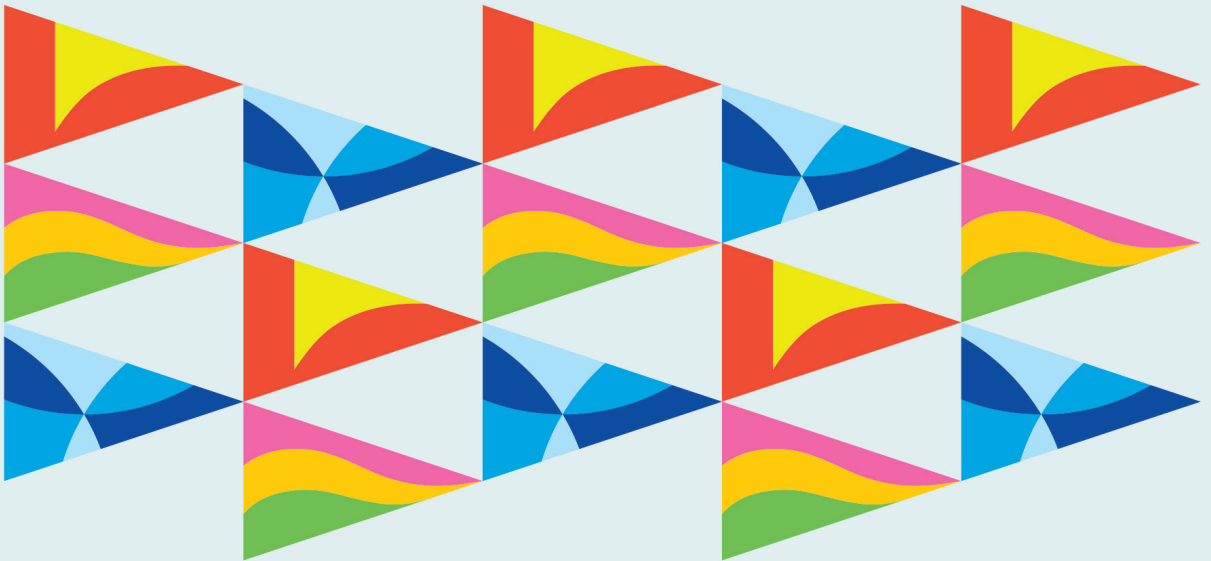




PRESENTATION CEREMONY

JAKARTA, THURSDAY, FEBRUARY 12, 2026

THE 31st PRESENTATION CEREMONY

HOTEL MULIA SENAYAN JAKARTA, 30 JANUARY 2025



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CEREMONY PROGRAM

32nd ITSF PRESENTATION CEREMONY

09.30 - 09.59	VVIP, Board of Directors and Selection Committee are meeting in VIP Room All the guests are waiting in Ballroom
10.00 - 10.05	Opening Ceremony
10.06 - 10.10	Speech by Dr. Laksana Tri Handoko Chairman of Indonesia Toray Science Foundation
10.11 - 10.15	Speech by HE Mr. Mitsuru Myochin Chargé d'Affaires ad interim Japan to Indonesia.
10.16 - 10.20	Speech by Prof. Brian Yulianto, S.T, M.Eng., Ph. D Minister of Higher Education, Research and Technology of Republic Indonesia
10.21 - 10.25	Speech by Prof. Abdul Mu'ti Minister of Primary & Secondary Education of Republic Indonesia
10.26 - 10.30	Speech by Mr. Akihiro Nikkaku Chairman of Toray Industries, Inc., Japan
10.31 - 10.36	Report from Herwindo Haribowo, Ph. D Chairman of Selection Committee on Science Education
10.37 - 10.42	Report from Dr. Ernawati Arifin Giri-Rachman Chairman of Selection Committee on Science and Technology
10.43 - 10.58	Presentation Award and Research Grants: • Science Education Award • Science and Technology Award • Science and Technology Research Grant
10.59 - 11.09	Presentation Science and Technology Award's recipient Prof. Dr. Ir. Jamari, S.T., M.T., IPU., ASEAN Eng. Universitas Diponegoro
11.10 - 11.15	Take picture (VVIP, Directors, Selection Committee & the Winners) Luncheon

MESSAGE FROM Dr. L.T. HANDOKO

THE CHAIRMAN OF INDONESIA TORAY SCIENCE FOUNDATION

Good Morning.

It is a great pleasure for me as the Chairman of the Indonesia Toray Science Foundation (ITSF) to welcome you all in this great occasion. Please allow me, on behalf of the Board of Directors of the Indonesia Toray Science Foundation, to convey our appreciation for your presence today. Your presence is very encouraging for us, and showing you commitment to support science in general and, in particular, scientific communities in Indonesia.

ITSF, since its establishment on December 1993 by Toray Indonesia with full supports from the Ministry of Education and Culture and the Indonesian Institute of Sciences (LIPI) that time, has been aiming to contributing on the development of education and scientific research in Indonesia. Currently, Indonesia government continues supporting ITSF through the National Research and Innovation Agency (BRIN).

ITSF has established several programs to support science educators and researchers in Indonesia, in the form of research grants and scientific awards. Applications are open to all Indonesian people, and are carried out transparently and competitively by independent committees consisting of leading scientists in the respected fields. This grant is intended to motivate and support researchers and educators from all over Indonesia to improve their capabilities through high quality research activities.

Please allow me to summarize the ITSF's programs this year:

1. Science Education Award for 10 educators in the fields of biology, physics and chemistry.
2. Science and Technology Award for 1 researcher.
3. Research grants for 18 researchers.

Taking this opportunity, on behalf of ITSF, I would like to congratulate all the awardees. Secondly, I would also like to express my personal appreciation to all members of Selection Committees for your hard work and dedication, and also your precious time to make those programs success.

Concluding my welcoming remark, I would like to thank the Governments of the Republic of Indonesia and Japan for their sincere support since the inception of ITSF program. I would especially like to express my deep gratitude to the Excellency Ambassador of Japan to the Republic of Indonesia.

Sincerely



Dr. L.T. Handoko

MESSAGE FROM MR. AKIHIRO NIKKAKU THE CHAIRMAN OF TORAY INDUSTRIES, INC., JAPAN

On behalf of Toray Industries, Inc., I am delighted to extend my warmest greetings to everyone attending the 32nd Presentation Ceremony of the Indonesia Toray Science Foundation (ITSF).

First and foremost, I would like to congratulate all ITSF award and grant recipients on your well-deserved achievements. I would also like to express my sincere appreciation to Prof. Brian Yulianto, S.T., M.Eng., Ph.D., Minister of Higher Education, Science and Technology; Prof. Arif Satria, Chairperson of BRIN; Prof. Dr. Abdul Mu'ti, Minister of Primary and Secondary Education; and His Excellency Mr. Mitsuru Myochin, Chargé d'Affaires ad interim of the Embassy of Japan to the Republic of Indonesia, for taking time out of their busy schedules to grace today's ceremony.

Toray Group, founded in 1926, is an integrated chemical industry group that conducts business globally based on the corporate philosophy, **“Contributing to society through the creation of new value with innovative ideas, technologies and products”**. In our overseas operations, the basic policy is to **“contribute to industrial promotion, export expansion, and the improvement of the country's technological standard from a long-term perspective.”**

To promote basic scientific research and education, guided by this corporate philosophy, Toray established the Toray Science Foundation of Japan in 1960. Toray subsequently set up the Science Foundation in Indonesia, Malaysia, Thailand, and Korea aiming to contribute to each nation through our business activities while fostering strong, mutually beneficial relationships.

Over the years, the ITSF has given awards and grants in the accumulated total amount of more than 27 billion Rupiah to 913 researchers and scientists for their outstanding achievements related to technology and science education, and for their contributions to natural science and basic research.

ITSF could not have carried out its activities successfully for 31 continuous years without the strong teamwork and earnest participation of everyone involved.

On this momentous occasion, I extend my heartfelt congratulations to the Indonesia Toray Science Foundation (ITSF) as we celebrate its 32nd anniversary. Over the past 31 years, ITSF has been supporting pioneering research and nurturing young talents. Together, we have created a legacy of excellence, advanced the frontiers of knowledge, and contributed to scientific progress.

We would like to express our sincere appreciation to ITSF Chairman, Dr. L.T. Handoko for his capable leadership, the dedicated Board and Committee members, secretariat staff and all other individuals and institutions who have rendered their invaluable assistance to the ITSF.

Once again, I would like to convey my good wishes and warmest congratulations to all the respective awards and research grants recipients. I hope that the well-deserved reward and recognition will motivate you towards accomplishing higher levels of success, while helping the Republic of Indonesia to cultivate the next generation of scientists. Please continue with your excellent efforts in the year ahead.

In conclusion, I also express my sincere gratitude to the honorable Ministers, the Chairperson of BRIN, and the representative of the Embassy of Japan for participating in today's Ceremony.

Finally, I wish everyone all the best in your future endeavors.

Thank you very much. **"Terima Kasih"**.



Akihiro Nikkaku

REPORT FROM THE SELECTION COMMITTEE FOR SCIENCE EDUCATION AWARD

For the year of 2025, the Science Education Award (SEA) selection committee has received 113 proposals or applicants through online media. This year applicants mostly had sent proposal in previous years. There were 49 new applicants and 64 were applicants who were send once, twice, up to six times applications.

ITSF appreciate and honor for the persistence of most SEA applicants who have sent applications in previous years. The applications were received from various types and levels of education, such as junior secondary school, senior secondary school, vocational school and madrasah. The criteria used for selecting the awardees this year still same as previous years, those are the correctness of the contents, the quality of the innovation, the originality, the simplicity in developing and applying the innovation, the reproducibility, and the use of local materials or local context.

After thoroughly evaluations, ITSF has decided awarding to the following teachers (in alphabetical order):

1. **Baiatur Ridhwan, S.Pd.**
SMA Negeri 1 Geger, Madiun, East Java
2. **Dimas Candra Atmaja, S. Pd, MT.**
SMA Unggulan CT Arsa Foundation Sukoharjo, Central Java
3. **Drs. H. M. Ridwan**
MAN 9 Jakarta Timur, DKI Jakarta
4. **Fajriyatun, S.Pd.**
SMP Negeri 1 Purwanegara, Banjarnegara, Central Java
5. **Melvatria Karim, S.Pd.**
MAN 1 Kabupaten Gorontalo, Gorontalo
6. **Nur Risnawati Kusuma, SP., M.Pd.**
SMAN 3 Makassar, South Sulawesi
7. **Qurrota A'yun, M.Pd.**
SMA Pribadi Premiere Depok, West Java
8. **Rika Fitriani Sitanggang, S.Pd.**
SMA Negeri 1 Tanjungpandan, Bangka Belitung
9. **Sahri Ramdan, M. Pd., Gr.**
SMA Daarut Tauhiid Boarding School Bandung, West Java
10. **Ullyatus Sa'adah, S.Pd.**
SMA Nasional KPS Balikpapan, East Kalimantan

We congratulate to the awardees with the hope that you all continue to innovate and encourage your colleague teachers to innovate their science teaching.

Thank you very much.



Jakarta, 12 February 2026

Science Education Award Selection Committee:

- Herwindo Haribowo, Ph.D. (Chairman)
- Paulus Cahyono Tjiang, Ph.D. (Member)
- Prof. Dr. Is Fatimah (Member)

REPORT FROM THE ITSF SELECTION COMMITTEE FOR SCIENCE AND TECHNOLOGY

On behalf of the ITSF Selection Committee for Science and Technology—Dr. Muhammad Aziz Majidi, Prof. Dr. Suryadi Ismadji, and myself—we are pleased to submit this report summarizing the outcomes of two major ITSF programs: the 32nd Science and Technology Award (STA) and the 32nd Science and Technology Research Grant (STRG). This report also highlights the ITSF Science and Technology Seminar, conducted online on January 17, 2026.

Science and Technology Award

In the 32nd Science and Technology Award, the Selection Committee reviewed 34 nominations originating from 31 universities and 3 national research institutes (BRIN). All submissions underwent a rigorous evaluation process, including quantitative and qualitative assessments based on criteria such as research track record, collaboration and networking, significant scientific contributions, independence, consistency, pioneering achievements, and national and international recognition. From this process, three candidates were shortlisted for the final interview stage.

Following a comprehensive and in-depth assessment of the finalists' scientific achievements, sustained commitment to research, and overall research portfolios, the Selection Committee unanimously determined that Prof. Dr. Jamari, ST., M.T., IPU, of Universitas Diponegoro, most fully satisfied the criteria and standards established by ITSF for the Science and Technology Award.

Prof. Jamari's research is characterized by strong originality, high national relevance, and clear translational value. His work focuses on the development of culturally and anatomically adapted medical engineering solutions, addressing critical local clinical needs while strengthening the pathway from research to healthcare implementation in Indonesia.

Science and Technology Research Grant

For the 32nd Science and Technology Research Grant program, ITSF received a total of 352 research proposals from across Indonesia, comprising 266 submissions from universities and 86 from research institutes. After a comprehensive review process, 18 research proposals were selected for funding, with a total grant allocation of Rp 700,000,000, as detailed in the accompanying table.

The ITSF Selection Committee extends its sincere congratulations to the grant awardees and hopes that this support will meaningfully contribute to the successful completion of their research. For applicants whose proposals were not selected this year, we strongly encourage continued refinement of their research ideas and future submissions to ITSF.

List of Science and Technology Research Grant Recipients

No	NAME	UNIVERSITY/RESERACH INSTITUTE	GRANT APPROVED (IDR)
1	Ainul Maghfirah, Ph.D. Eng.	Institut Teknologi Bandung	Rp 38,900,000
2	apt. Eka Noviana, Ph.D.	Universitas Gadjah Mada	Rp 38,050,000
3	Christian Harito, S.T., Ph.D.	Universitas Bina Nusantara	Rp 38,950,000
4	Dr. Eng. Rachmawati, S.T., M.Eng.	Institut Teknologi Bandung	Rp 38,950,000
5	Dr. rer. nat. Isom Hilmi, S.Si., M.Biotech.	Universitas Ahmad Dahlan	Rp 39,050,000
6	Dr. Riri Jonuarti, M.Si.	Universitas Negeri Padang	Rp 38,050,000
7	Dr. Supatmi, M.Biotech	National Research and Innovation Agency (BRIN)	Rp 38,850,000
8	Dr.apt.Ratna Annisa Utami	Institut Teknologi Bandung	Rp 39,050,000
9	Endang Rahmat, S.T., Ph.D.	Universitas Bina Nusantara	Rp 39,050,000
10	Peni Ahmadi, Ph.D.	National Research and Innovation Agency (BRIN)	Rp 39,050,000
11	Prof. I Wayan Gede Astawa Karang, S.Si., M.Si., Ph. D.	Universitas Udayana	Rp 38,950,000
12	Roni Permana Saputra, S.T., M.Eng.Sc., Ph.D., DIC.	National Research and Innovation Agency (BRIN)	Rp 38,950,000
13	Shella Permatasari Santoso, S.T., Ph.D., IPM.	Universitas Katolik Widya Mandala Surabaya	Rp 36,650,000
14	Yanoar Pribadi Sarwono, Ph.D.	National Research and Innovation Agency (BRIN)	Rp 38,950,000
15	Dr. Suriati Eka Putri, S.Si., M.Si.	Universitas Negeri Makassar	Rp 39,500,000
16	Ir. Rendy Muhamad Iqbal, S.Si, M.Si, Ph.D.	Universitas Palangka Raya	Rp 40,000,000
17	Nawwal Hikmah, S.Si., M.Sc.	Universitas Lambung Mangkurat	Rp 40,000,000
18	Rikno Harmoko, Ph.D.	National Research and Innovation Agency (BRIN)	Rp 39,050,000
TOTAL			Rp 700,000,000

Science and Technology Seminar

The ITSF Selection Committee is pleased to report the successful implementation of the ITSF Science and Technology Seminar, which was conducted online on January 17, 2026. The seminar served as an important forum for scientific exchange, featuring research presentations by 18 grant recipients from the 2024 funding cycle. Throughout the sessions, invited experts actively provided reviews, comments, and constructive feedback on the presented studies.

This seminar plays a significant role in supporting early-career researchers by providing a space to present their research progress, exchange ideas, and receive valuable input for further improvement. It also offers a broader learning platform for participants from universities and research institutes. In this year's seminar, participants were further enriched by a special lecture delivered by Prof. Jamari, the recipient of the Science and Technology Award. In recognition of presentation quality and scientific merit, the reviewers selected three best presenters from each session to receive awards of appreciation.

On this occasion, I would like to extend my sincere appreciation to all members of the ITSF Selection Committee for their strong collaboration and dedication throughout the selection and evaluation processes. We also gratefully acknowledge ITSF Toray Industries, Inc., Japan, and the Toray Group Indonesia for their continued and consistent support of ITSF programs. Our thanks are also extended to the ITSF Seminar Organizing Committee and the ITSF Executive Board of Directors for entrusting us with this important responsibility.

With this, we conclude the report of the ITSF Selection Committee for Science and Technology for the year 2026. Thank you very much for your kind attention.

Jakarta, February 12, 2026

On behalf the Selection Committee,



Dr. Ernawati Arifin Giri-Rachman	(Chairman)
Dr. M. Aziz Majidi	(Member)
Prof. Dr. Suryadi Ismadji	(Member)

INDONESIA TORAY SCIENCE FOUNDATION SCIENCE EDUCATION AWARD'S RECIPIENTS 32nd PROGRAM - 2025

NO	NAME	TITLE	AMOUNT
1	Baiatur Ridhwan, S.Pd. SMA Negeri 1 Geger Madiun, East Java	FGC (Fun Game Competition) Model Learning with Special and Secret Reward Using SEC (Smart Element Card) to Study the Periodic Table of Elements and Instilling Values of Integrity in Students	Rp25,000,000
2	Dimas Candra Atmaja, S.Pd, MT. SMA Unggulan CT Arsa Foundation Sukoharjo, Central Java	(STEM Based Scientific Method Learning through an Electricity Free Cooling Experiment Using Recycled Street Stall Waste Adsorbents for Grade 10, Phase E)	Rp25,000,000
3	Drs. H. M. Ridwan MAN 9 Jakarta Timur DKI Jakarta	Collaboration of Chemistry Concepts with Indonesian Children's Traditional Games through Mineral Water Bottle Cap Stack on Periodic System Map, Aufbau Pattern Cardboard, and Congklak Game	Rp25,000,000
4	Fajriyatun, S.Pd. SMP Negeri 1 Purwanegara Banjarnegara, Central Java	The Use of Magic Tektonic Box Teaching Aids to Improve Critical Thinking and Learning Outcomes in the Material on the Formation of Faults, Folds, and Earthquakes in Grade VIIID Students at SMP Negeri 1 Purwanegara	Rp25,000,000
5	Melvatria Karim, S.Pd. MAN 1 Kabupaten Gorontalo Gorontalo	Deep Learning-Based Koba-koba to Improve Understanding of Linear Motion Concepts in 10th Grade Students	Rp25,000,000
6	Nur Risnawati Kusuma, SP., M.Pd. SMAN 3 Makassar South Sulawesi	Exploring The Human Digestive Tract Using 3D Simulation Trajectories	Rp25,000,000
7	Qurrota A'yun, M.Pd. SMA Pribadi Premiere Depok, West Java	SINDARA Kit (Interactive Simulation of Blood Group System)	Rp25,000,000
8	Rika Fitriani Sitanggang, S.Pd. SMA Negeri 1 Tanjungpandan, Bangka Belitung	Visualization of Sound Waves Using a Badminton Shuttlecock Holder, Balloon, Mirror, and Laser in High School Physics Learning	Rp25,000,000
9	Sahri Ramdan, M.Pd.,Gr. SMA Daarut Tauhid Boarding School Bandung, West Java	E-Dinar (Egrang Dinamika Rotasi): Experimental Tools for Center of Gravity and Torque in High School Physics Learning	Rp25,000,000
10	Uliyatut Sa'adah, S.Pd. SMA Nasional KPS Balikpapan East Kalimantan	Ketinting Safety Simulator: An Educational Innovation Utilizing Sensors to Illustrate Newton's Laws and Enhance Awareness of Local Transport Safety	Rp25,000,000
TOTAL			Rp250,000,000

INDONESIA TORAY SCIENCE FOUNDATION SCIENCE AND TECHNOLOGY AWARD'S RECIPIENT 32nd PROGRAM - 2025

NO	NAME	TITLE	AMOUNT
1	Prof. Dr. Ir. Jamari, S.T., M.T., IPU., ASEAN Eng. Universitas Diponegoro	Design and Development of Dual Mobility Total Hip Prosthesis Accommodate Muslim Prayer (Salat) Movements	Rp100,000,000

INDONESIA TORAY SCIENCE FOUNDATION SCIENCE AND TECHNOLOGY RESEARCH GRANT'S RECIPIENTS 32nd PROGRAM - 2025

NO	NAME	RESEARCH TITLE	AMOUNT	FUNDED BY
1	Ainul Maghfirah, Ph.D. Eng. Institut Teknologi Bandung	MXene Nanosheets Modified by Ammonium Based-Ionic Liquid as Novel Adsorbents for Efficient Wastewater Treatment	Rp38,900,000	Toray Science Foundation Japan
2	apt. Eka Noviana, Ph.D. Universitas Gadjah Mada	Genetic Algorithm-Driven Design of β -Lactoglobulin Aptamer for Milk Allergen Testing	Rp38,050,000	Toray Science Foundation Japan
3	Christian Harito, S.T., Ph.D. Universitas Bina Nusantara	Nitrogen-Doped Graphene Conductive Inks for High-Performance Flexible Electronics via Direct Ink Writing	Rp38,950,000	Toray Science Foundation Japan
4	Dr. Eng. Rachmawati, S.T., M.Eng. Institut Teknologi Bandung	Advanced Nanocomposite Coating as Insulation Material to Improve High-Voltage Insulators' Performance and Reliability	Rp38,950,000	Toray Science Foundation Japan
5	Dr. rer. nat. Isom Hilmi, S.Si., M.Biotech. Universitas Ahmad Dahlan	Corona Plasma-Assisted Germination Enhancement of Rare Orchid Seeds for Ex-Situ Conservation of IUCN Red List Species	Rp39,050,000	Toray Science Foundation Japan
6	Dr. Riri Jonuarti, M.Si. Universitas Negeri Padang	First-Principles Investigation of g-C ₃ N ₄ /TM-Doped Fe ₂ O ₃ Z-Scheme Heterojunctions: Structural and Charge Transfer Engineering for Efficient Photocatalytic Water Splitting	Rp38,050,000	Toray Science Foundation Japan
7	Dr. Supatmi, M.Biotech National Research and Innovation Agency (BRIN)	Linking Downstream Lignin Gene Expression in Seed Coat with Seed Cake Lignin Composition of Pongamia pinnata for Biofuel Residue Valorization	Rp38,850,000	Toray Science Foundation Japan
8	Dr.apt.Ratna Annisa Utami Institut Teknologi Bandung	Gliadin-Derived Peptides for Enhanced Cell Permeability: Advancing Protein Delivery Strategies	Rp39,050,000	Toray Science Foundation Japan

9	Endang Rahmat, S.T., Ph.D. Universitas Bina Nusantara	Chromosome-Level Whole Genome Sequencing of “Temulawak” Medicinal Plant (<i>Curcuma Xanthorrhiza</i> Roxb.) to Uncover Its Comprehensive Genetic Information	Rp39,050,000	Toray Science Foundation Japan
10	Peni Ahmadi, Ph.D. National Research and Innovation Agency (BRIN)	Discovery of a New Anticancer Lead Compound from the Marine Sponge <i>Plakortis</i> sp. and Investigation of Its Mechanism of Action	Rp39,050,000	Toray Science Foundation Japan
11	Prof. I Wayan Gede Astawa Karang, S.Si., M.Si., Ph.D. Universitas Udayana	ATLAS-IWs: An AI-Based Digital Atlas Platform of Internal Solitary Waves for Enhancing Maritime Safety and Sovereignty in Indonesian Seas	Rp38,950,000	Toray Science Foundation Japan
12	Roni Permana Saputra, S.T., M.Eng.Sc., Ph.D., DIC. National Research and Innovation Agency (BRIN)	On-Device Tactile Intelligence for Low-Cost Prosthetic Hands Using Bio-Based Stretchable Sensors	Rp38,950,000	Toray Science Foundation Japan
13	Shella Permatasari Santoso, S.T., Ph.D., IPM. Universitas Katolik Widya Mandala Surabaya East Java	Valorization of Curtain Ivy Biomass into Cellulose-Based Hydrogels Functionalized with Metal-Phenolic Networks for Sustainable Antimicrobial Materials	Rp36,650,000	Toray Science Foundation Japan
14	Yanoar Pribadi Sarwono, Ph.D. National Research and Innovation Agency (BRIN)	STO-Lib: A Software Framework for Slater Orbital Basis Optimization on NISQ Quantum Computers	Rp38,950,000	Toray Science Foundation Japan
15	Dr. Suriati Eka Putri, S.Si., M.Si. Universitas Negeri Makassar South Sulawesi	Modification of Pelletized Gelcasted Porous Ceramic Catalyst from Natural Clay to Increase Biodiesel Production Efficiency	Rp39,500,000	ITSF
16	Ir. Rendy Muhamad Iqbal, S.Si, M.Si, Ph.D. Universitas Palangka Raya Central Kalimantan	Surface-Engineered PVDF Membrane with Nanohematite-PEI for Integrated Peat Water Reclamation and Liquid Organic Fertilizer Production in Submerged Membrane Bioreactors	Rp40,000,000	ITSF
17	Nawwal Hikmah, S.Si., M.Sc. Universitas Lambung Mangkurat South Kalimantan	Development of Alaban Wood-Derived Bio-Carbon Black as a Sustainable Conductive Additive for Li-Ion NMC Cathodes	Rp40,000,000	ITSF
18	Rikno Harmoko, Ph.D. National Research and Innovation Agency (BRIN)	CRISPR/Cas9-Mediated RDR1 Knockout in <i>Nicotiana tabacum</i> for Enhanced Therapeutic Protein Production in Tropical Climates	Rp39,050,000	ITSF
TOTAL			Rp700,000,000	

ITSF

Indonesia Toray Science Foundation “AWARDING PROPOSAL”

FGC (Fun Game Competition) Model Learning with Special and Secret Reward Using SEC (Smart Element Card) to Study the Periodic Table of Elements and Instilling Vlaues of Integrity in Students

- 1. Subject** : Chemistry
- 2. Receiver**
- | | | |
|---------------------|--|-----------|
| Name | : BAIATUR RIDHWAN, S. Pd. | |
| Sex | : Male | |
| Place/Date of Birth | : Magetan, October 6, 1995 | |
| School | : State Senior High School 1 Geger | |
| School Address | : Jl. Raya Uteran No.634, Sumberejo, Geger,
Karanganyar, Sumberejo, Madiun
Madiun, East Java 63171 | |
| Phone/Fax Number | : (0351) 367070 | Fax No: - |
| Email Address | : baiatur.ridhwan@gmail.com | |

3. Proposal Summary :

The Periodic Table of Elements holds a great secret chemistry, among others: atomic radius, ionization energy, electron affinity, metal properties, non-metallic properties, acid-base properties, melting point, boiling point, and others. Mastering the Periodic Table of Elements, it is the initial door to mastering and understanding chemistry.

So that students can easily master and understand chemistry. So very necessary implementation FGC(Fun Game Competition) learning model with special and secret reward to study the Periodic Table of Elements. The result are extraordinary, among others : Class XI-6 (25 students) and Class XI-8(33 students), total 58 students. The repetition the result were obtained: Mark (91-100)=21 students(36%), mark (81-90)=25 students(43%), mark (70-80)=12 students(21%). Statement from the result of the questionnaire : honestly 55 students(95%), transparent 57 students(98%), sportsmanship 56 students(97%), fair 55 students(95%), obbyektive 57 students(98%), responsibility of 54 students (93%), fair 56 students(97%), enthusiastic 57 students(98%), like 58 students(100%), fun 57 students (98%), easy 53 students(91%), clear 55 students (94%), happy 58 students(100%).



ITSF

Indonesia Toray Science Foundation

“AWARDING PROPOSAL”

(STEM Based Scientific Method Learning through an Electricity Free Cooling Experiment Using Recycled Street Stall Waste Adsorbents for Grade 10, Phase E)

- 1. Subject** : Chemistry
- 2. Receiver**
- | | | |
|---------------------|---|-------------------------|
| Name | : DIMAS CANDRA ATMAJA, S.Pd., M.T. | |
| Sex | : Male | |
| Place/Date of Birth | : Surakarta, 17 Januari 1984 | |
| School | : SMA Unggulan CT ARSA Foundation Sukoharjo | |
| School Address | : Jl. Jend Sudirman, Sidoarjo, Bendosari
Sukoharjo, Central Java 57141 | |
| Phone/Fax Number | : 081393352288 | No. Fax: (0271) 5992206 |
| Email Address | : dimascandraatmaja1984@gmail.com | |

3. Proposal Summary :

The innovator proposes an Electricity-Free Cooling Experiment Using Street Stall Waste Adsorbents as a STEM-Based Scientific Method Learning Medium for Grade 10 (Phase E) students. In this project, students practice the complete stages of the scientific method observation, hypothesis formulation, experimentation, analysis, and conclusion while integrating the elements of STEM: science (evaporation and adsorption), technology (simple and functional measuring tools), engineering (design of a cooling device), and mathematics (data processing and analysis). This activity fosters scientific literacy, a research-oriented mindset, and environmental awareness through the utilization of locally available waste materials.

The outcomes achieved from this learning innovation include: (1) optimizing waste materials, such as used tea dregs from local street stalls (commonly known as angkringan); (2) integrating STEM by designing an adsorption based refrigeration system using tea waste and zeolite as adsorbents; and (3) stimulating student creativity by connecting chemistry learning with STEM in the context of the scientific method. This integrated approach is expected to encourage students to create meaningful classroom learning experiences, apply their knowledge in daily life, and open opportunities to participate in science and innovation competitions. Furthermore, it can serve as an important foundation for students' future academic and research pursuits.

ITSF

Indonesia Toray Science Foundation
“AWARDING PROPOSAL”

Collaboration of Chemistry Concepts with Indonesian Children's Traditional Games through Mineral Water Bottle Cap Stack on Periodic System Map, Aufbau Pattern Cardboard, and Congklak Game

- 1. Subject** : Chemistry
- 2. Receiver**
- Name : **Drs. H. M. RIDWAN**
- Sex : Male
- Place/Date of Birth : Jambi, 23 March 1966
- School : Madrasah Aliyah Negeri (MAN) 9 Jakarta Timur
- School Address : Jl. H. Dogol No. 54
Kel. Pondok Bambu Kec. Jatinegara
Kota Jakarta Timur, DKI Jakarta 13430
- Phone/Fax Number : (021) 86611788 Fax No: (021) 86615530
- Email Address : mridwan230366@gmail.com

3. Proposal Summary :

Review of the regularity of Atomic Radius in periods and classes in the Periodic System of Elements and its relationship with Electron Configuration using Mineral Water Bottle Cap Stack and Cardboard Aufbau Pattern through Congklak Game as part of Indonesian Children's Tradition Game

**The Use of Magic Tektonic Box Teaching Aids
to Improve Critical Thinking and Learning Outcomes
in the Material on the Formation of Faults, Folds, and Earthquakes
in Grade VIIID Students at SMP Negeri 1 Purwanegara**

- 1. Subject** : Physics
- 2. Receiver**
- | | |
|---------------------|--|
| Name | : FAJRIYATUN, S.Pd. |
| Sex | : Female |
| Place/Date of Birth | : Banjarnegara, 20 Oktober 1974 |
| School | : SMP Negeri 1 Purwanegara |
| School Address | : Jalan Raya Purwanegara –
Banjarnegara, Central Java 53472 |
| Phone/Fax Number | : (0286)5988546 Fax No: - |
| Email Address | : fajriyatun00@guru.smp.belajar.id |

3. Proposal Summary :

One of the challenges of teaching physics in secondary school is explaining geological phenomena such as faults, folds and earthquakes that occur within the Earth's crust. Students often assume that this material is abstract and limited to memorising theory, which often causes them difficulty.

This results in students having poor critical thinking skills and learning outcomes, as well as minimal learning experiences. Based on initial observations of 30 students, only 26.09% demonstrated good critical thinking skills, and classical learning completeness only reached 52.17%.

The innovation carried out was to create and use a Magic Tectonic Box teaching aid. This teaching aid is made of wood, plywood, rubber, plasticine, and sand. There are three teaching aids. Box 1 simulates the process of fault formation, Box 2 simulates folding, and Box 3 simulates earthquakes.

By using these teaching aids, the learning process became more meaningful, not limited to memorisation, and was able to improve students' critical thinking and learning outcomes. The results of the learning activities showed that 82.61% of students demonstrated good critical thinking, 86.63% achieved learning completeness, and 83.33% of students were classified as very enthusiastic.

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Indonesia Toray Science Foundation “AWARDING PROPOSAL”

Deep Learning-Based Koba-koba to Improve Understanding of Linear Motion Concepts in 10th Grade Students

- 1. Subject** : Physics
- 2. Receiver**
- | | | |
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3. Proposal Summary :

Koba-koba is a traditional Gorontalo game similar to bowling, using ex-cans. It is used as a medium for learning Physics in the straight motion material for 10th grade, to study the relationship between distance and time. The results of the learning innovation were achieved based on the principles of deep learning; (1)mindful, students are able to easily understand the learning objectives, are intrinsically motivated to learn from the initial preparation until conclusion, and actively develop learning strategies to achieve the objectives; (2)meaningful, each stage of the activity is concrete so that it is easy to digest, and they feel the benefits and relevance of what they learn. (3)joyful, game system makes them curious to try it, and even if the pion cans can't knock down the target cans, they try to repeat the experiment. In addition, 28 students showed an increase in results from the pretest to the posttest; from 3 to 25 understood the difference between distance and displacement, from 20 to 28 understood the meaning of travel time, from 4 to 22 understood the meaning of speed, from 1 to 24 knew the meaning of acceleration, and from 5 to 18 understood how displacement affects travel time.

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Indonesia Toray Science Foundation “AWARDING PROPOSAL”

Exploring The Human Digestive Tract Using 3D Simulation Trajectories

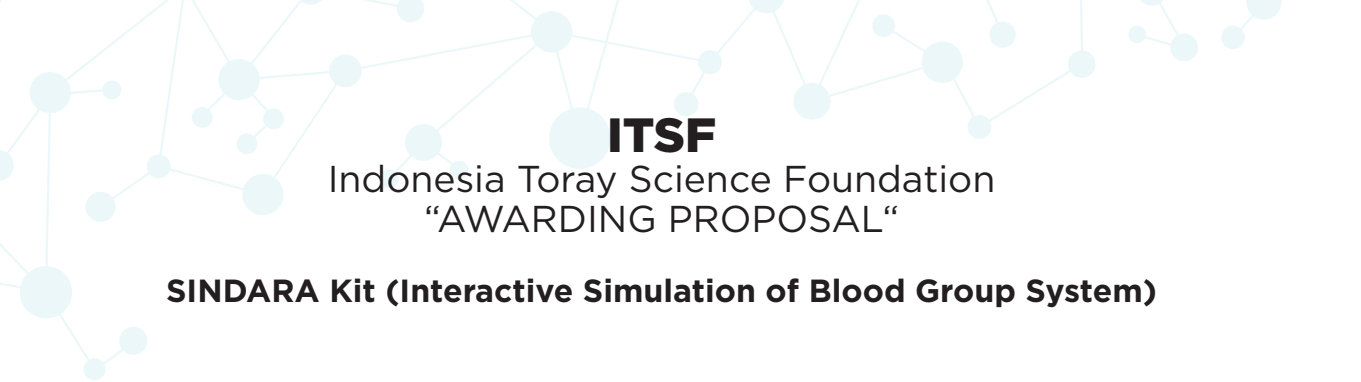
- 1. Subject** : Biology
- 2. Receiver**
- | | | |
|---------------------|--|-----------------------|
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3. Proposal Summary :

This innovative work, titled “Tracing the Human Digestive Pathway Using 3D Simulation Tracks,” was developed to address the challenges of learning biology, which remains abstract and passive. This media provides a real-life learning experience through 3D simulation activities made from simple, recycled materials to understand the human digestive process. Each digestive tract is equipped with a barcode containing simulation guidelines, which students actively and collaboratively complete using simple materials such as mung bean sprout extract as a substitute for the amylase enzyme, papaya leaf extract as a substitute for the pepsin enzyme, and HCl as stomach acid.

The media development followed the ADDIE model, from analysis, design, development, implementation, and evaluation. Validation results showed a score of 3.52 (very feasible) and a teacher response of 4.16 (very strong), while student process skills were categorized as very good. This media has been proven to improve students’ conceptual understanding, independence, and learning motivation.

The main advantages of this work lie in the use of affordable local materials, ease of implementation, and its ability to foster critical and reflective thinking. Through 3D simulation, Biology learning becomes more meaningful, enjoyable, and fosters a profound learning experience.



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Indonesia Toray Science Foundation

“AWARDING PROPOSAL”

SINDARA Kit (Interactive Simulation of Blood Group System)

- 1. Subject** : Biology
- 2. Receiver**
- | | |
|---------------------|--|
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3. Proposal Summary :

SINDARA Kit (Interactive Simulation of Blood Group System) is an innovative biology learning media designed to help students understand the concept of blood groups and transfusion scientifically and visually. This innovation emerged from the need for a medium that is safe, low-cost, easily accessible, and does not require real blood, syringes, medical personnel, or laboratory equipment, which are often unavailable in schools.

SINDARA Kit consists of two complementary packages: (1) Package A : Visual Simulation of Agglutination, containing artificial blood made from red-colored tapioca solution as the sample, along with two types of simulated antisera; concentrated saline solution and mineral water. When dropped onto the sample, students can observe 'clumping' reactions resembling real agglutination, helping them visually grasp the donor-recipient concept. (2) Package B : 3D Blood Clay Model, utilizing red clay to represent the red blood cells, colored push pins as the antigens, and flexible wire (mercy wire) as the antibodies. This model allows students to visualize the location of antigen and antibody and their interactions that occur during blood transfusion according to blood types.

The implementation results indicate a significant improvement in the cognitive aspect (N-gain 0.75, categorized as 'high'), affective aspect (score 3.45, 'high' category), psychomotor aspect (score 3.53, 'very good'), scientific attitude (score 3.63, 'very good'), and character (score 3.48, 'good'). Through the use of the SINDARA Kit, Biology learning is no longer limited to rote memorization but has transformed into an authentic and meaningful learning experience.

Visualization of Sound Waves Using a Badminton Shuttlecock Holder, Balloon, Mirror, and Laser in High School Physics Learning

- 1. Subject** : Physics
- 2. Receiver**
- | | | |
|---------------------|---|-----------|
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3. Proposal Summary :

This innovative project aims to help students understand the concept of sound waves, which is often abstract and difficult to visualize. In this activity, a balloon is used as a medium to catch sound vibrations, a small mirror is attached to the surface of the balloon, and a laser beam is directed at the mirror. When students speak toward the balloon with different voice intensities—soft, medium, and loud—the balloon vibrates with varying amplitudes, causing the reflected laser beam to move in different patterns on a screen.

Through observing the laser’s motion, students can directly visualize differences in wave amplitude and understand that the louder the sound, the greater the amplitude of the sound wave. This simple, low-cost, and easily constructed tool does not require a laboratory but effectively enhances students’ scientific curiosity, conceptual understanding, and experimental skills. The project represents an engaging and contextual innovation in physics learning, supporting active and inquiry-based learning approaches in senior high school physics education.

E-Dinar (Rotational Dynamics Stilts): A Center of Gravity and Torque Experimental Tool in High School Physics Learning

- 1. Subject** : Physics
- 2. Receiver**
- | | |
|---------------------|---|
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3. Proposal Summary :

Rotational Dynamics is a challenging high school physics topic to teach due to its complex and abstract concepts. Therefore, contextual learning is necessary to help students grasp the concepts. Egrang Dinamika Rotasi (E-Dinar) is an experimental tool, in the form of bamboo stilts (egrang), that facilitates two experiments: the determination of the center of gravity and the torque of the stilt system resulting from a change in the player's footing. The E-Dinar innovation aims to improve concept understanding, train science process skills, and 21st-century skills, while simultaneously utilizing natural potential and preserving local educational culture.

The learning model applied using E-Dinar is Discovery Learning. The stages of this learning model include stimulation, problem statement, data collecting, data processing, verification, and generalization. During the data collecting and data processing stages, students perform experiments on the center of gravity and torque, collect and analyze the data, draw conclusions, and then present their findings.

The students' reaction to the learning process and the E-Dinar tool has generally been very positive. Students learn from direct experience through enjoyable experiments. The achieved outcomes through the use of E-Dinar in learning include contributing to concept mastery, improved process skills, and increased student motivation and interest in learning. Furthermore, the advantages of E-Dinar include promoting active learning, low cost, ease of acquisition, and the promotion of local wisdom.



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Indonesia Toray Science Foundation “AWARDING PROPOSAL”

Ketinting Safety Simulator: An Educational Innovation Utilizing Sensors to Illustrate Newton’s Laws and Enhance Awareness of Local Transport Safety

- 1. Subject** : Physics
- 2. Receiver**
- | | |
|---------------------|---|
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3. Proposal Summary :

The Ketinting Safety Simulator is a sensor-based physics learning innovation developed to visualize Newton’s Laws in a contextual and culturally grounded manner, integrating modern science, digital technology, and Kalimantan’s local wisdom. This project was inspired by recurring river transportation accidents involving ketinting boats, often caused by limited understanding of fundamental mechanics such as force, mass, and acceleration.

Adopting a STEAM-based approach, the simulator provides an engaging and meaningful learning experience that links theoretical physics to students’ real-world contexts. Equipped with acceleration and force sensors, it generates real-time data that allow learners to observe and analyze the relationship between thrust, load, and acceleration transforming abstract formulas into tangible understanding. The project enhances scientific reasoning, technological literacy, and safety awareness while promoting creativity and collaboration.

With its simple, affordable, and replicable design, the Ketinting Safety Simulator can be effectively implemented in diverse educational settings, especially in river-based communities. Ultimately, it bridges physics education with cultural identity, fostering a generation of learners who are scientifically competent, environmentally conscious, and deeply rooted in local cultural values.

Advances in Total Hip Prosthesis Design: Meeting the Needs of Asian Patients and Religious Movements

2. Receiver

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3. Proposal Summary :

This work presents a pioneering solution in the design of total hip prostheses tailored to the anatomical and cultural needs of Asian patients, with a focus on accommodating the biomechanical demands of Muslim prayer movements. Conventional prostheses, predominantly designed for Western populations, often meets complexity when it is applied for Asian patients. Moreover, it fails to meet the requirements for deep flexion, kneeling, and rotational postures, leading to discomfort and limited functionality for many patients.

By integrating bio-tribological principles and advanced computational modeling these gaps are filled. Computational simulations were employed to optimize prosthesis design for high flexion angles and dynamic load distribution. Novel biocompatible materials with exceptional wear resistance were incorporated to enhance durability and reduce failure risks. The design underwent rigorous prototyping and testing, including simulated prayer movements, to ensure functionality, comfort, and long-term reliability.

Pilot trials demonstrate improved range of motion, stability, and user satisfaction compared to current designs. This work not only enhances the quality of life for Asian patients but also sets a new standard in culturally responsive healthcare innovation. By aligning engineering excellence with patient-centric care, this research establishes a foundation for future advancements in adaptive medical technologies.

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Indonesia Toray Science Foundation “RESEARCH PROPOSAL”

MXene Nanosheets Modified by Ammonium Based-Ionic Liquid as Novel Adsorbents for Efficient Wastewater Treatment

1. Research Team Leader

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2. Research Field : Environment

3. Number of Researcher(s) : 3

4. Research Location : Institut Teknologi Bandung

5. Time Allocation : 10 months

6. Research Grant : Rp. 38,900,000.00

7. Summary of Research Proposal :

The emerging two-dimensional material, MXene, has attracted tremendous attention among scientists due to its versatility for various applications, including wastewater treatment. MXene is a metal carbide/nitride/carbonitride family with a functional group of hydroxides (-OH)/oxygen (-O)/halogen (-F/-Cl) on its surface. The negatively charged MXene, due to its terminating functional groups, allows the adsorption of positively charged heavy metal ions (HMLs) in the wastewater onto the MXene surface. Examples of the harmful HMLs are Fe^{3+} , Cu^{2+} , Mn^{2+} , and Pb^{2+} . In this study, we aim to develop a novel adsorbent containing MXene modified with ammonium-based ionic liquid (IL) to increase its adsorption capacity toward HMLs. Ionic liquid is salt in the liquid state with a melting point < 100 oC and has a great affinity toward HMLs. There are four main stages in this study, i.e, fabricating MXene from its parent MAX phase, functionalizing MXene with IL by dispersing the synthesized MXene in the IL solution, characterizing the MXene/IL hybrids, and evaluating the adsorption performance of MXene/IL toward Fe^{3+} , Cu^{2+} , Mn^{2+} , and Pb^{2+} .

Genetic Algorithm-Driven Design of β -Lactoglobulin Aptamer for Milk Allergen Testing

1. Research Team Leader

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2. Research Field

: Analytical Biochemistry, Food Safety

3. Number of Researcher(s)

: 4

4. Research Location

: Faculty of Pharmacy, UGM

5. Time Allocation

: 12 months

6. Research Grant

: Rp. 38,050,000.00

7. Summary of Research Proposal

:

The purpose of this research is to develop high-affinity and highly selective aptamers for β -lactoglobulin (BLG), a major cow's milk allergen, by integrating computational design with experimental validation. By applying in silico maturation (ISM) driven by genetic algorithms and systematic enzyme-linked aptasorbent-assay (ELASA)-based characterization, this study aims to generate validated aptamers that can function as robust molecular recognition elements. The project addresses key limitations of antibody-based assays by providing stable, cost-effective, and customizable alternatives for allergen detection.

The research will be conducted in three interconnected phases. Phase 1 focuses on computational design, including literature-based aptamer mining, structure prediction, molecular docking, genetic algorithm-based ISM, and molecular dynamics simulations to optimize aptamer-BLG interactions. Phase 2 involves experimental validation, where selected aptamers are synthesized and evaluated using ELASA to determine binding affinity (Kd), sensitivity, detection limits, and selectivity against non-target milk proteins. Phase 3 performs cross-competition studies to identify aptamers with non-overlapping binding sites and prioritize optimal candidates. The validated aptamers generated will establish a foundation for future sandwich ELASA and lateral flow assay development.

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Indonesia Toray Science Foundation “RESEARCH PROPOSAL”

Nitrogen-Doped Graphene Conductive Inks for High-Performance Flexible Electronics via Direct Ink Writing

1. Research Team Leader

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2. Research Field : Material science & engineering
3. Number of Researcher(s) : 4
4. Research Location : Binus Kemanggisan
5. Time Allocation : 20 hour per week
6. Research Grant : Rp. 38,950,000.00
7. Summary of Research Proposal :

Recent progress in flexible electronics and conductive inks has opened new opportunities for applications in healthcare, sensors, and wearable devices. This project proposes the development of **nitrogen-doped graphene (N-graphene)** inks tailored for **Direct Ink Writing (DIW)**, a versatile additive manufacturing method for flexible electronics. **N-graphene** is particularly promising because its bonding configurations (pyridinic, pyrrolic, and graphitic nitrogen) enable tunable electronic properties, improved conductivity, and enhanced dispersibility, after addressing key limitations of current conductive inks. The research will focus on three integrated activities: (1) controlled **synthesis and characterizations of N-graphene**; (2) formulation of stable, DIW-compatible **N-graphene inks**; and (3) fabrication and testing of **flexible conductive** circuits and prototype devices such as RFID components and electrochemical sensors. By uniting material innovation with process optimization, this project aims to establish a scalable **pathway for next-generation printed electronics**. The expected outcomes include high-performance, low-cost conductive inks and functional prototypes that demonstrate real-world applicability, positioning this work as **both scientifically impactful and commercially promising**.

Advanced Nanocomposite Coating as Insulation Material to Improve High-Voltage Insulators’ Performance and Reliability

1. Research Team Leader

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2. Research Field : High Voltage Engineering, Materials

3. Number of Researcher(s) : 3

4. Research Location : Institut Teknologi Bandung, Bandung

5. Time Allocation : 1 year

6. Research Grant : Rp. 38,950,000.00

7. Summary of Research Proposal :

High-voltage insulators are critical components for the safe and reliable operation of power systems. However, their performance is increasingly threatened by rising electrical demand, renewable energy integration, and harsh environmental conditions, including industrial and coastal salt pollution and intense UV exposure. Failures often arise from surface contamination and moisture, which increase leakage currents, localized heating, and ultimately flashover events that compromise grid stability. Current mitigation relies on routine cleaning and recently Room Temperature Vulcanizing (RTV) silicone rubber coatings, valued for their hydrophobicity.

This project proposes the development of advanced nanocomposite coatings for high-voltage outdoor insulators. Building on our prior studies, which demonstrated the benefits of nano-silica (nSiO_2) for surface resistivity and nano-alumina (nAl_2O_3) with nano-boron nitride (nBN) for thermal and polluted-condition performance, we will integrate all three fillers into a tri-filler RTV silicone rubber matrix. The objective is to achieve synergistic enhancements in electrical, thermal, and extreme environmental performance simultaneously. Comprehensive material characterization will validate the coating's effectiveness. The outcome will be a multi-functional, robust protective material that significantly improves insulator reliability, reduces maintenance costs, and strengthens the resilience of modern power grids.

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Indonesia Toray Science Foundation

“RESEARCH PROPOSAL”

Corona Plasma-Assisted Germination Enhancement of Rare Orchid Seeds for Ex-Situ Conservation of IUCN Red List Species

1. Research Team Leader

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2. Research Field

: Physics, Biology, Biotechnology,
Agriculture, Forestry

3. Number of Researcher(s)

: 4

4. Research Location

: Yogyakarta/Bandung

5. Time Allocation

: 1 year

6. Research Grant

: Rp. 39,050,000.00

7. Summary of Research Proposal

:

Orchids possess high economic, aesthetic, and ecological value; however, seed-based propagation remains challenging due to the extremely small seed size and their natural dependence on symbiotic mycorrhizal fungi for germination. These biological constraints limit large-scale propagation and hinder conservation efforts, particularly for endangered orchid species.

In this context, atmospheric non-thermal plasma (NTP), specifically corona plasma treatment, is proposed as an environmentally friendly and chemical-free physical approach to enhance orchid seed germination. This study aims to develop and apply non-thermal plasma technology as an innovative tool to support orchid propagation and ex-situ conservation in Indonesia. Several endangered orchid species listed under CITES Appendix II—*Vanda tricolor* var. *suavis*, *Phalaenopsis javanica*, *Dendrobium antenatum*, and *Bulbophyllum biflorum*—will be treated using corona plasma under various operational conditions. The effects of plasma exposure on seed germination performance will be systematically evaluated.

The research consists of two main stages: (i) the design and development of a laboratory-scale non-thermal corona plasma generator, and (ii) the investigation of plasma-induced biochemical and physiological responses in seeds, accompanied by quantitative germination analysis. The proposed technology is expected to improve propagation efficiency, strengthen orchid conservation strategies, and contribute to the advancement of Indonesia's premium horticulture sector.

First-Principles Investigation of g-C₃N₄/TM-Doped Fe₂O₃ Z-Scheme Heterojunctions: Structural and Charge Transfer Engineering for Efficient Photocatalytic Water Splitting

1. Research Team Leader

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2. Research Field

: Materials Engineering and Renewable Energy

3. Number of Researcher(s)

: 2 persons

4. Research Location

: Universitas Negeri Padang

5. Time Allocation

: 12 months

6. Research Grant

: Rp. 38,050,000.00

7. Summary of Research Proposal

:

The development of efficient photocatalytic materials for solar-driven water splitting is crucial for accelerating the transition to clean energy and sustainable green hydrogen production. One promising approach is the construction of Z-scheme heterojunction systems, which can preserve strong redox capability while improving charge separation efficiency. The combination of graphitic carbon nitride (g-C₃N₄) and hematite (Fe₂O₃) has attracted considerable attention due to the excellent chemical stability of g-C₃N₄ and the natural abundance, low cost, and oxidative stability of Fe₂O₃. However, the photocatalytic performance of the g-C₃N₄/Fe₂O₃ system remains limited by unfavorable energy band alignment and severe charge recombination at the interface. Therefore, this study investigates the effects of transition metal doping (Ti, Co, and Ni) on the structural stability, electronic properties, energy band alignment, and charge transfer behavior of Fe₂O₃ in a g-C₃N₄/TM@Fe₂O₃ Z-scheme heterojunction to overcome the limitations. First-principles calculations based on Density Functional Theory (DFT) are employed to accurately describe the electronic structure of Fe-based systems. The research includes model optimization, formation energy and interface stability analysis, electronic structure evaluation, charge transfer analysis using charge density difference and Bader charge methods, and adsorption simulations of H⁺ and OH⁻ to identify active sites for hydrogen and oxygen evolution reactions.



ITSF

Indonesia Toray Science Foundation “RESEARCH PROPOSAL”

Linking Downstream Lignin Gene Expression in Seed Coat with Seed Cake Lignin Composition of *Pongamia pinnata* for Biofuel Residue Valorization

1. Research Team Leader

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- | | |
|--|--|
| 2. Research Field | : Molecular Biology, Plant Biotechnology |
| 3. Number of Researcher(s) | : 4 |
| 4. Research Location | : KST Sukarno, BRIN |
| 5. Time Allocation | : 1 year |
| 6. Research Grant | : Rp. 38,850,000.00 |
| 7. Summary of Research Proposal | : |

Pongamia (*Pongamia pinnata*) is a multipurpose tree with strong potential for biofuel production. While its seeds are valued for biodiesel, the residual seed cake and seed pods, all rich in lignocellulosic biomass, remain underutilized. In Indonesia, *Pongamia* is widely distributed, and provenance collections provide valuable resources for research and development. However, the lignin content and composition of these seed residues have not been systematically studied, even though lignin represents a major barrier to efficient conversion into value-added products.

This project investigates the link between downstream lignin biosynthetic gene expression in seed coats and the lignin composition of seed cake, while also considering residual seed pods as an additional biomass source. The study will identify and characterize key lignin biosynthetic genes in *Pongamia*, analyze how their expression correlates with lignin structure in seed residues, and evaluate how lignin variation affects conversion potential into biofuels and biomaterials. The central hypothesis is that expression profiles of lignin genes, revealed by bioinformatic identification and qPCR, are correlated with lignin composition determined through thioglycolic acid extraction and pyrolysis-GC-MS. By connecting gene expression to lignin structure, this research provides a foundation for sustainable valorization of *Pongamia* seed residues into renewable fuels and eco-friendly biomaterials.

**Gliadin-Derived Peptides for Enhanced Cell Permeability:
Advancing Protein Delivery Strategies****1. Research Team Leader**

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2. Research Field	: Pharmaceutical Biotechnology
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3. Number of Researcher(s)	: 2
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4. Research Location	: School of Pharmacy
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5. Time Allocation	: 10 months
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6. Research Grant	: Rp. 39,050,000.00
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7. Summary of Research Proposal	:
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The oral administration of therapeutic proteins or peptides remains challenging due to poor membrane permeability and physiological barriers. Cell Penetrating Peptides (CPPs) have emerged as promising permeation enhancers (PEs) for improving drug absorption by modulating tight junction dynamics or facilitating paracellular transport. Gliadin-derived peptides, including β -gliadin fragment p177-195 (QIPEQSQCQAIHNVVHAI), have demonstrated potential as CPPs and PEs due to their amphipathic anionic properties and structural similarities with established CPPs like MAP and gH625. This study evaluates p177-195's ability to enhance the permeation of various molecules, including superoxide dismutase from Citrus limon (SOD-CI) and FITC-Dextran using a Caco-2 monolayer model. Additionally, its antimicrobial activity against representative gut microbiota species is assessed to ensure compatibility for oral delivery applications. Results from this research aim to establish p177-195 as a novel permeation enhancer for oral drug delivery systems while ensuring its safety profile for gut microbiota.



ITSF

Indonesia Toray Science Foundation

“RESEARCH PROPOSAL”

Chromosome-Level Whole Genome Sequencing of “Temulawak” Medicinal Plant (*Curcuma Xanthorrhiza* Roxb.) to Uncover Its Comprehensive Genetic Information

1. Research Team Leader

Name	: ENDANG RAHMAT, S.T., Ph. D.
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- | | |
|---------------------------------|----------------------------------|
| 2. Research Field | : Medicinal plants biotechnology |
| 3. Number of Researcher(s) | : 3 |
| 4. Research Location | : Jakarta |
| 5. Time Allocation | : 1 year |
| 6. Research Grant | : Rp. 39,050,000.00 |
| 7. Summary of Research Proposal | : |

Curcuma xanthorrhiza Roxb., known as “Temulawak,” is Indonesia’s flagship medicinal plant declared by the Ministry of Health in 2023, renowned for its diverse therapeutic properties including anti-inflammatory, hepatoprotective, and antioxidant activities. Despite its significant medicinal importance and economic potential, the complete nuclear genome of this species remains unsequenced, creating a critical knowledge gap that limits understanding of the molecular mechanisms underlying its bioactive compound biosynthesis, particularly xanthorrhizol and curcuminoids. This research project addresses this fundamental limitation through comprehensive chromosome-level genome sequencing using cutting-edge Oxford Nanopore Technology, followed by detailed annotation and identification of biosynthetic pathways responsible for key therapeutic compounds.

The project adopts an innovative integrated genomics-biotechnology approach that bridges fundamental research with practical applications. Current study focuses on complete genome assembly, annotation, and comprehensive characterization of biosynthetic pathways for xanthorrhizol and other medicinal compounds through comparative genomics and transcriptome analysis. Future study will translate these genomic insights into biotechnology applications by enhancing the production of therapeutic compounds, combining genomic knowledge with advanced biotechnology. This integrated approach will generate the first complete genome of *C. xanthorrhiza*, establish sustainable production systems for its bioactive compounds, and provide a foundation for Indonesia’s pharmaceutical industry development while supporting its global recognition.

Discovery of a New Anticancer Lead Compound from the Marine Sponge Plakortis sp. and Investigation of Its Mechanism of Action

1. Research Team Leader

Name	: PENI AHMADI, Ph.D.
Sex	: Female
Place/Date of Birth	: Gaya Baru 2/ May 5 th , 1988
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2. Research Field

: Marine Natural Products; Cancer therapy

3. Number of Researcher(s)

: 3

4. Research Location

: BRIN Cibinong

5. Time Allocation

: 1 year

6. Research Grant

: Rp. 39,050,000.00

7. Summary of Research Proposal

:

The marine sponge Plakortis sp. is known for its potential to produce bioactive compounds. In this study, we used bioassay-guided isolation to isolate and evaluate the anticancer properties of Plakortis sp. collected from Nusa Penida, Bali, Indonesia. One particular fraction, labeled NUP-027-1-2, was identified as a new compound (referred to as Compound **1**) and showed strong cytotoxic activity. We plan to determine its chemical structure through detailed spectroscopic analysis, including 1D and 2D NMR and HRMS. Compound **1** demonstrated potent cytotoxic effects against cancer cell lines A549 (lung), HeLa (cervical), and MCF-7 (breast), with IC₅₀ values of 4.7, 3.9, and 9 µg/mL, respectively. Importantly, it exhibited minimal toxicity toward non-cancerous HEK293 cells (IC₅₀ = 112.4 µg/mL), suggesting it selectively targets cancer cells. These encouraging findings highlight NUP-027-1-2 as a promising candidate for further development in cancer therapy. Therefore, we will conduct a detailed in vitro evaluation of compound **1**'s mechanism of action using a range of biochemical kits and protein-targeting assays.

On-Device Tactile Intelligence for Low-Cost Prosthetic Hands Using Bio-Based Stretchable Sensors

1. Research Team Leader

Name	: RONI PERMANA SAPUTRA, S.T., M.Eng.Sc., Ph.D., DIC.
Sex	: Male
Place/Date of Birth	: Tasikmalaya, 7 February 1985
University/Institution	: National Research and Innovation Agency (BRIN)
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- | | |
|---------------------------------|------------------------------------|
| 2. Research Field | : robotics and intelligent systems |
| 3. Number of Researcher(s) | : 3 |
| 4. Research Location | : Bandung |
| 5. Time Allocation | : 12 months |
| 6. Research Grant | : Rp. 38,950,000.00 |
| 7. Summary of Research Proposal | : |

This project aims to develop an intelligent prosthetic hand with better grasp performance by combining bio-based tactile sensors with on-device TinyML based intelligent system. The tactile sensors will be placed on the fingertips and palm to measure contact, force, and early slip during object handling. The sensors will be evaluated for key properties such as sensitivity, hysteresis, signal drift, and durability under realistic grasp conditions. The hypothesis of this study is that that these bio-based sensors can provide stable and informative signals, and that compact TinyML models can run efficiently on a microcontroller to interpret the signals in real time.

A small, low-power analog front-end will acquire tactile signals and send short data windows to the microcontroller. The embedded TinyML model will classify grasp states and directly trigger a reflex controller. This controller will adjust grip force and finger compliance in closed loop to reduce slipping, avoid repeated regrasping, and protect fragile objects. System performance will be tested using manipulation tasks with fragile and dynamic items, using metrics such as stabilization time, actuation effort, task success rate, and user-reported comfort and controllability. The expected outcome is an intelligent prosthetic solution that uses locally sourced materials and energy-efficient embedded AI for real-time grasp intelligence.

**Valorization of Curtain Ivy Biomass into Cellulose-Based Hydrogels
Functionalized with Metal-Phenolic Networks
for Sustainable Antimicrobial Materials**

1. Research Team Leader

Name	: SHELLA PERMATASARI SANTOSO, S.T., Ph.D., IPM.
Sex	: Female
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2. Research Field

: Biomass Valorization

3. Number of Researcher(s)

: 2

4. Research Location

: Chemical Engineering Laboratory,
Universitas Katolik Widya Mandala Surabaya

5. Time Allocation

: January 2026 – December 2026

6. Research Grant

: Rp. 36,650,000.00

7. Summary of Research Proposal

:

This research aims to develop sustainable and functional antimicrobial hydrogels through the valorization of curtain ivy (*Cissus sicyoides*), a fast-growing tendril-climbing ornamental plant rich in cellulose. Conventional cellulose sources are predominantly derived from woody plants, raising sustainability and resource competition concerns. By utilizing pruning waste generated from its rapidly growing tendrils, this study proposes an alternative renewable cellulose feedstock for advanced material fabrication.

Cellulose extracted from curtain ivy will be converted into cellulose acetate and processed into hydrogel scaffolds. To enhance functionality, the hydrogels will be modified using bioinspired metal-phenolic networks (MPNs) through a green surface functionalization strategy. This approach is expected to impart tunable antibacterial activity, strong surface adhesion, and improved structural stability while maintaining environmental compatibility. A hydrophobic surface modification will be applied to enhance moisture resistance and material durability.

The hydrogels will be characterized using FTIR, XRD, SEM, and swelling analysis, followed by antibacterial performance evaluation and cytocompatibility testing. This work integrates biomass valorization, green chemistry, and advanced material design, offering a scalable and environmentally friendly platform for antimicrobial materials. The outcomes are expected to contribute to sustainable material innovation for the biomedical and environmental applications while promoting the utilization of locally available and underutilized biomass resources.

ITSF

Indonesia Toray Science Foundation “RESEARCH PROPOSAL”

STO-Lib: A Software Framework for Slater Orbital Basis Optimization on NISQ Quantum Computers

1. Research Team Leader

Name	: YANOAR PRIBADI SARWONO, Ph. D.
Sex	: Male
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2. Research Field : Quantum Physics, Atoms, Molecules

3. Number of Researcher(s) : 4

4. Research Location : Jakarta and Serpong

5. Time Allocation : 1 year

6. Research Grant : Rp. 38,950,000.00

7. Summary of Research Proposal :

In quantum simulations on quantum computers, test systems are typically represented using Gaussian-type orbitals (GTOs), which, despite their computational efficiency, often yield limited accuracy. To overcome this, we explore the use of Slater-type orbitals (STOs), which more accurately capture the cusp behavior of atomic wavefunctions. We implement our approach using STO-Lib, an open-source Python library developed by our group for generating STO-based integrals, and integrate it with IBM's Qiskit and Qibo quantum computing frameworks.

Our method explicitly formulates the second-quantized Hamiltonians for atomic and ionic systems and maps them into qubit Hamiltonians. Using the variational quantum eigensolver (VQE) with a hardware-efficient ansatz, we compute the ground-state energy, corresponding eigenfunction, local qubit expectation values, and state overlaps. We demonstrate that incorporating STOs using our STO-Lib not only provides a better initial guess but also improves accuracy, achieving energy convergence comparable to or better than GTO-based approaches, while requiring a similar or even reduced number of qubits and quantum gates.

Modification of Pelletized Gelcasted Porous Ceramic Catalyst from Natural Clay to Increase Biodiesel Production Efficiency

1. Research Team Leader

Name	: Dr. SURIATI EKA PUTRI, S.Si., M.Si.
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2. Research Field : Material Chemistry

3. Number of Researcher(s) : 2 (two)

4. Research Location : Makassar, South Sulawesi

5. Time Allocation : 8 months

6. Research Grant : Rp. 39,500,000.00

7. Summary of Research Proposal :

This research proposes the development of a pelletized gelcasted porous ceramic catalyst derived from natural clay to enhance the efficiency and sustainability of biodiesel production. The study addresses the limitations of conventional powder-based heterogeneous catalysts, such as poor mechanical stability, difficult separation, and limited reusability. Natural clay, an abundant and low-cost local resource, will be purified and fabricated into porous ceramic pellets using the gelcasting method, followed by surface and structural modification through CaO–ZnO impregnation.

The research aims to optimize pore structure, surface area, and mechanical strength to improve catalytic activity in the transesterification of waste cooking oil into biodiesel. Comprehensive characterization will be conducted using XRF, XRD, FTIR, SEM, surface area analysis, and acidity–basicity measurements, while catalytic performance will be evaluated in terms of conversion efficiency, reaction time, and reusability over multiple cycles.

Expected outcomes include a reusable, environmentally friendly, and cost- effective heterogeneous catalyst with superior performance compared to conventional systems. This research contributes to advancements in materials science and supports Indonesia’s renewable energy strategy by promoting sustainable biodiesel production using locally sourced materials.

ITSF

Indonesia Toray Science Foundation “RESEARCH PROPOSAL”

Surface-Engineered PVDF Membrane with Nanohematite-PEI for Integrated Peat Water Reclamation and Liquid Organic Fertilizer Production in Submerged Membrane Bioreactors

1. Research Team Leader

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2. Research Field : Membrane Technology

3. Number of Researcher(s) : 4 peoples

4. Research Location : Palangka Raya

5. Time Allocation : 12 months

6. Research Grant : Rp. 40,000,000.00

7. Summary of Research Proposal :

This research proposes the development of a surface-engineered poly(vinylidene fluoride) (PVDF) hollow fiber membrane modified with nanohematite stabilized by polyethylenimine (PEI) for application in submerged membrane bioreactors (MBRs) treating organic-rich peat water. Peat water, prevalent in tropical peatland regions such as Central Kalimantan, contains high concentrations of humic substances that promote microbial growth and severe membrane biofouling, limiting conventional treatment technologies. The study aims to enhance membrane hydrophilicity, antibacterial activity, and antifouling resistance through surface modification and stable nanohematite-PEI surface functionalization. The modified membranes will be evaluated in lab-scale submerged MBRs inoculated with a microbial consortium to assess filtration performance, biofouling behaviour, and long-term stability. In addition to clean water production, this research explores the recovery of retained organic matter and nutrients from the MBR feed side as a potential liquid organic fertilizer, supporting circular economy principles. Comprehensive membrane characterization, reactor performance evaluation, and nutrient analysis will be conducted. The proposed dual-function system integrates advanced membrane materials with biological treatment to provide a cost-effective, scalable, and sustainable solution for decentralized peat water reclamation while generating value-added agricultural products.

Development of Alaban Wood-Derived Bio-Carbon Black as a Sustainable Conductive Additive for Li-Ion NMC Cathodes

1. Research Team Leader

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2. Research Field

: Energy materials

3. Number of Researcher(s)

: 6

4. Research Location

: ULM, Banjarbaru and BRIN, Banten

5. Time Allocation

: 1 year

6. Research Grant

: Rp. 40,000,000.00

7. Summary of Research Proposal

:

Indonesia's ambition to become a global leader in Li-ion battery production relies heavily on locally sourced materials for electrode components. This research proposes to develop Alaban wood-derived carbon black (AW-CB) as a green alternative to petroleum-based conductive additives in Li-ion NMC cathodes.

The specific objectives are to optimize the synthesis conditions for AW-CB, characterize its structural, surface, and electrical properties, and evaluate its electrochemical performance in Li-NMC cathodes against commercial carbon black. The main hypothesis is that tropical biomass residues can produce bio-carbons with electrical conductivity comparable to conventional conductive additives. The research will use local Alaban wood (AW) waste from South Kalimantan as biomass feedstock, which will undergo cleaning, hydrolysis, carbonization, and pyrolysis to produce AW-CB under varied process conditions. The resulting material will be characterized using FTIR-ATR, Raman spectroscopy, SEM-EDX, and SAA before being incorporated into Li-NMC cathodes for half-cell fabrication and electrochemical testing via impedance spectroscopy. The outcomes are expected to advance sustainable battery material development, support Indonesia's clean energy transition, and provide a foundation for scaling biomass-derived carbons into high-value energy storage applications.

ITSF

Indonesia Toray Science Foundation

“RESEARCH PROPOSAL”

AATLAS-IWs: An AI-Based Digital Atlas Platform of Internal Solitary Waves for Enhancing Maritime Safety and Sovereignty in Indonesian Seas

1. Research Team Leader

Name	: Prof. I WAYAN GEDE ASTAWA KARANG, S.Si., M. Si., Ph. D.
Sex	: Male
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2. Research Field

: Maritime

3. Number of Researcher(s)

: 2 (two)

4. Research Location

: Indonesian Seas (Shouthern part)

5. Time Allocation

: 1 year

6. Research Grant

: Rp. 38,950,000.00

7. Summary of Research Proposal

:

The Indonesian Seas are a hotspot for Internal Solitary Waves (ISW), massive subsurface waves that threaten maritime safety, underwater operations, and offshore infrastructures. The KRI Nanggala-402 tragedy highlighted the urgency of systematically mapping ISW distribution to support disaster risk reduction and maritime sovereignty. Existing monitoring approaches face critical limitations: in-situ observations are costly and logistically constrained, while numerical models lack sufficient validation data. Although Synthetic Aperture Radar (SAR) imagery has been widely applied, its massive data volume renders manual detection inefficient, creating a pressing need for automation. This research introduces ATLAS-IWs, an AI-based digital atlas platform designed to detect, classify, and map ISWs in Indonesian seas. We hypothesize that deep learning models trained on a dedicated benchmark dataset can outperform manual or semi-automatic methods in accuracy and efficiency. Our methodology integrates (1) development of a benchmark ISW dataset from multi-sensor SAR archives, (2) design and training of advanced deep learning architectures for ISW detection and characterization, and (3) generation of a digital atlas for visualizing ISW distribution and properties. The expected outcome is the first automated ISW mapping system in Indonesia, providing essential geospatial intelligence for maritime safety, defense operations, industrial planning, and marine science.

CRISPR/Cas9-Mediated RDR1 Knockout in *Nicotiana tabacum* for Enhanced Therapeutic Protein Production in Tropical Climates

1. Research Team Leader

Name	: RIKNO HARMOKO, Ph.D.
Sex	: Male
Place/Date of Birth	: Sukabumi, 30 May 1982
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2. Research Field

: Biotechnology

3. Number of Researcher(s)

: 2

4. Research Location

: Cibinong, Bogor, West Java

5. Time Allocation

: January 1st - December 31st, 2026

6. Research Grant

: Rp. 39,050,000.00

7. Summary of Research Proposal

:

Therapeutic proteins used to treat or prevent human diseases are commonly produced using recombinant DNA technology in mammalian CHO cells. However, population growth and the prevalence of chronic diseases have increased global demand for therapeutic proteins, which exceeds the production capacity of CHO-based systems. Alternatively, a plant-based expression system using *Nicotiana benthamiana* provides a cost-effective, scalable, and rapid means of producing recombinant proteins. The defective RDR1 gene in *N. benthamiana* suppresses endogenous gene silencing, allowing higher transgene expression. Because *N. benthamiana* originates from subtropical climates, its cultivation in tropical areas requires controlled environments and advanced growth chambers, thereby increasing production costs. Alternatively, its close relative, *Nicotiana tabacum*, is suitable for a tropical climate and is widely cultivated in Indonesia. However, expressing the transgene in *N. tabacum* yields low levels of recombinant protein. To overcome this problem, the present research proposes knocking out the RDR1 gene by targeting its exon using CRISPR/Cas9 to create a mutant line. This genetic modification is expected to enhance recombinant protein expression in *N. tabacum* to levels comparable to those in *N. benthamiana*, positioning *N. tabacum* as a suitable platform for therapeutic protein production in tropical regions, such as Indonesia.

OUTLINE OF THE INDONESIA TORAY SCIENCE FOUNDATION

FOUNDATION HISTORY

The Indonesia Toray Science Foundation was established in 1993 through 3 billion rupiah endowment by Toray Industries, Inc. The foundation is registered with and recognized by the Indonesian authority as an organization formed to advance the objective of promoting Science and Technology in Indonesia.

FOUNDATION OBJECTIVE

The object of the foundation is to contribute to the progress of “Science and Technology” in Indonesia. Science and Technology will be limited in to the fields of natural science, including environment, but excluding clinical medicine and mathematics.

FOUNDATION ACTIVITIES

In order to achieve the objectives, the Foundation will endeavor to undertake the following activities

1. The awarding of the Science Education to recognize creative and innovative contributions to effective science education in vocational school, junior high school, senior high schools
2. The awarding of the Science and Technology, to recognize outstanding achievements in their field
3. The Science and Technology Research Grant, to provide to young scientist financial assistance for basic research in science and technology
4. All other activities related to the science

SCALE OF FOUNDATION OPERATIONS

The annual scale of operations will be approximately Rp 1 billion supplied from operating income from corporate contribution

AWARDS AND GRANTS

1. Science Education Award
2. Science and Technology Award
3. Science and Technology Research Grant

HONORARY CHAIRMAN OF ITSF (Non Board of Directors): Mr. Akihiro Nikkaku

Chairman of Toray Industries, Inc., Japan

Honorary Chairman of Indonesia Toray Science Foundation

BOARD OF DIRECTOR MEMBERS:

Chairman : **Dr. L. T. Handoko**

Managing Director : **Mr. Hideo Umeki**

Director : **Prof. Dr. Dali Santun Naga**
Prof. Dr. Ir. Bambang Soehendro, M. Sc
Prof. Dr. Satryo Soemantri Brodjonegoro
Mr. Hironobu Sudo, PT. TIN

SELECTION COMMITTEE

1. The Examination Selection Committee for Science Education Award:

- **Herwindo Haribowo, Ph. D.** (chairman)
- **Paulus Cahyono Tjiang, Ph. D.** (member)
- **Prof. Dr. Is Fatimah** (member)

2. The Examination Selection Committee for Science and Technology Award and Science and Technology Research Grant:

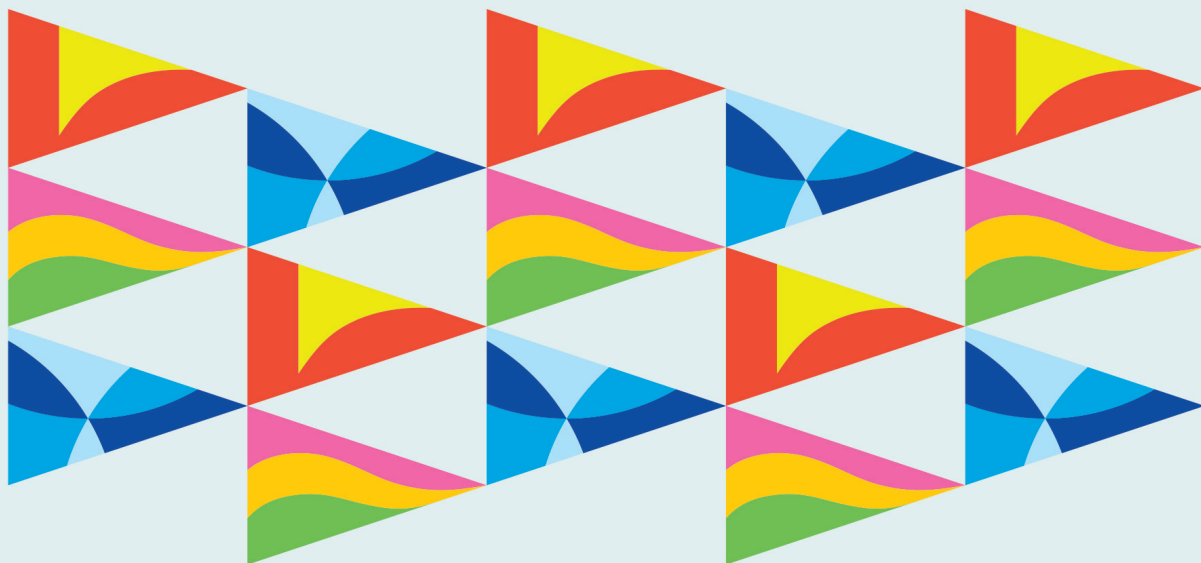
- **Dr. Ernawati Arifin Giri-Rachman** (chairman)
- **Dr. M. Aziz Majidi** (member)
- **Prof. Dr. Suryadi Ismadji** (member)

SUPPORTER

NO	NAME	LOCATION	DESCRIPTION
1	TORAY INDUSTRIES, INC	Tokyo, Jepang	Established in 1926, Toray is Japan's largest manufacturer of synthetics fiber, textiles high performance films, plastic that biggest in Japan. The annual sales of ¥ 2,563.2 millions in March 2024. Toray leads the world in develop production of carbon fibers & other advanced composite materials. Building on its extraordinary technological strength, Toray is diversif into chemicals, pharmaceuticals, medical supplies, electronic materials, housing, and construction materials.
2	TORAY SCIENCE FOUNDATION	Chiba, Jepang	Toray Science Foundation established in 1960, through ¥ 1,000 million endowment by Toray Industries, Inc. to contribute to the progress of science by supporting basic research in science & technology

SUPPORTING COMPANY TORAY GROUP INDONESIA

NO	COMPANY		LOCATION	MAIN BUSINESS
1	 Innovation by Chemistry	PT Indonesia Toray Synthetics (PT ITS)	Jakarta	Manufacturer of polyester staple fiber, nylon, polyester filament yarn & resin
2		PT Indonesia Synthetics Textile Mills (PT ISTEM)	Jakarta	Spinning, weaving, dyeing of polyester based textiles
3		PT Acryl Textile Mills (PT ACTEM)	Jakarta	Spinning and dyeing of acrylic fibers
4	 PT. CENTURY TEXTILE INDUSTRY Tbk	PT Century Textile Industries, Tbk (PT CENTEX)	Jakarta	Spinning, weaving, dyeing of industry blended dyeing of blended polyester & cotton textiles
5	 PT EASTERNTX	PT Easterntex (PT ETX)	Pandaan, Jawa Timur	Spinning, weaving of blended polyester & cotton textiles
6	 TORAY POLYTECH JAKARTA	PT Toray Polytech Jakarta (PT TPJ)	Jakarta	Nonwoven polypropilene
7	 PT TAK Textiles Indonesia	PT TAK Textile Indonesia (PT TATI)	Jakarta	Spinning, weaving, dyeing of polyester based textiles
8	 Innovation by Chemistry	PT Toray International Indonesia (PT TIIN)	Jakarta	Trading company
9		PT TI Matsuoka Winner Industry (PT TIMW)	Semarang	Garment



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TORAY SCIENCE
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