pemanfaatan Senyawa Antibakteri Dari Spon Laut Asal Sumatera Barat Untuk Pengendalian Penyakit Layu Bakteri Pada Tanaman Jahe (Hibah Stranas)	DIKTI	80
2	2015	Endophytic bacteria and fungi with anti-microbial and anti- cancer activities isolated from West Sumatran Marine Sponge <i>Haliclona fascigera</i> (Isolation, Bioassay, Taxonomy and Phytochemical Studies), (Hibah Kerjasama Luar Negeri)	DIKTI	180
3	2016	Endophytic bacteria and fungi with anti-microbial and anti- cancer activities isolated from West Sumatran Marine Sponge <i>Haliclona fascigera</i> (Isolation, Bioassay, Taxonomy and Phytochemical Studies), (Hibah Kerjasama Luar Negeri)	DIKTI	160
4	2017	Endophytic bacteria and fungi with anti-microbial and anti- cancer activities isolated from West Sumatran Marine Sponge <i>Haliclona fascigera</i> (Isolation, Bioassay, Taxonomy and Phytochemical Studies), (Hibah Kerjasama Luar Negeri)		193
5	2016	Isolasi dan karakteriksasi Jamur Endofit Penghasil Senyawa Antibakteri dan Antikanker dari Tanaman Mangrove Sumatera Barat (Hibah riset Guru Besar universitas Andalas)		110
6	2016	2016 Isolasi dan Karakterisasi Senyawa Antimikroba Dari Jamur Simbion Spon Laut IB-01 Asal Pulau Mandeh Sumatra Barat, (Penelitian Pendidikan Magister menuju Doktor untuk Sarjana Unggul)		60
7	2016	Isolasi dan Karakterisasi Senyawa Antikanker dari Jamur Simbion Spon Laut AR-01 Asal Pulau Mandeh Sumatra Barat, (Penelitian Pendidikan Magister menuju Doktor untuk Sarjana Unggul)		60
8	2017	Isolasi dan karakteriksasi Jamur Endofit Penghasil Senyawa Antibakteri dan Antikanker dari Tanaman Mangrove Sumatera Barat (Hibah riset Guru Besar universitas Andalas)	BOPTN	110

# **D.** Community Services in the Last 5 Years

				Funding	
No	Year	Title	Source*	Amoun (Millior IDR)	

1	2013 Penggunaan dan Pengolahan Buah Mengkudu Sebagai Obat Alternatif yang Aman di Kecamatan Koto XI Tarusan Kanagaria Ampang Pulai Pesisir Selatan	n DIPA F. Farmasi Unand 5
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## E. Publikation in the Last 5 Years

No.	Title	Name of Journal	Vol. / No./ Year
1	Skrining Aktivitas Antibakteri Ekstrak Spon Laut Yang Dikoleksi Dari Perairan Pulau Tangah Sumatera Barat Terhadap Bakteri <i>Methicillin Resistant Staphylococcus aureus</i> (MRSA)	Jurnal Bahan Alam Indonesia	08/06/2013
2	Screening of Endophytic Bacteria Isolated from Marine Sponge <i>Haliclona fascigera</i> for Inhibition against Clinical Isolates of Methicillin Resistant Staphylococcus aureus (MRSA)	J App Pharm Sci	05/09/2015
3	Antimicrobial Activity of Endophytic Fungi from marine Sponge <i>Haliclona fascigera</i>	J App Pharm Sci	05/10/2015
4	Antimicrobial Activity Screening of Symbiotic Fungi from Marine Sponge <i>Petrosia nigrans</i> Collected from South Coast of West Sumatera, Indonesia	International J. Pharmacognosy and Phytochemical Research	08/04/2016
5	Isolation of endophytic bacteria from bark, leaf, and pericarp of mangosteen ( <i>Garcinia</i> <i>mangostana</i> L.) and testing of the antimicrobial activity	Research Journal of Pharmaceutical, Biological and Chemical Sciences	07/01/2016
6	Effects of scopoletin from noni fruit ( <i>Morinda citrifolia</i> L.) to IL-10 levels in male white mice with hypersensitivity type I	Research Journal of Pharmaceutical, Biological and Chemical Sciences	07/4/2016
7	In Vitro Inhibitory Activity of Ethyl Acetat Extract of Symbiotic Bacteria Isolated from the Marine Sponge <i>Haliclona fascigera</i> against Multidrug Resistant Organism (MDRO)	J App Pharm Sci	06/11/2016
8	Antibacterial and Cytotoxic Activity of Ethyl Acetate Extract of Symbiotic Fungi from	J App Pharm Sci	07/02/2017

	WestSumatraMarineSpongeAcantharongylophora ingens		
9	Antibacterial and Cytotoxic Activity of Symbiotic Fungi Extract from Marine Sponge <i>Neopetrosia chaliniformis</i> AR-01	J App Pharm Sci	07/05/2017
10	Antibacterial Activity of Endophytic Fungi Isolated from Mangrove Plant Sonneratia griffithii Kurz.	J App Pharm Sci	07/04/2017
11	Senyawa Antibiotik dari Bacillus sp1 (HA1) yang Bersimbiosis pada Spon Laut <i>Haliclona</i> <i>fascigera</i> .	Jurnal Sains Farmasi dan Klinis	03/02/2017

## F. Oral Presentation in the Last 5 Years

No	Name of Symposium	Title of Presentation	Place & Time
1	1st National Symposium and Workshop on Marine and Fisheries Biotechnology	Screening of Antioxidant Activity of Marine Sponge Extracts Collected from West Sumatera	5-6 October 2012, Semarang
2	2nd Makassar International Symposium on Pharmaceutical Science, "From Discovery of Chemical and Natural Drugs to Application in Clinical Pharmacy"	investigation of antibacterial substances from west sumatran marine sponge, <i>halicondria</i> sp	22-23 March 2013, Makassar
3	International Conference on Marine Science	Bioactive metabolite from West Sumatran Marine Sponges	4-6 June 2013, Bogor
4	The Aceh International Pharmacy Conference	Bioactivity screening of natural products from West Sumatran marine invertebrates	13-15 September, Aceh
5	The 6 <sup>th</sup> international seminar of Indonesian society for microbiology (ISISM)	Symbiotic Bacteria and Fungi from Marine Sponge <i>Petrosia nigrans</i> as a Antimicrobial Compound Source	17-18 Oktober 2013, Pontianak
6	Seminar Nasional Perkembangan Terkini Sains dan Farmasi Klinik 4, Fakultas Farmasi Universitas Andalas	PROSPEK MIKROBA ENDOFIT YANG DIISOLASI DARI SPON LAUT <i>PETROSIA NIGRANS</i> SEBAGAI SUMBER SENYAWA ANTIMIKROBA	23 April 2014, Padang
7	Invited Speaker pada Konferda IAI Sumbar	POTENSI SENYAWA KIMIA BAHAN ALAM KELAUTAN SEBAGAI SUMBER BAHAN BAKU OBAT	17 May 2014, Padang

8	The 7 <sup>th</sup> international seminar of Indonesian society for microbiology (ISISM)	Symbiotic Bacteria and Fungi from Marine Sponge <i>Petrosia nigrans</i> as an Antimicrobial Compound Source	Padang, September 2014
9	The 14th International Conference on QiR (Quality in Research)	Screening Antimicrobial Compounds Producing By Endophytic Fungi from Marine Sponge <i>Haliclona fascigera</i>	Lombok, 10-13 August 2015
10	The 4th International on Pharmacy and Advanced Pharmaceutical Sciences,	Antibacterial Compounds from <i>Staphylococcus</i> spp. (C1) Bacteria Associated with Marine Sponge of <i>Haliclona fascigera</i> .	Yogyakarta 7-8 September 2015
11	Asean Microbial Biotechnology Conference (AMBC 2016)	In Vitro Cytotoxic Activity in Extracts of Symbiotic Fungi from West Sumatran Marine Sponge Haliclona fascigera	Bali, 3 -4 August 2016
12	The 8th International Seminar of Indonesian Society for Microbiology,	Antibacterial Activity of Endophytic Fungi from West Sumatran Mangrove Plant <i>Sonneratia griffithin</i> Kurz	Jakarta, August 2016.
13	Seminar Nasional Perkembangan Terkini Sains dan Farmasi Klinik 6, Fakultas Farmasi Universitas Andalas,	Aktivitas Sitotoksik Secara In vitro dari Ekstrak Jamur Simbion Spon Laut Asal Sumatra Barat <i>Haliclona fascigera</i>	Padang, 23-24 September 2016
14	Simposium Nasional KBAI XXIV, Prodi Farmasi, Universitas Islam Indonesia,	Potensi Jamur Endofit dari Tanaman Mangrove <i>Sonneratia griffithii</i> Kurz Asal Sumatera Barat Sebagai Penghasil Senyawa Antibakteri	Yogyakarta 18-19 October 2016

## G. Book/Chapter Published

No	Title	Year	No of Page	Publisher
1	-	-	-	-

## H. Acquisition of IPRs in 5-10 Years

No	Title/ HKI Theme	Year	Туре	Number of P/ID
1	-	-	-	-

## I. Experience Formulating Public Policy / Social Engineering in the Last 5 Years

1
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### J. The award in the Last 10 Years (from government, associations or other institutions)

No	Type of Award	Institution	Year/Place
1	-	-	-

All the data I enter and listed in the biographical data is correct and legally accountable. If it turns out later on found discrepancies with reality, I could accept sanctions. Thus I created this biographical data with the actual one to meet the filing requirements in cooperation Research Grant for Foreign Affairs and International Publications.

Padang, 6 June 2017 Proposer,

01391ABF356

(Prof. Dr. Dian Handayani, Apt)

## CURRICULUM VITAE OF INTERNATIONAL PARTNER

## **EXECUTIVE SUMMARY**

### Dr. rer. nat. RuAngelie Edrada-Ebel

Strathclyde Institute of Pharmacy and Biomedical Sciences

University of Strathclyde, The John Arbuthnott Building

161 Cathedral Street, Glasgow G4 0RE, UK

Telephone: +44(0)141 548 5968

Fax: +44(0)141 552 2562

e-Mail: ruangelie.edrada-ebel@strath.ac.uk

### Qualifications

- Highly-qualified expert in marine natural product research
- All-encompassing international links to groups in marine natural product research
- Adept in European and International networking for marine biodiversity and biotechnology
- Vast experience in research management, organisation, and leadership
- Proficient skills in competent teaching and mentoring of students, fellows, and staff

### Accomplishments

- <u>Afforded a major grant funding at the European level.</u>
- Played an essential central role in strategically organising and coordinating SeaBioTech to secure the €7.5M EU-FP7 grant award. The consortium involves 14 partners from eight countries and SeaBioTech generated an income of £1.55M for SIPBS.
- Yielded a four-year funding of £620K to lead work package 5 for the natural products metabolomics group in the industry-driven SeaBioTech EU-FP7 consortium.
- Led multidisciplinary research group in Natural Products Research.
- Innovated metabolomics for the systematic discovery and production of biologically active natural products for novel drugs which won awards at the 2011 59th Medicinal Plant Research Meeting and 2012 American Society for Pharmacognosy Meeting as well as the 2012 technical program of the Biocom Congress of the Phytochemical Society of Europe.
- Authored more than 120 publications and two patents on the topic of marine natural products. Published highly cited papers resulting to an h-index of 28. Member of the editorial board for Scientific Report and Marine Drugs.
- Established the Natural Products Metabolomic group in SIPBS with 2 Postdocs, 3 PhDs, 4 regular visiting scientists from Germany, Brazil and Egypt. Lab equipment funding support acquired from **a Royal Society Award** in 2012.
- <u>Headed successful knowledge-exchange projects with Scottish SMEs for further major</u> <u>funding.</u>

• Yielded total funding of £39.7K from the Knowledge Exchange Hub and ERDF-ENCOMPASS to collaborate with Marine Biopolymers (MBL) and Bryoactives Ltd. Nominated for the 2012 Interface Excellence Award for Sustained Partnership. MBL is also a SeaBioTech partner. Secretary of the Society for Chemical Industry, Scotland Group.

#### **Curriculum Vitae**

#### **Educational Background**

1994 - 1998 (Dr. rer. Nat) Doctorate degree in Pharmaceutical Biology Magna cum Laude Julius- Maximillians-Universität Würzburg, Germany Dissertation: "Isolation and structure elucidation of bioactive secondary metabolites from Philippine marine sponges and soft corals." Adviser: Prof. Dr. Peter Proksch Date of Graduation: 18 June 1998 1989 - 1992 Master of Science degree in Pharmacy, University of the Philippines, Manila, Philippines Thesis: "The biological and chemical investigation of the colored constituents of Kokoona ochracea (Elm) Merrill (Fam. Celastraceae)." **Positions Held** 

- 2015 to date Senior Lecturer in Pharmaceutical Analysis Strathclyde Institute of Pharmacy and Biomedical Sciences Head, Natural Products Metabolomics Group
- 2009 to 2015 Lecturer in Pharmaceutical Analysis Strathclyde Institute of Pharmacy and Biomedical Sciences
- 2007 to 2009 NMR Spectroscopist and MS Spectrometrist Strathclyde Institute of Pharmacy and Biomedical Sciences
- 2005 to 2007 Research Scientist (part-time) BioMar, Düsseldorf Life Science Centre
- 2001 to 2007 Senior Research Fellow and Lecturer Institute of Pharmaceutical Biology and Biotechnology Heinrich-Heine-Universität Düsseldorf

1999 to 2001	Research Fellow (Post Doctorate), Prof P. Crews Group
	Department of Chemistry, University of California Santa Cruz
1998 to 1999	Research Fellow (Post Doctorate), Prof F. Schmitz Group
	Department of Chemistry and Biochemistry,
	University of Oklahoma

#### **Research Areas and Collaborations**

#### 2013 to date

Microbial endosymbionts from extreme environments Natural product metabolomics of fungal endophytes and marine microbial symbionts

#### 2012 to date

Metabolomics of bryozoan microbial symbionts in collaboration with Dr Joanne S Porter of the Centre for Marine Biodiversity and Biotechnology, School of Life Sciences, Heriot Watt University and Dr. Michael Winson of Bryoactives Ltd

Morphoanatomical, metabolomic and molecular studies as subsidies to the systematic of Asteraceae species with Prof Fernando De Costa, Universidade de São Paulo, Faculdade de Ciências Farmacêuticas de Ribeirão Preto (<u>http://www.asterbiochem.org/links</u>)

Marine cyanobacteria from the Colombian Coastline with Dr Freddy A Ramos, Departamento de Química en Universidad Nacional de Colombia.

Analytical Monograph of Scottish Seaweeds with Marine Biopolymers Ltd.

#### 2010 to date

- Metabolomics of sponge microbial symbionts in collaboration with Prof. Ute Hentschel of the Sponge Microbiology Group at the University of Wuerzburg
- Real Time Flux Modeling in Biopharmaceutical Bioprocessing, jointly co-funded by the BBSRC and the EPSRC, a collaborative research on metabolomics and fermentation work with Prof. Brian McNeil which also opened up further national collaborative work with Aquapharm, a medium-scale enterprise based in Oban on the cultivation of marine microorganism.
- Metagenomic approach of optimizing the production of novel antibiotics from Streptomyces in collaboration with Dr. Paul Herron and Prof. Iain Hunter
- Within the Pharmaceutical Analysis Group, there is a continuous collaboration with Dr. David Watson on the propolis project with Beevital exploring the anti-trypanosomal activity of the African collection.

Ecological implications of the production of secondary metabolites in Crustaceans and alternative application of utilizing the waste products of the by-catch in collaboration with Professor Douglas Neil, Langoustine Laboratory, University of Glasgow.

### Details of research grants and contracts (2008 to date)

### **Research Grants and Awards**

- Awarded the RMIT (Royal Melbourne Institute of Technology) FOUNDATION INTERNATIONAL VISITING FELLOWSHIP for Natural Product Metabolomics Lectureship for academic year 2017/2018 (AU\$10,000)
- CAPES (Coordination for the Improvement of Higher Education Personnel) for a shortterm Academic Exchange position under the International Programme of the University of Sao Paolo Staff Exchange on Natural Products Metabolomics at the School of Pharmaceutical Sciences (R\$40,000=£10,000). PI: Prof. Fernando Da

Costa (Sao Paolo), CI: R. Edrada-Ebel,

- Vacation Scholarship from Medical Research Scotland on Novel Antibiotics from Scottish/Arctic Sponges (£2000) Sept 2016.
- 2016-2019, ARC, with Professor Ronald Quinn, Griffith University, Escaping Bio-Assay Guided Isolation: Nature's Tools for Chemical Biology (CI: 30% of AU\$493,300 = £280,750)
- IBioIC (Industrial Biotechnology Innovation Centre): Enhanced engineering of industrial strains by combining genomics, metabolomics and transcriptomics. A collaborative project with Ingenza. £145,909 01 November 2014 to 30 November 2015, (Co-investigator with 50% ownership)
- From sea-bed to test-bed: harvesting the potential of marine biodiversity for industrial biotechnology (SeaBioTech -311932 Ares (2012)116637), Funding organisation: EU FP7 (KBBE-2012-6) which involves 14 partners from eight countries with £1,550,806.50 for SIPBS, 01 August 2012 to 31 July 2016, Total award: €7,466,716.00. Work Package Leader for WP5 (Natural Products Metabolomics) and member of the coordinating team. (Co-Investigator with Academic ownership of 40% £620,322.60)
- MARINE SYMBIONTS AND TERRESTRIAL ENDOPHYTES FOR INDUSTRIAL BIOTECHNOLOGY OF NOVEL ANTIBIOTICS, Edrada-Ebel, R., 15/03/12 to 14/03/13, 115773, £14,790, Royal Society Seed-Corn Research Grant award 2012 (Principal Investigator)
- MARINE SYMBIONTS AND TERRESTRIAL ENDOPHYTES FOR INDUSTRIAL BIOTECHNOLOGY OF NOVEL ANTIBIOTICS, Edrada-Ebel, McNeil, B., & Harvey, L. R., 1/12/11 to 31/05/12, 115756, £16,378, Korea Institute for Advancement of Technology. (Co-Investigator with 68% Academic Ownership, £11,137.04)
- Real Time Flux Modelling in Biopharmaceutical Bioprocessing. Secured joint BBSRC and EPSRC funding: with Prof. Brian McNeil, Prof.David Littlejohn, and Dr. Linda Harvey. Total project value of £ 98,380.68, (Co-investigator with 10% Academic Ownership, £9,838.08). Oct 2010 September 2011
- Investigating synergies between advanced bioprocess monitoring and production of valuable marine bioproducts. International Partnering Award from BBSRC with Prof. Brian McNeil and Dr. Linda Harvey. Total project value of funded at £15,529.00. (Co-investigator with 33% Academic Ownership, £5,124.57) March 2011 April 20

### Knowledge exchange programme

- IBioIC: Enhanced engineering of industrial strains by combining genomics, metabolomics and transcriptomics. A collaborative project with Ingenza.
- European Research Development Fund and EPSRC, through KE-Hub, Strath-Link and SULSA, Marine Biopolymers, £30,000 January 2012 to August 2013 (Principal Investigator). The collaboration was nominated for the 2012 Interface Excellence Award for Sustained Partnership.
- European Research Development Fund and EPSRC through KE-Hub, Bryoactives, £9,666.00 May to August 2012 (Principal Investigator).

### **Studentships and Placements**

- Egyptian Graduate Link for Split PhD programs since March 2013 to date (£7,500 per annum)
- Commonwealth Scholarship Placement for 12 months (£22,997.00) for Muniba Jadoon. Metabolomics of the production of secondary metabolites in taxol-producing endophytic fungi from Pakistan. Jan 2014 – Dec 2014
- SORSAS PhD Studentship for 36 months (ca. £88k) for Christina Viegelmann. Metabolomics in the production of secondary metabolites in microbial symbionts from marine sponges of the Celtic and Irish Sea. Research funding of £18,000 for bench fee under the Beaufort Marine Biodiversity Project. Oct 2010 – Oct 2013
- PhD Studentship for Ahmed Fares Tawfike on Missions Call Award from the Egyptian Education and Culture worth £118K for 48 months. Novel anti-cancer drugs from Egyptian medicinal plant endophytes. Oct 2010 Oct 2014
- EPSRC Summer Research Experience Placement 2011 funding of £1.5k for student stipend. Metabolomics of the cultivation of a marine microbial symbiont.
- BBSRC Research Experience Placement 2010 funding of £3k for student stipend and consumables. The three-month summer project involves the determination of the genetic basis of oxytetracycline productivity for *Streptomyces rimosus* through metabolomics.

1) books	1
2) publications in journals with selective editorial policy	128
3) book chapters	8
4) patents	2
5) supervised and concluded Master's dissertations	15
6) supervised and concluded Doctoral theses	7
7) number of citations received in the international scientific literature	
(Source: Web of Science, Journal Citation Report, 09 February 2017)	
Sum of the Times Cited : 305	1
Sum of Times Cited without self-citations: 291	!
Citing Articles : 2472	2
Citing Articles without self-citations : 2412	2
Average Citations per Item : 26.30	)
h-index : 30	)

### **Details of Research Publications**



#### a) Most Recent Publications

#### 2017

- (1) Zin NM, Baba MS, Zainal-Abidin AH, Latip J, Mazlan NW, **Edrada-Ebel R**. (2017). Gancidin W, a potential low-toxicity antimalarial agent isolated from an endophytic Streptomyces SUK10. Drug Design, Development and Therapy. 11, 351–363.
- (2) Bafor EE, McKenna J, Rowan EG, **Edrada-Ebel R**. (2017). Characterisation of the antiproliferative constituents and activity of *Ficus exasperata* (Vahl) on ovarian cancer cells -a preliminary investigation. Nat Prod Res. 1-5.

#### 2016

- (3) Alshaibani MM, Jalil J, Sidik NM, **Edrada-Ebel R**, Zin NM. (2016). Isolation and characterization of cyclo-(tryptophanyl-prolyl) and chloramphenicol from Streptomyces sp. SUK 25 with antimethicillin-resistant Staphylococcus aureus activity. Drug Des Devel Ther. 10: 1817-1827.
- (4) Bafor EE, Rowan EG, **Edrada-Ebel R**. (2016). Toward Understanding Myometrial Regulation: Metabolomic Investigation Reveals New Pathways of Oxytocin and Ritodrine Activity on the Myometrium. *Reprod Sci.* doi: 10.1177/1933719116667224
- (5) Kamal N, Viegelmann CV, Clements CJ, **Edrada-Ebel R**. 2016. Metabolomics-Guided Isolation of Anti-trypanosomal Metabolites from the Endophytic Fungus *Lasiodiplodia theobromae*. Planta Med. doi:10.1055/s-0042-118601
- (6) Sampaio BL, **Edrada-Ebel R**,\* Da Costa FB. (2016) Effect of the environment on the secondary metabolic profile of *Tithonia diversifolia*: a model for environmental metabolomics of plants. Sci Rep. Jul 7;6:29265. doi: 10.1038/srep29265.
- (7) Cheng C, Othman EM, Fekete A, Krischke M, Stopper H, Edrada-Ebel R, Mueller MJ, Hentschel U, Abdelmohsen UR. (2016). Strepoxazine A, a new cytotoxic phenoxazin from the marine sponge-derived bacterium Streptomyces sp SBT345. Tetrahedron Lett. 57: 4196-4199.
- (8) Purves K, Macintyre L, Brennan D, Hreggvidsson GO, Kuttner E, Asgeirsdottir ME, Young LC, Green DH, Edrada-Ebel R, Duncan KR (2016) Using Molecular Networking for Microbial Secondary Metabolite Bioprospecting. Metabolites 6 (1). doi:10.3390/metabo6010002

(9) Kamal, N., Clements, C., Gray, A. I. & Edrada-Ebel, R. (2016) Anti-infective Activities of Secondary Metabolites from *Vitex pinnata*. J App Pharm *Sci*, 6 (1), 102-106. doi:10.7324/JAPS.2016.600117

### **Organised and Chaired Conferences**

- Advisory Board Member for the 10th European Conference on Marine Natural Products (ECMNP) in Crete 2<sup>nd</sup> – 9<sup>th</sup> September 2017
- Day of Science and Careers Scotland 2016. The University of Strathclyde's impressive Institute of Pharmacy and Biomedical Sciences hosted the 2nd SCI Scotland Group Day of Science and Careers on 31 May 2016 with the theme Made in Scotland - Applied Research and Manufacturing. The event was fully booked with 64 attendees. Early career delegates (undergraduates and postgraduates) from various Scottish institutes were given the opportunity to network with scientists currently in the Scottish manufacturing industry and to listen to stimulating talks delivered by those who have experienced or are currently working in industry, SMEs and research institutes.
- A one-day free ECMNP pre-conference workshop on the 30th August 2015 was offered for the first time to 40 early career researchers. Led by SeaBioTech with support from BIOCOM AG, Berlin and PharmaSea. The aim of the workshop is to integrate and disseminate the project objectives and methodologies of five marine biotechnology FP7 consortia (MicroB3, MaCumBa, BlueGenics, PharmaSea and Seabiotech) to younger scientists involved in marine research. This was in line with the objectives of the ECMNP in promoting Marine Natural Products Research to a younger generation of scientists. Funded by EU-FP7-SeaBioTech.
- Glasgow Science Festival and Explorathon, Seabiotech, Marine Natural Products, June 2015 and September 2015
- Chair for the 9th European Conference on Marine Natural Products (ECMNP) in Glasgow 31st August -2nd September 2015
- Startup-Science Masterclasses of the Royal Society of Edinburgh to offer weekend courses on Flavours and Fragrances at the University of Aberdeen, April 2015
- Member of the Local Organising Committee for the 9th International Conference of the Metabolomics Society in Glasgow, Scotland, 1st 4th July 2013.
- Member of the Scientific Committee for the 61st International Congress of the Society for Medicinal Plants Research in Münster, Germany, 1st-5th September 2013. Chairperson for the highlight lecture for the young Scientist Award.

### **Invited Lectures**

- (1) Plenary Speaker. Natural Products Metabolomics for the Health Sciences. Environmental and Industrial Biotechnology Division, The Energy and Resources Institute (TERI), India Habitat Centre, New Delhi, 12 19 November 2016
- (2) Plenary Speaker. Using Concatenated Analytical Data for Metabolomic Guided Production and Isolation of Bioactive Natural Products. The Integration of Science, Technology and Industry on Herbal Medicine for Clinical Application International

Conference of Herbal Medicine 2016. Universitas YARSI Jakarta Jakarta, 6-7 October 2016.

- (3) Invited Lecturer. Five-day course on *Metabolomics* to the graduate students of the Pharmaceutical Sciences Graduate Program. 12 to 16 September 2016, at the School of Pharmaceutical Sciences of Ribeirao Preto, University of São Paulo, in Ribeirão Preto, SP, Brazil.
- (4) Invited Lecture. Accelerate Chemistry Challenge Programme for Secondary Schools in Scotland, August 2016
- (5) Invited Graduate Seminar Speaker: Utilisation of Metabolomics to Dereplicate the Production of Secondary Metabolites in Microbial Symbionts and Endophytes. Institute of Pharmaceutical Biology, University of Duesseldorf, 2 May 2016
- (6) Invited Lecturer. A course on Searching Active compound from Marine Organisms specifically on the application of metabolomics on marine microbial research, 20th to 24th of April 2016, La Paz, Mexico with 30 participants. Funded by the Fundacion de Farmecal de BCS, AC, Mexico.
- (7) Plenary Speaker: Utilisation of Metabolomics to Dereplicate the Production of Secondary Metabolites in Microbial Symbionts and Endophytes. The International Conference on Natural Products 2016 (ICNP2016) hosted by the Universiti Malaysia Terengganu (UMT) held in Kuala Terengganu, Terengganu from 15-17 March 2016.
- (8) Invited Lecturer. The International Conference on Natural Products 2016 (ICNP2016) Workshop, 13-14 March 2016, was offered to 20 early career researchers in the field of marine microbiology and natural products with the following themes: a) Good Practice of Sample Processing at Field for Identification/ Storage/ Extraction; b) Optimization of Extraction and Isolation Technique for Different Marine Organism from Fresh Sample to Pure Compound; c) Metabolomic Approaches to Study Natural Products from Marine Microbes. Funded by the Malaysian Natural Products Society.
- (9) Keynote Speaker: BioNat 2016, International Conference on "Biodiversity and Bioactive Natural Products For Human Welfare – 2016, a special lecture on the topic "Endozoic Microbes", 10 February 2016, Karur, Tamil Nadu, India
- (10) Invited Lecture Seminar in Marine Natural Products Metabolomics in National University of Ireland in Galway (17 and 18 February 2015)
- (11) Keynote Speaker. Metabolomic Strategies in Dereplication for Targeted Cultivation and Isolation of New Bioactive Secondary Metabolites from Fungal Endophyes and Marine Microbial Symbionts. The 7th International Seminar of the Indonesian Society for Microbiology on 13-18 October 2014 in Padang, West Sumatera.
- (12) Harnessing the potential of marine biodiversity for industrial biotechnology. SeaBioTech – Year 2 and onwards. 7<sup>th</sup> Annual European Forum for Industrial Biotechnology and the Biobased Economy. 1<sup>st</sup> October 2014, Reims, France
- (13) Collaborative Workshop Lecture. Marine Biotechnology in SeaBioTech. Hong Kong University of Science and Technology. 8<sup>th</sup> October 2014
- (14) Post-Graduate Seminar Lecture. The Application of NMR in the Health Sciences. Universiti Kebangsaan Malaysia. 1<sup>st</sup> Apr 2014.
- (15) UK-India Seminar Lecture Series. Metabolomic Strategies in Dereplication for Targeted Cultivation and Isolation of New Bioactive Secondary Metabolites from Fungal Endophyes and Marine Microbial Symbionts (Lecture 1). Department of Biotechnology Tanharil, Aizawl, Mizoram University: 15th January 2014 sponsored by the Royal Society and the Indian Department of Science and Technology.
- (16) UK-India Seminar Lecture Series. Basic NMR and MS Tools to Complex Dereplication and Metabolomic Data Sets. (Lecture 2) Department of Biotechnology Tanharil, Aizawl,

Mizoram University: 16th January 2014 sponsored by the Royal Society and the Indian Department of Science and Technology.

- (17) Post-Graduate Workshop Lecture. Basic NMR and MS Tools to Complex Dereplication and Metabolomic Data Sets. Universidade de São Paulo Faculdade de Ciências Farmacêuticas de Ribeirão Preto Laboratório de Farmacognosia 23<sup>rd</sup> April 2013 sponsored by Santander UK.
- (18) Post-Graduate Seminar Lecture. Metabolomic Strategies in Dereplication for Targeted Cultivation and Isolation of New Bioactive Secondary Metabolites from Fungal Endophyes and Marine Microbial Symbionts Universidade de São Paulo Faculdade de Ciências Farmacêuticas de Ribeirão Preto Laboratório de Farmacognosia: 20<sup>th</sup> April 2013 sponsored by ThermoFinnigan Sao Paulo.
- (19) Institute Seminar Lecture. Dereplication and Metabolomics of Plant Endophytes and Marine Microbial Symbionts. Centre for Marine Biodiversity and Biotechnology. School of Life Sciences. Heriot Watt University, 21 November 2012
- (20) Post-Graduate Seminar Lecture. The Application of NMR in the Health Sciences. PONTIFICIA UNIVERSIDAD JAVERIANA. Bogota, Colombia, 19 September 2012
- (21) Keynote Speaker. Metabolomics of Plant Endophytes and Marine Microbial Symbionts. International Conference on Exploration of Biotechnology by Student Scholars and Researchers which will be held in Bangalore, India on the 8th – 9th of June 2012 at the Shridevi Institute of Engineering and Technology (Plenary Speaker)
- (22) Dereplication and Metabolomics of Plant Endophytes and Marine Microbial Symbionts presented to the KOREAN PHARMACEUTICAL MANUFACTURERS ASSOCIATION on February 2012.
- (23) Metabolomics of Plant Endophytes and Marine Microbial Symbionts. BBSRC International Partnering Award, National Key Laboratory of Biochemical Engineering, Institute of Process Engineering, Chinese Academy of Sciences, Beijing, May 30, 2011
- (24) Screening for Novel Anti-trypanosomal Drugs through Metabolomic Tools. Seminal Workshop:,,Research Initiative on Natural Products against Neglected Diseases", Deutsch-Brasilianischen Jahres der Wissenschaft, Technologie und Innovation (DBWTI) Muenster, Germany April 26-28, 2011
- (25) Application of Metabolomics in Natural Products Research. 4th Asian Link Meeting, Duesseldorf, Germany, September 20 22, 2010
- (26) Post-Graduate Seminar Lecture. The Application of NMR in the Pharmaceutical Sciences. Faculty of Pharmacy, University of Jordan, 5th-11th July 2009.

## CURRICULUM VITAE OF MEMBERS RESEARCHER 1

## I. IDENTITAS DIRI

1.1.	Nama Lengkap (dengan gelar)	Dr.rer.nat. Triana Hertiani, M.Si., S.Si., Apt (P)
1.2.	Jabatan Fungsional/ Golongan	Lektor Kepala/ IVb
1.3.	NIP/NIDN	197306091998032003/0009067301
1.4.	Tempat dan Tanggal Lahir	Jakarta, 9 Juni 1973
1.5.	Alamat Rumah	Jl. Ki Ageng Pemanahan 43, Sorosutan,
		Yogyakarta 55162
1.6.	Nomor Telepon/Fax Rumah	0274-376166
1.7.	Nomor HP	0811286598
1.8.	Alamat Kantor	Sekip Utara, Yogyakarta
1.9.	Nomor Telepon/Fax Kantor	(+62274) 552956 / (+62274) 552956
1.10.	Alamat e-mail	hertiani@ugm.ac.id;
		triana_hertiani@ugm.ac.id
		hadna3ana@yahoo.com

### II. RIWAYAT PENDIDIKAN

2.1. Program:	<b>S1</b>	S2	<b>S</b> 3
2.2. Nama PT	UGM Yogyakarta	UGM Yogyakarta	Heinrich-Heine
			Universität
			Düsseldorf, Jerman
2.3. Bidang Ilmu	Farmasi	Ilmu Farmasi	Biologi Farmasi
2.4. Tahun Masuk	1991	1997	2004
2.5. Tahun Lulus	1996	2000	2007
2.6. Judul Skripsi/	Efek dari beberapa	Isolasi dan	Isolation and
Tesis	kombinasi ethambutol	Identifikasi	Structure
	HCl dan Rifampin	Senyawa Flavonoid	Elucidation of
	terhadap M.	Antioksidan daei	<b>Bioactive Secondary</b>
	tuberculosis H37Rv	daun Plantago	Metabolites from
	secara in vitro	major L.	Indonesian Marine
			Sponges
2.7. Nama	Dr. Achmad Purnomo,	Prof.Dr. Suwijiyo	Prof.Dr. Peter
Pembimbing	Apt.	Pramono, Apt.	Proksch

### III.BIDANG AKADEMIK: PENDIDIKAN

Tahun	Kegiatan	Keterangan
1998 – sekarang	Mengajar pada mata kuliah:	
	1. Kimia Produk Alami	S1 Farmasi UGM: Kuliah
		dan Praktikum
	2. Analisis Kimia	S1 Farmasi UGM:
	Tumbuhan Obat	Praktikum
	3. Teknologi	S1 Farmasi UGM: Kuliah
	Fitofarmasetik	dan praktikum

	4. Mikrobiologi	S1 Farmasi UGM:
	Farmasi	Praktikum
2007 – sekarang	5. Produk Suplemen	S1 Farmasi UGM: Kuliah
	6. Zat warna alami	S1 Farmasi UGM: Kuliah
2011 – sekarang	7. Galenika	S1 Farmasi UGM: Kuliah
		dan praktikum
	8. Elusidasi struktur	S1 Farmasi UGM: kuliah
	senyawa alami	
	9. Farmasi Kelautan	S1 Farmasi UGM: Kuliah
	10. Jaminan Kualitas	S1 Farmasi UGM: Kuliah
	Bahan Baku Herbal	dan praktikum
2009 – sekarang	11. Metabolit sekunder	S2 Farmasi UGM: Kuliah
	12. Fitoterapi	S2 Farmasi UGM: Kuliah
2014 – sekarang	13. Teknologi Farmasi	S2 Farmasi UGM: Kuliah
	Bahan Alam	
2015 - sekarang	14. Biologi Farmasi I	S3 Farmasi UGM: Kuliah
	15. Advanced	S3 Bioteknologi: Kuliah
	Phyotochemistry	
	16. Elusidasi struktur	S3 FKG: Kuliah
1998 – sekarang	Membimbing Skripsi S1	40 lulusan
2009 – sekarang	Membimbing Tesis S2	18 lulusan
2011 – sekarang	Membimbing Disertasi	1 lulusan

## PENELITIAN

No	o Tahun Judul Penelitian		Penda	anaan
140.	1 anun	Judui i chentrali	Sumber	Jml (Juta
				Rp)
1.	2016	Pemanfaatan kulit batang masoyi sebagai agen	DIKTI	140
		antiinfeksi pada kondisi imun tersupresi		
1.	2014-	Identification of massoia lactone and Massoia	DIKTI	280
	2015	aromatica bark exract molecular mechanism in		
		Candida albicans biofilm inhibition the		
		possibility of an immunesupressed		
		related infection treatment		
2.	2014-	Identifikasi kandungan katekin dan optimasi	DIKTI	
	2015	produksi teadenol dari ekstrak gambir dan		
		ampas teh melalui fermentasi menggunakan		
		aspergillus sp.		
2.	2014	Formula development of anticholesterol herbal	UGM	50
		drink		
3.	2014	Pacing (Costus speciosus) leaves as an	DIKTI	250
		effective and safe male contraceptive		
		standardized herbal drug		
4.	2014	Development of traditional medicine extract	Kemenkes	330
		raw materials Sambungnyawa [Gynura		
		procumbens (Lour.) Merr.] leaves		

5.	2013	Efek polisakarida buah mengkudu (Morinda	Farmasi	30
		citrifolia IL.) sebagai ko-kemoterapi	UGM	
		doxorubisin terhadap sel		
		makrofag, sel limfosit tcd8+, enzim katalase,		
	2012	sel vero, sel HeLa dan sel 14/D		100
6.	2013	Pengembangan Formula Minuman Nano-	LPPM	100
		herbal Anti-Kolesterol dari	UGM	
		Kombinasi Ekstrak Temulawak (Curcuma		
		(Comune and sumband)		
7	2012	(Gynura procumbens)		15
/.	2012-	Somut dalam Panghambatan Quorum Sansing		15
	2015	P Acruginosa	UGM	
0	2012	1. Aeruginosu Ontimesi metode isolesi polisekeride bueh	Falcultas	30
0.	2012	mengkudu (Morinda citrifolia L.) Dan efek	Fakultas	30
		imunostimulator terhadan aktivitas sel	LIGM	
		makrofag dan proliferasi sel limfosit	UUWI	
	2011	Pengaruh ketinggian tempat tumbuh dan	World Bank	50
	2011	intensitas cabava terbadan kualitas kandungan	(I-MHERE	50
9		zat aktif tumbuhan obat: Kapulaga	Project	
7.		Temulawak Kunyit dan Lengkuas koleksi	UGM)	
		hutan wanagama Kulonprogo	0.011)	
			World Bank	37.5
10	2011	Penentuan senyawa marker ekstrak Sarang	(I-MHERE	,
10.	2011	Semut	Project,	
			UGM)	
		Efek Imunomodulator Ekstrak dan Flavonoid	World Bank	50
		(3-Deoksiantosianidin) Umbi Sarang Semut	(I-MHERE	
11	2010	(Myrmecodia tuberosa dan Myrmecodia	Project,	
11.	2010	pendens) pada Tikus Galur Sprague Dawley	UGM)	
		yang Dipejani Agen Antikanker. Peneliti		
		Kedua		
	2010-	Skrining actinomycetes simbion spons laut	Insentif	250
12.	2012	sebagai produsen senyawa bioaktif anti infeksi	Riset Dasar-	
	2012		DIKTI	
13.	2010	Potensi ekstrak tumbuhan obat Indonesia	Mandiri	15
		sebagai antibiofilm	TT'1 1	25
		Eksplorasi Minyak Atsiri Sebagai Komponen	Hibah	25
14	2000	Aktif Pasta Gigi Anti Plak Berdasarkan Daya	Berkualitas	
14.	2009	Antibakteri dan Penghambatan Biofilm	Frima Fak.	
		Terhadap S. mutans	Farmasi	
		-	World Rank	50
		Effects of Shading and Fertilizer on Phylanthin		50
15.	2009	and Total Phenolic content of <i>Phylanthus niruri</i>	Project	
		planted in Inceptisol Kalitirto Sleman	LIGM)	
	2004-	Isolation and Structure Identification of	DAAD	
7.	2007	Bioactive Indonesian Marine Sponges	Jerman	
1	1 · · · ·			

## Publikasi ilmiah

No.		Tahun	Penulis	Judul Artikel Ilmiah	Volume/ Nomor	Nama Jurnal
	1.	2017	Prisci Permanasari, <u>Triana Hertiani</u> , Agustinus Yuswanto	<i>In vitro</i> Evaluation of Massoia Bark Essential Oil and C-10 Massoialactone Potency as Immunomodulator	Vol 20, 1- 9	Journal of Essential Oil Bearing Plants
	2.	2017	Sylvia Utami Tunjung Pratiwi	Efficacy of massoia oil in combination with some indonesian medicinal plants oils as anti-biofilm agent towards candida albicans	Vol. 8(5),2013- 2025	International Journal of Pharmaceutical and Sciences Research
3.	3.	2015	Sylvia Utami Tunjung Pratiwi, Ellen Louise Lagendijk, Sandra De Weert, <u>Triana</u> <u>Hertiani</u> , Rinaldi Idroes, Cornellius AMJJ Van Den Hondel	Effect of Cinnamomum burmannii Nees ex Bl. and Massoia aromatica Becc. Essential Oils on Planktonic Growth and Biofilm formation of Pseudomonas aeruginosa and Staphylococcus aureus In Vitro	8(2):1-13	International Journal of Applied Research on Natural Product
	2015	Sylvia U. T. Pratiwi, Ellen L. Lagendijk, <u>Triana Hertiani</u> , Sandra De Weert, Cornellius A. M. J. J. Van Den Hondel	Antimicrobial effects of Indonesian medicinal plants extracts on planktonic and biofilm growth of <i>Pseudomonas</i> <i>aeruginosa</i> and <i>Staphylococcus aureus</i>	7(4): 183- 191	International Journal of Pharmacy and Pharmaceutical Sciences	
	5.	2015	Ediati Sasmito, <u>Triana Hertiani</u> , Tiya Novlita Renggani, Brata Jaya Laksana	Polysaccharide-Rich Fraction of Noni Fruit ( <i>Morinda citrifolia</i> L.) as Doxorubicin Co- Chemotherapy : Evaluation on Catalase, Macrophage and TCD8+ Lymphocyte	83: 479- 488	Scientia Pharmaceutica

6.	2015	<u>Triana Hertiani,</u> Sylvia U.T. Pratiwi	HydnophytumformicarumJackEthanolExtractModulatesQuorumSensing-ControlledPathogenicityPathogenicityinPseudomonasaeruginosa	28(5): 1691-1607	Pakistan Journal of Pharmaceutical Sciences
7.	2015	Akhmad Khumaidi, <u>Triana Hertiani,</u> Ediati Sasmito	Isolasi Dan Identifikasi Senyawa Flavonoid Subfraksi Etil Asetat Myrmecodia tuberosa (non Jack) Bl	4(2): 69- 77	Online Journal of Natural Sciences
8.	2015	Akhmad Khumaidi, <u>Triana Hertiani,</u> Ediati Sasmito	Analisis Korelasi antara Efek Proliferasi limfosit dengan kandungan fenolik dan flavonoid subfraksi etil aseetat Myrmecodia tuberosa (non Jack)Bl. Secara in vitro pada mencit Balb/c	13(1): 102-107	Jurnal Ilmu Kefarmasian Indonesia
9.	2014	<u>Triana Hertiani</u>	New Hope on Drug Leads Development from Deep Ocean: Halogenated Alkaloids of Agelas Sponges	25(4):199- 222	Indonesia Journal of Pharmacy
10	2014	Hanif Nasiatul Baroroh, Iskandar Sobri, Eka Prasasti Nur Rachmani, <u>Triana Hertiani,</u> and Zullies Ikawati	Jatropha curcas leaves exert anti-arthritic activity on adjuvant- induced arthritis in rats	33(1):3-10	Universa Medicina
11	2014	Ferry Rahmapuspita, Sintayu Putri Wandan Sari, Nuri Iriyani, Sylvia Utami Tunjung Pratiwi, <u>Triana</u> <u>Hertiani</u>	Penelusuran Potensi Kapulaga, Temu Putri dan Senggugu sebagai Penghambat Pembentukan Biofilm	12(1)	Jurnal Ilmu Kefarmasian Indonesia

12	2014	David Darwis, Ediati Sasmito, <u>Triana Hertiani</u>	The effects of Hydnophytum formicaum ethanolic extract towards lymphocyte, vero and T47d cells proliferation	4 (6):103- 109	Journal of Applied Pharmaceutical Science
13	2013	Fitri Apriliany, Hady Anshory, <u>Triana Hertiani</u>	Anti Quorum Sensing Activity of Kayu Manis Leaves Extracts (Cinnamomum burmanii Ness. Ex Bl.) Against Pseudomonas aeruginosa	18(3):173- 177	Majalah Obat Tradisional
14	2013	Maria Ulfah, <u>Triana Hertiani</u> , Ediati Sasmito	Immunomodulatory compound from <i>Myrmecodia pendens</i> Merr and Perry	11(2): 167-174	Jurnal Ilmu Kefarmasian Indonesia
15	2013	Sumardi, Ediati Sasmito, <u>Triana</u> <u>Hertiani</u>	Ant plant (Myrmecodia tuberosa) hypocotyl extract modulates TCD4+ and TCD8+ cells profile of doxorubicin-induced immunesuppressed Sprague Dawley rats in vivo	81(4):105 7-1069	Scientia Pharmaceutica
16	2013	Yuli Nurulailli Efendi, <u>Triana</u> <u>Hertiani</u>	Antimicrobial potency of ant-plant extract (Myrmecodia tuberosa Jack.) against Candida albicans, Escherichia coli and Staphylococcus aureus	18(1): 53- 58	Traditional Medicine Journal
17	2012	Eko Hanuddin, <u>Triana Hertiani</u> , Bambang Sunarminto,	Effect of shading, nitrogen and magnesium fertilizer on phyllanthin and total flavonoid yield of <i>Phyllanthus niruri</i> in indonesia soil (penulis kedua dari 4 authors)	6(30): 4586-92	Journal of Medicinal Plant Research
18	2011	Dwi Prasasti, <u>Triana Hertiani</u>	Potensi Campuran Minyak Atsiri Rimpang Temulawak dan Daun Cengkeh Sebagai Inhibitor Plak Gigi	3(2): 118- 127	Jurnal Tumbuhan Obat Indonesia

19	2011	Galih Pratiwi, <u>Triana Hertiani</u> , Mufrod	Optimasi Komposisi Sukrosa dan Aspartam sebagai Bahan Pemanis pada Formula Tablet Effervescent Ekstrak Etanolik Buah Mengkudu	16/2: 43- 50	МОТ
20	2011	Rezania Panatta, <u>Triana</u> <u>Hertiani</u> , Mufrod	Formulasi Tablet <i>Effervescent</i> Ekstrak Etanolik Buah Mengkudu Menggunakan Variasi Komposisi Sumber Asam	4(2): 92- 102	Jurnal Tumbuhan Obat Indonesia
21	2011	<u>Hertiani. T</u> ., Pratiwi, S.U.T., Irianto, I.D.K., Adityaningrum, D. and Pranoto, B	Effect of Indonesian medicinal plants essential oils on <i>Streptococcus mutans</i> biofilm Pengaruh Minyak Atsiri dari Beberapa Tanaman Obat Indonesia terhadap Biofilm <i>Streptococcus mutans</i>	22(3):174- 181	Majalah Farmasi Indonesia
22	2010	Triana Hertiani, RuAngelie Edrada-Ebel, Sofia Ortlepp, Rob W.M. van Soest, Nicole J. de Voogd, Victor Wray, Ute Hentschel, Svetlana Kozitskaya, Werner E.G. Müller, Peter Proksch	From Antifouling to Biofilm Inhibition of New cytotoxic secondary metabolites from two Indonesian Agelas sponges	18: 1297- 1311	Bioorganic and Medicinal Chemistry
23	2010	<u>Triana Hertiani</u> , Sumardi, Maria Ulfah, Ediati Sasmito	Preliminary Study on Immunomodulatory Effect of Sarang-Semut Tubers (Penulis pertama dari 4 <i>authors</i> )	10(3):136- 141	Online Journal of Biological Sciences
24	2010	<u>Triana Hertiani,</u> Sylvia Utami Tunjung Pratiwi, Iramie Duma Kencana	Kaempferia galanga L. Rhizome as a potential dental plaque preventive agent	1(1): 19- 25	Indonesian Journal of Cancer Chemoprevention

		Irianto, Aini Febriana			
25	2010	Triana Hertiani, Sylvia Utami Tunjung Pratiwi, Muhammad Herianto, Aini Febriana	Effect of some selected herbal plant extracts as potential dental plaque biofilm inhibitors		Proceeding of International Conference on Medicinal Plants, UWM, Surabaya
26	2010	Marisya Ardani, Sylvia Utami Tunjung Pratiwi, Triana Hertiani	Effect of cengkeh leaves and kayu manis cortex essential oils blend as anti dental plaque	21/3: 194- 204	Indonesian journal of Pharmacy
27	2009	Triana Hertiani, RuAngelie Edrada, Rob W.M. van Soest , Sudarsono, Werner E.G., Müller, and Peter Proksch	Chemical Investigation on Indonesian Marine Sponge <i>Mycale</i> <i>phyllophila</i>	20/3: 104-111	Indonesian Journal of Pharmacy
28	2009	Triana Hertiani, RuAngelie Edrada, Rob W.M. van Soest, Werner E.G. Müller, Sudarsono, and Peter Proksch	Chemical Investigation on <i>Pseudoceratina</i> <i>purpurea</i> collected from Banyuwangi Indonesia	20/1: 17- 26	Indonesian Journal of Pharmacy
29	2009	<u>Triana Hertiani</u>	Biofouling in Agelas nakamurai sponge	Presenter	The International Conference on Pharmacy and Advanced Pharmaceutical Sciences, UGM, Indonesia
30	2008	Triana Hertiani, RuAngelie Edrada-Ebel, Michael Kubbutat, Rob W.M. van Soest, and Peter Proksch	Protein Kinase Inhibitors from Indonesian Sponge Axynissa sp.	19(2): 78- 85	Indonesian Journal of Pharmacy

31 2	2008	Triana Hertiani,RuAngelieEdrada,RobW.M.vanSoest,Sudarsono,andPeter Proksch	Isolation and Structure Identification of New Alkaloids from the Sponge <i>Rhabdastrella</i> <i>rowi</i>	19(3): 128-136	MFI
32 2	2008	I'anatun Nihlati A, Abdul Rohman, <u>Triana</u> <u>Hertiani</u>	Daya antioksidan ekstrak etanol rimpang temu kunci [ <i>Boesenbergia</i> <i>pandurata</i> (Roxb.) Schlecth] dengan metode penangkapan radikal bebas DPPH (1,1-difenil-2- pikrilhidrazil)	13(45)	Majalah Obat Tradisional (MOT)
33 2	2004	Astuti,P.,Alam,G.,Pratiwi,ST.,Hertiani,T.,Wahyuono, S.,	Screening of Anti- infectious Compounds of Sponges Collected from Bunaken, Manado	Vol VIII(2): 47-52	Biota

No.	Tahun	Judul Artikel Ilmiah	Volume/ Nomor	Nama Jurnal	Status
1.	2017	<i>In vitro</i> Evaluation of Massoia Bark Essential Oil and C-10 Massoialactone Potency as Immunomodulator (Penulis kedua dari tiga orang, <i>corresponding author</i> )	Vol 20, pp 1-9	Journal of Essential Oil Bearing Plants	International Scopus
1.	2016	Potency of Massoia Bark in Combating Immunosuppressed- related Infection (Penulis pertama dari empat orang, <i>corresponding author</i> )	12(Suppl3) S363-370	Pharmacognosy Magazine	Internasional Scopus
2.	2016	Immunomodulatory Effect of Massoia Bark Extract and the Cytotoxicity Activity Against Fibroblast and Vero Cells in Vitro (Penulis kedua dari tiga orang, <i>corresponding author</i> )		<b>Conference</b> <b>Proceedings</b> International Journal of Pharmaceutical and Clinical Research	Internasional Scopus

3.	2016	A Novel Reversed Phase High Performance Liquid Chromatography Method To Accurately Determine Low Concentrations Of Curcumin In Rat Plasma (Penulis kelima dari enam orang)		<b>Conference</b> <b>Proceedings</b> International Journal of Pharmaceutical and Clinical Research	Internasional Scopus
4.	2016	Pyrophen Produced by Endophytic Fungi Aspergillus sp Isolated from Piper crocatum Ruiz & Pav Exhibits Cytotoxic Activity and Induces S Phase Arrest in T47D Breast Cancer Cells (Penulis kelima dari lima orang)	17(2): 615- 618	Asian Pacific Journal of Cancer Prevention	Internasional Scopus
5.	2016	DPPH radical scavenging activity, total phenolics and flavonoids of water soluble extracts derived from leaves and fruit of <i>Ficus carica</i> L. and <i>Ficus parietalis</i> Bl. (Penulis kedua dari dua orang, <i>corresponding author</i> )	21(2): 86- 92	Traditional Medicine Journal	Nasional terakreditasi
6.	2016	Optimization of ethanol-water composition as extraction solvent in producing sambung nyawa ( <i>Gynura</i> <i>procumbens</i> (Lour.) Merr. ) leaves dry extract (Penulis kedua dari dua orang, <i>corresponding author</i> )	21(1)	Traditional Medicine Journalq	Nasional terakreditasi
7.	2015	Effect of Cinnamomum burmannii Nees ex Bl. and Massoia aromatica Becc. Essential Oils on Planktonic Growth and Biofilm formation of <i>Pseudomonas aeruginos</i> a and <i>Staphylococcus aureus In Vitro</i> (Penulis kelima dari enam orang)	8(2):1-13	International Journal of Applied Research on Natural Product	Internasional Scopus
8.	2015	Antimicrobial effects of Indonesian medicinal plants extracts on planktonic and biofilm growth of <i>Pseudomonas aeruginosa</i> and <i>Staphylococcus aureus</i> (Penulis kelima dari enam orang)	7(4): 183- 191	International Journal of Pharmacy and Pharmaceutical Sciences	Internasional Scopus
1.	2015	Polysaccharide-Rich Fraction of Noni Fruit ( <i>Morinda citrifolia</i> L.) as Doxorubicin Co-Chemotherapy : Evaluation on Catalase, Macrophage and TCD8+ Lymphocyte (Penulis kedua dari empat orang)	83: 479- 488	Scientia Pharmaceutica	Internasional Scopus

		<i>Hydnophytum formicarum</i> Jack Ethanol Extract Modulates Quorum	28(5).	Pakistan Journal	Internasional Scopus
2.	2015	Sensing-Controlled Pathogenicity in <i>Pseudomonas aeruginosa</i> (Penulis kesatu dari dua orang, <i>corresponding author</i> )	28(5): 1691-1607	of Pharmaceutical Sciences	
3.	2014	New Hope on Drug Leads Development from Deep Ocean: Halogenated Alkaloids of Agelas Sponges (Penulis tunggal)	25(4):199- 222	Indonesia Journal of Pharmacy	Nasional terakreditasi
4.	2014	Jatropha curcas leaves exert anti- arthritic activity on adjuvant- induced arthritis in rats (Penulis keempat dari lima orang)	33(1):3-10	Universa Medicina	Nasional terakreditasi
5.	2014	Penelusuran Potensi Kapulaga, Temu Putri dan Senggugu sebagai Penghambat Pembentukan Biofilm (Penulis kelima dari lima orang, <i>corresponding author</i> )	12(1)	Jurnal Ilmu Kefarmasian Indonesia	Nasional terakreditasi
6.	2014	The effects of Hydnophytum formicaum ethanolic extract towards lymphocyte, vero and T47d cells proliferation (Penulis ketiga dari tiga orang, <i>corresponding author</i> )	4 (6):103- 109	Journal of Applied Pharmaceutical Science	Internasional Scopus
7.	2013	Anti Quorum Sensing Activity of Kayu Manis Leaves Extracts (Cinnamomum burmanii Ness. Ex Bl.) Against Pseudomonas aeruginosa (Penulis ketiga dari tiga orang, <i>corresponding author</i> )	18(3):173- 177	Majalah Obat Tradisional	Nasional
8.	2013	Immunomodulatory compound from <i>Myrmecodia pendens</i> Merr and Perry (Penulis ketiga dari tiga orang)	11(2): 167- 174	Jurnal Ilmu Kefarmasian Indonesia	Nasional terakreditasi
9.	2013	Ant plant (Myrmecodia tuberosa) hypocotyl extract modulates TCD4+ and TCD8+ cells profile of doxorubicin-induced immunesuppressed Sprague Dawley rats in vivo (Penulis ketiga dari tiga orang, <i>corresponding author</i> )	81(4):1057 -1069	Scientia Pharmaceutica	Internasional Scopus
11.	2013	Antimicrobial potency of ant-plant extract ( <i>Myrmecodia tuberosa</i> Jack.) against Candida albicans, Escherichia coli and Staphylococcus aureus (Penulis kedua dari tiga orang,	18(1): 53- 58	Traditional Medicine Journal	Nasional

		corresponding author)			
12.	2012	Effect of shading, nitrogen and magnesium fertilizer on phyllanthin and total flavonoid yield of <i>Phyllanthus niruri</i> in Indonesia soil (Penulis keempat dari empat orang)	6(30): 4586-92	Journal of Medicinal Plant Research	Internasional Scopus

## PENGABDIAN KEPADA MASYARAKAT

No.	Tahun	Judul Pengabdian Kepada Masyarakat	Pendanaan	
			Sumber	Jml (Juta Rp)
1.	2010-	PIC kegiatan KKN PPM dan TOT di Kec.	I-MHERE Project	132
	2012	Berbah Sleman		
2.	2010-	PIC kegiatan Workshop dan Exhibition GACP	I-MHERE Project	63
	2012	obat tradisional		
3.	2010-	PIC Kegiatan Empowering farmers	I-MHERE Project	190
	2012			
4.	2011-	Sosialisasi program pascasarjana ilmu farmasi	Pascasarjana Ilmu	30
	2012		Farmasi UGM	
5	2013	TOT Obat tradisional untuk kader di	Pascasarjana Ilmu	8
		Tawangmangu	Farmasi UGM	
6	2013	Buku saku pengabdian masyarakat	BOPTN	
7	2013	Kegiatan Penyuluhan Rutin di Puskesmas	Fakultas Farmasi	
		Srandakan di Dusun Polosiyo, Srandakan	UGM	
		Bantul		
8	2013	Kegiatan Penyuluhan Suplemen Herbal untuk	PSKK UGM	
		Kesehatan dan kecantikan pada pertemuan		
		Dharma Wanita Persatuan LPPM UGM		
9	2013	Penyuluhan dan Edukasi Penyakit Hipertensi	Fakultas Farmasi	
		dan Asam Urat	UGM	
10	2013	Penyuluhan Pengolahan Obat Tradisional/	Fakultas Farmasi	
		Herbal Kosmetik di Pedukuhan Gerso,	UGM	
		Trimurti Srandakan Bantul		
11	2014	Penyuluhan tentang obat dan obat tradisional	Pascasarjana Ilmu	4
		di Magelang dan Sleman	Farmasi UGM	
12	2014	Sosialisasi program pascasarjana ilmu farmasi	Pascasarjana Ilmu	6
		di Surabaya dan Banjarmasin	Farmasi UGM	
13	2014	Pelaksana Hibah Pemanfaatan Hasil Penelitian	LPPM UGM	25
		dan Penerapan Teknologi Tepat Guna TA		
		2014: Pemberdayaan Masyarakat Petani Gama		
		Herbal melalui Teknologi Optimalisasi		
		Budidaya Tanaman dan Pascapanen untuk		
		Peningkatan Produktif Senyawa Bioaktif		
14	2014	Pemberdayaan Masyarakat Petani Gama	S2 Farmasi UGM	2
		Herbal melalui Teknologi Optimalisasi		

		Budidaya Tanaman dan Pascapanen untuk Peningkatan Produktif Senyawa Bioaktif		
15	2014	Pembuatan media audio visual: "Siapa itu Apoteker?" kegiatan pengabdian masyarakat Program Studi S2 Ilmu Farmasi UGM	Se Ilmu Farmasi UGM	
16		Penyuluhan penggunaan obat over the counter (OTC), obat herbal, pengenalan HIV/AIDS dan pemeriksaan kesehatan di Dukuh Tutup Duwur, Magelang dan Dukuh Sinduharjo, Sleman	S2 Ilmu Farmasi UGM	
17	2015	Apoteker Cilik Sekolah sebagai Kader Kesehatan Sadar Obat dan Makanan Sehat Sejak Usia Dini	LPPM UGM	50
18	2015	Sebagai Kontributor (Penulis) pada Harian Tribun Jogja dengan judul: "Mengenal Lebih Dekat Omega 3 dan Omega 6"	Farmasi UGM	
19	2015	Sebagai Narasumber pada Kegiatan Siaran Radio Mengenai Serba Serbi Obat Herbal di Radio Swaragama	Farmasi UGM	
20	2016	Optimalisasi program Apoteker Cilik sebagai sarana pengenalan Green Medicine	LPPM UGM	25
21	2016	Pemanfaatan daun cengkeh, sereh, dan daun jeruk purut sebagai anti nyamuk: pembinaan produksi obat nyamuk bakar dan larvasida pada masyarakat desa Purwobinangun, Pakem, Sleman, Yogyakarta	LPPM UGM	20
22	2016	Sebagai Pembimbing Kegiatan Pengabdian Masyarakat Pengenalan Peran Farmasis Remaja dalam Swamedikasi di SMK Kesehatan Pelita Bangsa, Bantul, Yogyakarta	S2 Ilmu Farmasi UGM	2
23	2016	Pelatihan Pembuatan Minuman Wedang Uwuh Celup Terhadap kelompok herbal Mahkota Daun di Imogiri kegiatan pengabdian masyarakat Program Studi S2 Ilmu Farmasi UGM	S2 Ilmu Farmasi UGM	2

## PENGALAMAN KEPEMIMPINAN DAN MANAJERIAL

Masa jabatan	l	Jabatan		SK			
04-01-2016	s/d	Ketua D	epartemen	SK	Rektor	UGM	No.
03-01/2021		Biologi Farmasi	, Fakultas	3/UN1	/P/SK/Huko	or/2016	
		Farmasi UGM					
01-02-2013	s/d	Ketua Program	Studi S2	Dekan	Fakultas Fa	armasi UGI	M No.
2016		Ilmu Farmasi,	Fakultas	UGM/I	FA/362/UM	[/01/39	
		Farmasi UGM					

01-10-2009 s/d 2013	Koordinator Program S2 Farmasi Sains, Fakultas Farmasi UGM	SK Rektor 496/P/SK/HT/2009	UGM	No.
2003 s/d 2004	Sekretaris Bagian Biologi Farmasi, Fakultas Farmasi UGM	SK Rektor 119/P/SK/KP/2003	UGM	No.

## JEJARING AKADEMIK

Tahun	Mitra	Jenis kegiatan
2014 2015		
2014-2015	Prof. C.A. M.J.J. van Den	Kerjasama penelitian (Hibah KLN)
	Hondel	
	Institute Biology Leiden,	
	University of Leiden,	
	Belanda	
2016	Prof. Dr. Evamarie Hey-	Pertukaran staff edukatif (Erasmus +)
	Hawkins Institute for Increanie	
	Chamistary University	
	Laingia	
	Leipzig	
2015 2016	Drof Dr. Dion Handayani	Kaniagama papalitian (IIIbah KI N)
2013 - 2010	Fior. Dr. Dian Handayani	Kerjasama penentian (HIDan KLIN)
	Fakultas Farmasi	
	Universitas Andalas	
	Indonesia Dr. Eluci Markaidale 7	
	Dr. Elmi Nurnaidan Z	
	Fakultas Budidaya	
	Perairan, Universitas	
	Hasanuddin, Indonesia	
	dan	
	Prof.Dr. Peter Proksch	
	Universitas Heinrich-	
	Heine, Duesseldorf	
	Jerman	
2013 - 2014	Wiwin Herdwiani MSc.,	Kerjasama bidang penelitian
	Apt dan Fransiska	(PEKERTI)
	Leviana M.Sc., Apt.,	
	Fakultas Farması	
	Universitas Setia Budi,	
	Surakarta, Indonesia	
2012 - 2013	Hanif Nasiatul Baroroh	Kerjasama bidang penelitian
	M.Sc., Apt.,	(PEKERTI)
	Iskandar Sobri S.SI.,	

	M.Biotech		
	Fakultas	Farmasi	
	Universitas	Soedirman,	
	Purwokerto,		
	Indonesia		
1997 – sekarang			Anggota Asosiasi Profesi: ISFI
			(Ikatan Sarjana Farmasi Indonesia)
			kemudian berganti menjadi IAI
			(Ikatan Apoteker Indonesia)
2016			Anggota PERMI (Persatuan
			Mikrobiologi Indonesia)
2009 – sekarang			Anggota Society for Medicinal Plant
_			and Natural Product Research
2008 – sekarang			Anggota Indonesian Society for
_			Cancer Chemoprevention
2007 – sekarang			Anggota DAAD Alumni

Semua data yang saya isikan dan tercantum dalam biodata ini adalah benar dan dapat dipertanggungjawabkan Bilamana di kemudian hari ditemukan ketidaksesuaian dengan pernyataan ini, maka saya bersedia dituntut dan diproses sesuai dengan ketentuan yang berlaku. Demikian biodata ini saya buat dengan sebenarnya untuk memenuhi salah satu persyaratan pengajuan Penugasan Penelitian Kerja Sama Luar Negeri.

Yogyakarta, 6 Juni 2017 Anggota Pengusul,

(Dr.rer.nat. Triana Hertiani, M.Si., Apt) NIP197306091998032003
#### **CURRICULUM VITAE OF MEMBERS RESEARCHER 2**

#### A. Identitas Diri

1.	Nama Lengkap	Dr. Trina Ekawati Tallei		
2.	Jenis Kelamin	Perempuan		
3.	Jabatan Fungsional	Lektor Kepala		
4.	NIP	19660508 199512 2001		
5.	NIDN	0008056604		
6.	Tempat dan Tanggal Lahir	Manado 8 Mei 1966		
7.	E-mail	trinatallei@yahoo.com		
8.	Nomor Telepon/HP	082195228666		
9.	Alamat Kantor	FMIPA UNSRAT, Jl. Kampus UNSRAT Manado 95115		
10.	Nomor Telepon/Fax	0431-8895310 / 0431-853715		
11.	Lulusan yang Telah Dihasilkan	S-1 = 20 orang, S-2 = 1 orang S-3 = -		
12.	Mata Kuliah yang Diampu	<ol> <li>Genetika Konservasi</li> <li>Genetika Molekuler</li> <li>Bioinformatika</li> <li>Rekayasa Genetika</li> <li>Biologi Molekuler</li> <li>Biologi Sel</li> <li>Genetika</li> <li>Biologi Dasar</li> <li>Metode Penelitian Biologi</li> </ol>		

### B. Riwayat Pendidikan

	<b>S1</b>	S2	<b>S</b> 3
Nama PT	ITB	ITB	UNSRAT
Bidang Ilmu	Biologi	Genetika dan	Entomologi (Molekuler)
		Biologi	Riset di Universitas

		Molekuler	Goettingen Jerman
		(Riset di	
		Universitas	
		Kanazawa	
		Jepang)	
Tahun Masuk -	1984 -1989	1998 -2001	1996 - 2010
Lulus			
Judul	Perbandingan	Plasmid GT704	Gen-gen yang Berfungsi
Skripsi/Tesis/	Efektivitas Bacamid	pada	Secara Biologis dan
Disertasi	dan Biosid pada	Paramecium	Molekuler pada
	tanah yang	caudatum	Perkembangan Kelenjar
	Terinfestasi dengan		Bau Tribolium
	Pseudomonas		castaneum
	solanacearum		
Nama	Dra. Arbajah	Dr. Maelita	Prof. Dr. Joutje Warouw
Pembimbing/	Siregar	Moeis	Prof. Dr. Inneke
Promotor		Dr. Hiroshi	Rumengan
		Endoh	Prof. Dr. Ernst Wimmer
		(Kanazawa	(Uni. Goettingen
		University Japan)	Jerman)

#### C. Pengalaman Penelitian dalam 5 Tahun Terakhir

No.	Tahun	Judul Penelitian	Per	ndanaan
			Sumber	Jml (Juta Rp)
1	2011	Eksplorasi Khitin dan Khitosan dari	Program	100.000.000
		Zooplankton Laut serta Karakterisasi Sifat	Insentif	
		Kimia-Fisika dan Farmasetika sebagai	Riset Dasar	
		Sediaan Farmasi (Anggota peneliti)	Ristek	
2	2014	Barcode DNA Myristica Fragrans	Mandiri	
3	2015	Pengembangan Model Pengelolaan Taman	PUPT	112.500.000
		Hutan Raya Gunung Tumpa Sulawesi	Tahun I	
		Utara Berdasarkan Kajian Potensi		
		Biodiversitas dan Aspek Sosial Sebagai		
		Pusat Pendidikan dan Pariwisata Alam		
4.	2015	Analisis Filogenetik Molekuler Capung	DIPA	42.000.000
		(Ordo: Odonata) di Taman Nasional	Unsrat	
		Bogani Nani Wartabone, Sulawesi Utara		
5.	2015	DNA polymerase Mtplasmid Paramecium	Mandiri	
		caudatum		

6.	2016	Pengembangan Model Pengelolaan Taman	PUPT	130.000.000
		Hutan Raya Gunung Tumpa Sulawesi	Tahun II	
		Utara Berdasarkan Kajian Potensi		
		Biodiversitas dan Aspek Sosial Sebagai		
		Pusat Pendidikan dan Pariwisata Alam		
7.	2016	Tinjauan Klasifikasi Syzygium sp.	Riset	30.000.000
			Unggulan	
			Universitas	
8.	2017	Pengembangan Model Pengelolaan Taman	PUPT	260.000.000
		Hutan Raya Gunung Tumpa Sulawesi	Tahun III	
		Utara Berdasarkan Kajian Potensi		
		Biodiversitas dan Aspek Sosial Sebagai		
		Pusat Pendidikan dan Pariwisata Alam		

#### D. Pengalaman Pengabdian kepada Masyarakat dalam 5 Tahun Terakhir

No.	Tahun	n Judul Pengabdian Kepada Masyarakat Pendanaan		ndanaan
			Sumber	Jml (Juta Rp)
1.	2012	Pelatihan Survei dan Inventarisasi Fauna bagi Kelompok Pencinta Alam Kota Bitung (IbM Pencita Alam Kota Bitung)	DIKTI	40.000.000
2.	2012	IbM Kelurahan Pakowa Kecamatan Wanea Kota Manado Dalam Pembuatan LubangBiopori Sebagai Teknologi Tepat Guna Untuk Mencegah Banjir	DIPA	10.000.000
3.	2013	Penyuluhan Pemanfaatan Lahan Pesisir Bagi Kesejahteraan Nelayan di Desa Likupang,	FMIPA	10.000.000
4.	2013	IbM Masyrakat Lokal Pemandu Wisata Alam	Dikti	40.000.000
5.	2014	Sosialisasi Biodiversitas Dan Konservasi di Kota Bitung kepada Guru dan Siswa Sekolah Sekota Bitung dalam Rangka Peringatan Hari Cinta Puspa dan Satwa Nasional pada tanggal 5 November 2014	FMIPA	10.000.000

6.	2014	Sosialisai FMIPA Unsrat dan seleksi siswa calon peserta workshop penggunaan DNA Barcoding untuk Identifikasi Spesies	FMIPA	10.000.000
7.	2015	Ipteks Bagi Masyarakat: Kelompok Siswa SD dalam Rangka Pengenalan Satwa Endemik Sulawesi di SDN 70 Manado	DIPA Unsrat	10.000.000
8.	2016	IbM Pekarangan Hijau Berbasis Hidroponik di Kampung Jawa Tondano	DRPM Dikti	30.000.000

#### E. Publikasi Ilmiah dalam Jurnal dalam 5 Tahun Terakhir

No.	Judul Artikel Ilmiah	Nama Jurnal	Volume/Nomor/Tah
			un
1	IndigenousKnowledgeofMinangkabauCommunityintheConservationofLocalPlantGeneticDiversity </td <td>Pacific Journal., Regional Board of Research – North Sulawesi.</td> <td>3/7/2012</td>	Pacific Journal., Regional Board of Research – North Sulawesi.	3/7/2012
2	The yield, nitrogen content, and dye's binding capacity of chitin and chitosan of rotifer Brachionus rotundiformis	Aquatic Science & Management.	Special Edition I/2013
3	Variasi genetik tanaman tomat dari beberapa tempat di Sulawesi berdasarkan gen <i>matK</i>	Pharmacon	2/4/2013
4	Local Community-based Initiatives of Waste Management Activities on Bunaken Island in North Sulawesi, Indonesia.	Research Journal of Environmental and Earth Sciences	5/12/2013
5	Structural Characteristics of Chitin and Chitosan Isolated from the Biomass of Cultivated Rotifer, <i>Brachionus rotundiformis</i>	International Journal of Fisheries and Aquatic Sciences	3/1/2014
6	Density of Tangkasi ( <i>Tarsius</i> spectrum) Population and Development of Population Estimation Method Based on Duet Call at Tangkoko-Batuangus Nature Reserve, North Sulawesi	Current Research Journal of Biological Sciences	6/1/2014
7.	Kelimpahan Populasi Capung Jarum (Zygoptera) di Kawasan Taman Nasional Bogani Nani Wartabone	Jurnal Bioslogos	4/2/2014

0	DNA Deresding of Congiles Nutmag	IIAVATI Low al of	22/1/2015
ð.	DINA Barcoding of Sangine Nutmeg	HATAII Journal of	22/1/2015
	(Myristica fragrans) using matK	Biosciences	
	Gene	(terindeks Scopus)	
9.	Variasi Genetik Troides helena	Journal MIPA	4/2/2015
	(Lepidoptera: Papilionidae)	UNSRAT ONLINE	
	Berdasarkan Gen COI (Cytochrome C		
	Oxidase I).		
10.	Putative DNA-dependent RNA	HAYATI Journal of	11/4/2016
	polymerase in Mitochondrial Plasmid	Biosciences	
	of Paramecium caudatum stock	(terindeks Scopus)	
	GT704		
11.	Biodiversity Assessment of Mt.	Asian Journal of	6/2/2015
	Tumpa Forest Park, North Sulawesi,	Biodiversity	
	Indonesia	(terindeks Thomson	
		Reuter)	
12.	Effects of arbuscular mycorrhiza	Asian J. of Microb.	11/2016
	inoculation on length, leaf number	Biotech. Env. Sc.	
	and flowering of Arachis pintoi	(terindeks Scopus)	
13.	Sequence Variation and Phylogenetic	Bioscience Research	12/2016
	Analysis of Sansevieria trifasciata	(terindeks Scopus)	
	(Asparagaceae)		
14.	Sequence Analysis of the Cytochrome	Makara J.	03/2017
	C Oxidase Subunit I Gene of	Biosciences	
	Pseudagrion pilidorsum (Odonata:	(terindeks Thomson	
	Coenagrionidae)	Reuter)	

#### F. Pemakalah Seminar Ilmiah (Oral Presentation) dalam 5 Tahun Terakhir

No.	Nama Pertemuan Ilmiah/	Judul Artikel Ilmiah	Waktu dan Tempat
	Seminar		
1	International Alumni	Local Wisdom of	The Carl von Ossietzky
	Seminar in Water, Energy	Danowudu Community in	University Oldenburg,
	and Sanitation	Preserving Forest as a	Germany 2-12 April
	in Urban and Decentralised	Water Source for the City	2014
	Regions	of Bitung	
2	Semiar Nasional FMIPA	Biodiversity Assessment	FMIPA Unsrat
		of Mt. Tumpa Forest Park	Manado, Agustus 2015
3	Seminar Nasional Pertanian	Potensi Biodiversitas	Fakultas Pertanian
		Gunung Tumpa Sebagai	Unsrat Manado, 26
		Basis Ketahanan Pangan	April 2016
		_	
4.	International Conference on	Phylogenetic Analysis of	Indonesian
		Bird Found in Mt. Tumpa	Biodiversity

	Biodiversity	Forest Park	Association, Bandung 28-29 Mei 2016
5.	Seminar Nasional Strategi	DNA Barcode untuk	Kementerian
	Nasional dan Rencana Aksi	mendeteksi Jenis Asing	Lingkungan Hidup, 10
	Pengendalian Jenis Asing	Invasif	Agustus 2016
	Invasif di Indonesia		
6.	Asean Microbial	Sequence Analysis NS5	Denpasar, 2-4 August
	Biotechnology Conference	of Dengue Virus Serotype 2	2016
7.	Workshop on Bioinformatics	Sequence Analysis of	Al Azhar Jakarta, 13-
		Syzygium	15 September 2016

#### G. Karya Buku dalam 5 Tahun Terakhir

No.	Judul Buku	Tahun	Jumlah	Penerbit
			Halaman	
1	Foods in Thanksgiving Tradition of the Mnahasan in North Sulawesi	2017		(Book Chapter) Kassel University Germany
2	Biodiversitas Gunung Tumpa	2016		Penerbit UNSRAT Press
3	MekanismeDetoksikasiMolekulerTriboliumcasaneum	2016		Penerbit UNSRAT Press
4	Epigenetik	2015		Penerbit UNSRAT Press
5	Biologi Sel untuk Farmasi dan Kedokteran	2014		Penerbit STAIN Manado Press. ISBN 978-602-14812- 7-1
6	Seni Berpikir.	2013		Penerbit STAIN Manado Press. ISBN: 978-602-14812- 6-4.
7	Local Wisdom of Danowudu Community in Preserving Forest as a Water Source in City of Bitung. In: Climate Change Management: Climate Change and Sustainable Use of Water Resources	2012		(Book chapter) Penerbit Springer-Verlag Jerman

# H. Penghargaan dalam 10 tahun Terakhir (dari pemerintah, asosiasi atau institusi lainnya)

No.	Jenis Penghargaan	Institusi Pemberi Penghargaan	Tahun
1	Finalis Dosen Berprestasi Tingkat Universitas Sam Ratulangi 2010	Unsrat	2010
2	Millenium Development Goal Awards	Kementerian Lingkungan Hidup	2013

Semua data yang saya isikan dan tercantum dalam biodata ini adalah benar dan dapat dipertanggungjawabkan secara hukum. Apabila di kemudian hari ternyata dijumpai ketidak-sesuaian dengan kenyataan, saya sanggup menerima sanksi. Demikian biodata ini saya buat dengan sebenarnya untuk memenuhi salah satu persyaratan pengajuan Penugasan Penelitian Kerja Sama Luar Negeri.

Manado, 21 April 2017 Anggota Pengusul,

AEF0927

(Dr. Trina Ekawati Tallei, MSi)

#### **APPENDIX 6 A STATEMENT OF CHIEF RESEARCHER**



## KEMENTERIAN RISET, TEKNOLOGI DAN PENDIDIKAN TINGGI UNIVERSITAS ANDALAS

LEMBAGA PENELITIAN DAN PENGABDIAN KEPADA MASYARAKAT (Institute for Research and Community Service)

Gedung Rektorat Lantai II Kampus Limau Manis, Padang 25163 Telp./Faks.: 0751-72645, Alamat e-mail: lppm.unand@gmail.com sekretariat lppm@unand.ac.id

#### SURAT PERNYATAAN KETUA PENGUSUL

Yang bertanda tangan di bawah ini:

Nama: Prof. Dr. Dian Handayani, Apt.NIDN: 00-1705-6811Pangkat / Golongan: IVcJabatan Fungsional: Guru Besar

Dengan ini menyatakan bahwa proposal saya dengan judul:

"Marine Invertebrate Derived Fungi for Industrial Biotechnology of Antibiotics and Anticancers (Isolation, Bioassay, Taxonomy, Phytochemical and Metabolomic Studies)"

yang diusulkan dalam skim penelitian Kerja Sama Luar Negri untuk tahun anggaran 2018 bersifat original dan belum pernah dibiayai oleh lembaga/sumber dana lain.

Bilamana di kemudian hari ditemukan ketidak sesuaian dengan pernyataan ini, maka saya bersedia dituntut dan diproses sesuai dengan ketentuan yang berlaku dan mengembalikan seluruh biaya penelitian yang sudah diterima ke kas negara.

Demikian pernyataan ini dibuat dengan sesungguhnya dan dengan sebenar-benarnya.

Mengetahui, Ketua Lembaga Penelitian dan Pengabdian Universitas Andalas



(Dr. –Ing. Uyung Gatot S. Dinata) NIP. 196607091992031003 Padang, 8 Juni 2017

Yang menyatakan,

(Prof. Dr. rer. nat. Dian Handayani, Apt.) NIP.196805171991032002